

April 12, 1955

J. W. WELSH
SNAP-ACTION VANE

2,706,226

Filed Aug. 18, 1953

2 Sheets-Sheet 1

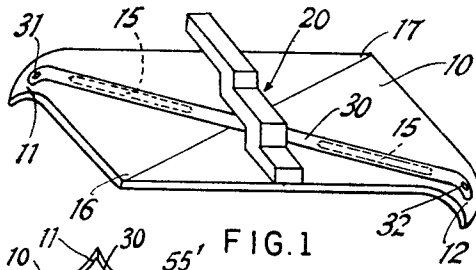


FIG. 1

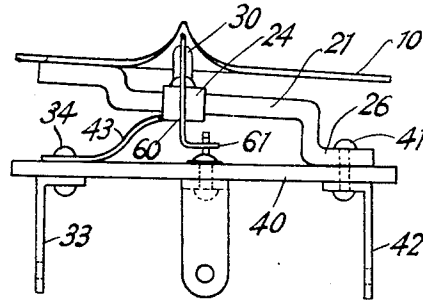


FIG. 3

FIG. 10

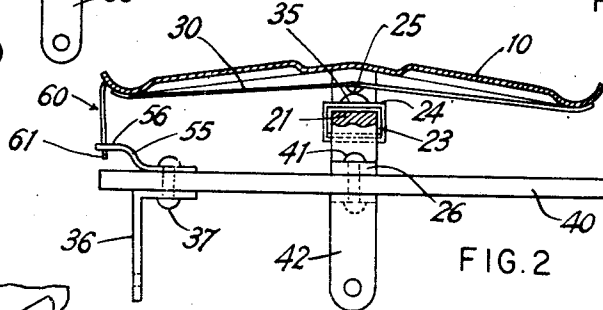


FIG. 2

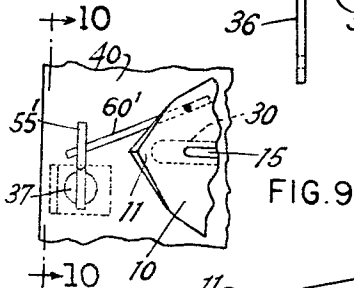


FIG. 9

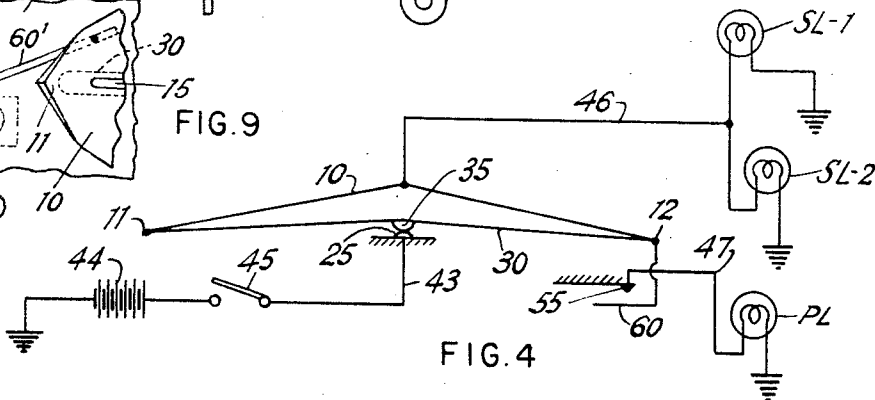


FIG. 4

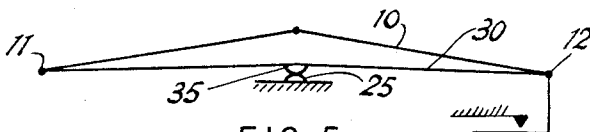


FIG. 5

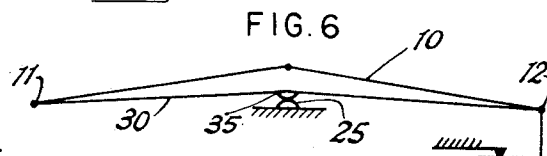


FIG. 6

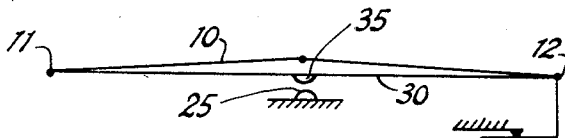


FIG. 7

INVENTOR
James W. Welsh
BY
Raymond
ATTORNEY

April 12, 1955

J. W. WELSH
SNAP-ACTION VANE

2,706,226

Filed Aug. 18, 1953

2 Sheets-Sheet 2

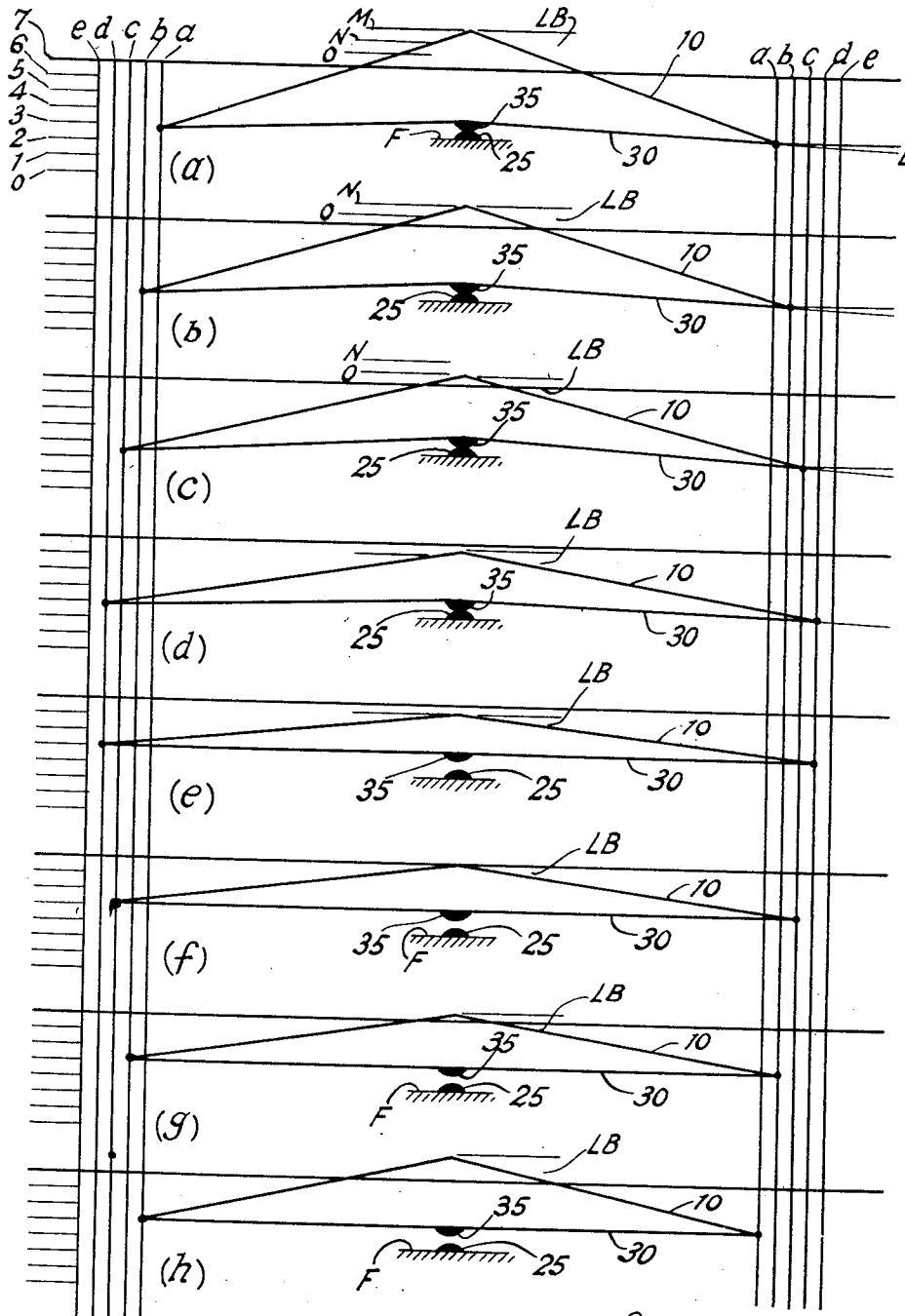


FIG. 8

INVENTOR
James W. Welsh
BY *Raymond*
as ATTORNEY

1

2,706,226

SNAP-ACTION VANE

James W. Welsh, Summit, N. J., assignor to Signal-Stat Corporation, Brooklyn, N. Y., a corporation of New York

Application August 18, 1953, Serial No. 374,977

7 Claims. (Cl. 200—122)

This invention relates to snap action electric switches and, more particularly, to a snap action flasher embodying a novel pilot lamp contact arrangement.

Flashers are commonly used in automotive signalling circuits to flashingly energize the signal lamps when the circuits therefor are selectively closed. To indicate the operation of the signal lamps, a pilot or indicator lamp is usually mounted on the dash-board or instrument panel of the vehicle. This pilot lamp is flashed whenever the signal lamps are energized, either in synchronism with the signal lamps or in alternation therewith.

The usual flasher includes a high resistance wire or strip which, when current flows therethrough, heats rapidly and expands. The wire is operatively associated with a movable switch arm to hold this arm against a first contact when the wire is cold and thus contracted. As the wire expands, the arm is spring biased to disengage such first contact and break the heating circuit for the wire. The latter thereupon cools and contracts to re-engage the arm with such first contact and thus re-close the heating circuit for the high resistance wire to repeat the operating cycle. In some flashers, when the high resistance wire expands to disengage the arm from the first contact, the arm engages a second contact which may control another circuit.

To operate the pilot lamp, a magnetic switch or relay is associated with either one of the two contacts, dependent upon whether synchronous or alternate operation of the pilot lamp is desired. This relay, when energized, closes a circuit for the pilot lamp. The flasher parameters are generally so selected that, if a signal lamp is inoperative, the current load is insufficient to operate the relay and the pilot lamp is not energized. This apprises the vehicle operator of lamp trouble in the signal circuit.

The present flasher arrangements, including pilot lamp relays, while reliable in operation, are relatively complicated and frequently too expensive for many installations. Hence, there is a demand for a simple, reliable and inexpensive flasher pilot lamp device.

In my co-pending application, Serial No. 374,976, filed August 18, 1953, for "Snap Action Device," I have shown and described a novel snap action vane which may be incorporated in a snap action switch. This vane is provided with an initial deformation along a right line extending across the vane by thinning or deforming the vane along this line in two or more spaced sections of the line, these sections being spaced at their inner ends from the center of the vane and also preferably spaced from the outer ends of the bent line. When such a vane is to be utilized in a snap action switch, such as a flasher, the vane is bent about another line, at an angle to the line of initial deformation, by applying force to the ends of such line. When such force is released, the vane snaps back to its initial position, the action closely resembling that of a toggle.

The vane is held in the new deformed position by attaching a high resistance wire or strip at each of its ends to the vane at the ends of the line of initial deformation. This high resistance wire or strip thus forcibly holds the vane in a distorted position bent about a line angularly related to the line of initial deformation. When the high resistance wire has electric current passing therethrough, it heats and expands. During the expansion of the wire, a point is reached at which the tension exerted by the wire is over-balanced by the kinetic energy of the vane stored therein by bending the latter from its

2

initial condition. At this point, the vane snaps back to its initial condition.

As described in said co-pending application, the vane has a mounting member secured thereto at a point in an elliptical line representing the distribution of stresses adjacent the vane center due to the initial deformation of the vane. This mounting member extends across the high resistance wire and carries a contact cooperative with a contact carried by a high resistance wire. When the vane is in the deformed position, in which it is held by the contracted high resistance wire, these two contacts are in engagement, so that current from a source of electric power connected to a contact carried by the mounting member flows in parallel paths through the high resistance wire, through the vane, and thence to the other terminal of the current source. When the vane snaps back to its initial condition as a result of heating and expansion of the wire, the contacts separate and the high resistance wire then cools and contracts. During such contraction, the force exerted by the wire over-balances the force tending to maintain the vane in its initially deformed condition, and the resultant toggle action snaps the vane to the deformed condition re-engaging the contact carried by the resistance wire with the contact carried by the mounting member for the vane. The electrical circuit is thus reclosed and the cycle repeats.

In my co-pending application, Serial No. 374,918, filed August 18, 1953, for "Snap Action Device," a flasher or electric switch arrangement embodying such a vane and mounting structure is provided in which the two contacts are held in full pressure engagement, or even under increasing pressure, during the time the resistance wire is heating and expanding and right up to the instant that the vane snaps back to its pre-set condition. Thus, there is no diminution or reduction of contact pressure during the initial part of the switch opening movement or cycle, and full pressure is maintained between the contacts until they are snapped apart by the snap action of the vane in restoring itself to its present deformation.

More specifically, the switch parameters are so selected that, when the contacts are engaged, and up to the time that the snap action takes place, the resistance wire is depressed at its center toward the vane, so that the center of the wire exerts a force component in the direction of the contact carried by the vane mounting means. By proper selection of the switch parameters, this contact pressure effecting force may be made to increase during the expansion of the resistance wire so that at least full contact pressure is maintained up to the instant the snap action of the vane occurs.

At such instant, the contacts are snapped apart, thus instantaneously moving the contacts from the full pressure engaged position to a widely separated circuit breaking position. Thereby, with such arrangement, a pilot of the current flowing across the contacts versus time will essentially resemble a square wave and there will be practically no slope to the lines connecting the full current portion of the curve to the no current portion of the curve.

Due to the depression of the resistance wire and the consequent increase in the stress imposed on the vane, as described in such latter application, there is a very substantial displacement of the vane corners, to which the resistance wire is secured, during snapping of the vane between the stress-deformed and initially preset, or "restored" positions. In accordance with the present invention, this relatively large magnitude movement of such vane corners is utilized to provide a novel pilot lamp circuit controlling arrangement.

In the invention arrangement, a contact is secured to one of such vane corners for movement therewith. This contact is operatively associated with a second contact fixed relative to the vane mounting member or bracket. As the vane snaps between its deformed and restored positions, when the flasher is connected to a source of electric potential, these last mentioned contacts are alternatively engaged and disengaged.

The pilot lamp is connected to the relatively fixed contact. The vane-carried contact is made "live" by virtue

of the circuit connection to the vane through its mounting member. Thus, the pilot lamp is flashed whenever the flasher is energized. Preferably, the pilot lamp contacts are engaged when the vane is in the restored position and disengaged whenever the vane is snapped to the deformed position by cooling contraction of the resistance wire, so that the pilot lamp flashes in synchronism with the signal lamps. However, a reverse interaction of the contacts may be equally well provided to obtain alternation of the pilot lamp and signal lamp flashing.

Due to the division of the current in two parallel paths through the resistance wire, in the event a signal lamp is inoperative the resultant reduced current flow will be insufficient to heat the wire sufficiently to expand to the degree allowing snapping of the vane to the restored position. Thus, either steady burning or non-illumination of the pilot lamp will indicate a defective signal lamp.

For an understanding of the invention principles, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a perspective view of a snap action vane and mounting member used in the invention flasher;

Fig. 2 is an elevation view, partly in section of the invention flasher;

Fig. 3 is an elevation view of the flasher at right angles to the view of Fig. 2;

Figs. 4 through 7 are diagrams illustrating operating positions of the flasher;

Figs. 8a through 8h are graphical diagrams of the snap action of the flasher vane;

Fig. 9 is a partial plan view illustrating a modified contact construction; and

Fig. 10 is an elevation view on the line 10—10 of Fig. 9.

Referring to Fig. 1, which is substantially identical with Fig. 1 of my said co-pending application, Serial No. 374,918, a snap action vane 10 is illustrated which is identical with that shown and described in said co-pending application. Vane 10 is preferably made of relatively thin spring metal, with consideration being given to its spring factor, stiffness, temperature coefficient, and the like, in accordance with the desired rate of operation of the snap action.

To provide an initial set to vane 10 and to give the same some depth so that it will resemble a beam in its action, the vane 10, which is shown as a substantially rectangular vane, is deformed or thinned along a diagonal interconnecting corners 11 and 12. This vane deformation is preferably effected by lineally embossing the vane along the line 11—12 in two elongated spaced portions or bosses 15. It will be noted that the bosses 15 have their inner ends disposed substantially equal distances from the center of vane 10 so that the center area of the vane is left unmarred. As explained in said co-pending application Ser. No. 374,976, this greatly prolongs the life of vane 10 by removing the stress concentration from the center to a pair of points on bosses 15. If the deformation lines 11—12 were continuous through the vane center area, the flattening of the vane at the center during repeated cycles would eventually cause fatigue of the vane at the center and reduce the amount of force required to snap the vane between the illustrated position and another deformed position. Due to the bosses 15, the sections 13 and 14 of the vane on either side of line 11—12 bend upwardly so that the vane assumes the form of a shallow vee (V) having its apex on line 11—12. When vane bending forces are applied to the end of lines 11—12, and the value of these forces equals or over-balances the inherent tendency of the vane to stay in its preset condition, the vane snaps into a new bent or deformed position, forming another shallow vee (V) along the other diagonal 16—17. When the forces at points 11 and 12 are decreased to a point where they are overbalanced by the kinetic energy stored in vane 10 due to such distorting force, the vane snaps back to a position bent along the lines 11—12.

Photographs, taken with polarized light, of a transparent vane formed in this manner show lines of force in the unmarred center area of the vane which comprise elliptical bands having radii centered on the vane center. If the vane is secured or supported at a point on one of these elliptical stress loci, the stress points on the vane during application of bending force at corners 11 and 12

occur within the lengths of bosses 15. Thus, the stresses are removed from the center area and distributed between two points spaced from the center. This greatly prolongs the period before fatigue takes place in the stressed section of the vane. As described in said co-pending application Ser. No. 374,976, advantage is taken of this fact by supporting the vane by securing the latter, at a point of one of such elliptical lines of force, to a relatively rigid electrically conductive metal mounting member 20. The point of attachment of the mounting member to the vane acts as a pivot point for the vane during its snap action and is preferably spaced laterally of the initial bend line 11—12.

When the vane is used to form a snap action switch, the bending stresses may be conveniently applied to points 11 and 12 by means of a high resistance wire or strip 30 secured to these corners of the vane. For this purpose, the points 11 and 12 are bent downwardly as illustrated in Fig. 1, and the ends of wire or strip 30 are secured thereto at 31 and 32, while the vane is bent along the line 16—17, so that the wire in its cold or contracted position holds the vane deformed into a vee (V) having its apex along line 16—17. If wire 30 has electric current passed therethrough, it expands and, as the wire force is over-balanced by the restoring kinetic energy built up in vane 10, the vane snaps back to its initially bent condition along the line 11—12.

An arrangement for utilizing this action is illustrated in Figs. 2 and 3, which show the invention snap action switch. The center section 21 of mounting member 20 has a band 23 of insulation wrapped thereon and a band 24 of conductive metal is wrapped around band 23. Band 24 carries a contact point 25 at the intersection of mounting member 20 and wire 30. The wire 30 has a contact point 35 secured to its mid-section for cooperation with contact 25.

The free end of mounting member 20 is secured to a dielectric base 40 as by a rivet connecting the outer end 26 of member 20 to a prong or terminal 42 on base 40. Another prong or terminal 33 is connected by rivet 34 to a conductive strip 44 connected to band 24.

In accordance with the invention, base 40 has a third terminal or prong 36 secured by rivet 37 to a stepped contact 55 aligned beneath a corner 11 or 12 of vane 10. Contact 55 is thus fixed relative to base 40 and bracket 20. Cooperable with fixed contact 55 is a movable contact 60 secured to one of the corners 11, 12 of vane 10. Contact 60 is L-shaped and has a leg 61 projecting laterally between the offset spring end 56 of contact 55 and base 40. In the illustrated stress-deformed position of vane 10, arm or leg 61 is spaced from end 56 of contact 55, so that contacts 55, 60 are separated or "open."

Referring to Fig. 4, a grounded battery 44 is connected, through a signal lamp control switch 45, to terminal 33, and thus through conductor 43 to band 24 and contact 25. A conductor 46 connects terminal 42, and thus vane 10 and bracket 20, to parallel and grounded signal lamps SL-1 and SL-2. A conductor 47 connects terminal 36, and thus relatively fixed contact 55, to grounded pilot lamp PL.

Referring more particularly to Figs. 2 and 4, the switch parameters are so selected that, in the contracted or cooled condition of wire 30, contacts 25 and 35 are engaged and the relation of parts is such that the center part of wire 30, carrying contact 35, is forced inwardly toward vane 10. The wire thus assumes a shallow vee (V) as is shown in Fig. 2, and the tension of wire 30 thus increases the force with which contacts 25 and 35 are held engaged.

When switch 45 is closed, current flows from battery 44 through switch 45, conductor 43, band 24 and contact points 25 into contact point 35 at the midpoint of wire 30. At this midpoint, the current branches through both halves of wire 30, in parallel, and flows into vane 10 at points 31 and 32. The current flows through vane 10 into mounting member or bracket 20, and thus through rivet 41 into prong 42 and through conductor 46, resistance 47 and switch 48 to the other side of the current source. The current flowing through wire 30 causes the latter to rapidly heat and expand, this wire preferably being "Nichrome" wire. As wire 30 expands and thus lengthens, the force exerted by the wire is finally over-balanced by the kinetic energy stored in vane 10, and the latter snaps to its initial or "restored" position. This pulls wire 30 downwardly relatively to bracket 20, and snaps

5

contacts 25 and 35 apart to break the electrical circuit. The wire 30 then cools and contracts. As the force exerted by the contracting wire overbalances the force tending to maintain vane 10 in its "restored" position, the vane again snaps to a position bent along line 16—17 wherein wire 30 snaps toward bracket 20 to reengage contacts 25 and 35. The cycle then repeats.

The initial relation of parts is shown diagrammatically in Fig. 4, which corresponds to the position of the switch or flasher shown in Fig. 2. It should be noted that the connection of battery 44 to prong or terminal 33 is exemplary only, and that the connections of terminals 33 and 42 could be reversed with battery 33 connected to terminal 42 and lamps SL-1, SL-2 to terminal 33. This reversal will result in a slightly different operation of pilot lamp PL as will be explained in connection with Fig. 7. With the parts as shown in Fig. 4, and with switch 45 closed, lamps SL-1 and SL-2 have a potential applied thereacross. Due to the bending of vane 10 about the line 16—17, corners 11, 12 of the vane are depressed so that contacts 55 and 60 are disengaged. Thus, pilot lamp PL is not lit. Wire 30 is heating and expanding, and thus corners 11, 12 are moving upwardly.

Should only one signal lamp SL-1 or SL-2 be operative, the current through wire 30 will be insufficient to heat and expand the wire an amount sufficient for the stored energy in vane 10 to snap the vane to its restored position. By proper initial spacing of contacts 55 and 60, these contacts can be made to remain out of engagement during such partial heating of wire 30 and the resultant partial movement of vane 10 toward the restored position. This condition is illustrated in Fig. 5, wherein vane 10 has moved only partially toward the restored position, due to reduced current flow in wire 30 as a result of one signal lamp being inoperative. Continued failure of pilot lamp PL to light indicates a defective condition of the signal lamp circuit.

However, if both signal lamps are operative, wire 30 continues to expand and vane 10 continues to flatten, thus moving corners 11, 12 upwardly sufficiently to engage contacts 55, 60 to energize pilot lamp PL. This position is shown in Fig. 6.

As the wire 30 continues to heat and expand, the energy of vane 10 over-balances the stress imposed by wire 30 and the vane snaps to the restored position. This separates contacts 25 and 35 to open the signal lamp and wire 30 heating circuit. While contacts 55, 60 remain engaged, due to the full upward movement of corners 11, 12, lamp PL is deenergized due to opening of contacts 25, 35.

Should the circuit connections to terminals 33 and 42 be reversed from those of Fig. 4, however, lamp PL would remain energized due to battery potential being applied directly to vane 10 through bracket 20.

In either case, contacts 55, 60 remain engaged in the restored position of vane 10. To accommodate the relatively large magnitude movement of corners 11, 12 and remain in contact over a long period, either or both contacts 55, 60 are made resilient. In Fig. 7, wire 30 is starting to cool and contract and, as the stress exerted thereby over-balances the resistance of vane 10, the vane snaps back to the position of Figs. 2 and 4. The cycle then repeats.

Referring now to Figs. 8a through 8h, the action of the invention switch maintaining full contact pressure until the circuit break point is reached will be described as graphically illustrated. Before proceeding to this description, it should be mentioned that the mounting of contact 35 at the mid-point of wire 30 has several important advantages. In the first place, the resistance is decreased due to the parallel circuits through wire 30. This enables the use of a wire rather than a ribbon for the high resistance element which facilitates the proper expansion. In the second place, this contact position is utilized to increase the pressure in wire 30, thus assuring a faster snap action at the end of a cycle. A third advantage is that this mounting of contact 35 in effect provides lever arms between the center of the vane and the vane mounting point which comprise springs storing kinetic energy.

The relatively fixed mounting point of member 20 is illustrated by the line F carrying the contact point 25. The lines a through e are reference lines graphically illustrating the lengthening and contracting of wire 30. The lines O—X are scale lines indicating relative vertical move-

6

ment of the ends of wire 30 relative to the fixed reference line F. The angle B is proportional to the vane deflection. This angle is also indicative of the contact pressure.

As shown, in the contracted position of wire 30 illustrated in Fig. 8a the wire is bent into a shallow inverted vee (V) so that the force of the wire tends to increase the pressure between contacts 25 and 35, the wire 30 acting as a pressure increasing spring. In Fig. 8a, wire 30 is cool and is just about to be heated. The vane apex is in an elevated condition illustrated by point M due to the mechanical advantage provided when vane 10 is secured at a stress loci point to bracket 20. The vane center is also raised due to the stress imparted thereto by the upward bending of wire 30 to increase the contact pressure. Wire 30 is contracted to its smallest length as indicated by its ends lying on lines a—a. As the center of vane 10 is high, a small force in the wire will hold the vane due to the relatively large angle B of the toggle joint arrangement.

As the wire starts to heat, the parts assume the position of Fig. 8b. Wire 30 has increased in length to lines b—b, and the center section of vane 10 is lowered to the line N due to flattening of the vane adjacent to its center section. Wire 30 upon elongating tends to raise its ends but its center, being higher than its ends, as previously explained, is lower in Fig. 8b than in Fig. 8a, thus giving an overall lowering of the vane ends from line 4 to a position between lines 4 and 5. The lowering of the vane ends increases angle B, thus increasing the contact pressure.

In Fig. 8c wire 30 has lengthened so that its ends are on the lines c—c. The center section of vane 10 has moved down to line O and is approaching a flat condition so that its downward movement diminishes. However, the stored energy in the vane decreases, thus providing a new angular relationship. The pressure on contacts 25 and 35 remains substantially the same as in Fig. 8b. The wire relationship also remains about the same as in Fig. 8b. Angle B becomes smaller so that the tension in wire 30 increases.

In Fig. 8d, the wire has lengthened so that its ends are at the lines d—d, vane 20 is approaching a flat condition, and wire 30 is under great stress. The vane center has lowered slightly. The contact pressure has increased due to the decrease in angle B and the vane is about to snap to its restored condition.

Fig. 8c shows the relation of parts immediately after such snapping of the vane to change the apex of the vee (V) from line 16—17 to line 11—12. The relationship of wire 30 to the mounting 20 has changed, due to the snapping of vane 10, thus snapping open contacts 25 and 35 to break the circuit. The wire is essentially the same length as in Fig. 8d and angle B is quite small.

In Fig. 8f, wire 30 is contracting to build up pressure in the vane and increase the angle B. The vane angle is decreasing and the resultant is a build-up in pressure in wire 30, which has moved slightly in an upward direction. However, as the vane center is moving more than the wire, the resultant movement of wire 30 is toward line F representing bracket 20.

In Fig. 8g, wire 30 is still contracting but is moving towards bracket 20 due to the diminishing of the upward movement of the vane center as it approaches the flat condition. The stress in wire 30 has increased and the movement of the parts begins to accelerate. Angle B is increasing and thus building up kinetic energy in vane 10.

Fig. 8h illustrates a position where wire 30 has contracted even further than the position shown in Fig. 8g and vane 10 is about to snap to a bend along lines 16—17 to assume the position diagrammatically illustrated in section 6.

In the modified arrangement of Figs. 9 and 10, the vane carried pilot lamp contact 60' is a short straight bar welded to vane 10 adjacent a corner 11 to project from the vane. Contact 60' is cooperable with a Z-shaped bar contact 55' welded to rivet 37 of terminal 36. This construction is more practical from a commercial standpoint, but the contacts 55' and 60' interact in the same manner as contacts 55, 60.

The invention thus takes advantage of the snap action movement of the vane 10 to provide a record and simplified pilot lamp energizing arrangement for flashers. This arrangement fulfills all the usual requirements for pilot lamp operators, including the circuit defect indicating function, in an inexpensive and simple construction.

While a specific embodiment of the invention has been

shown and described in detail to illustrate the application of the invention's principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A snap action electric switch comprising, in combination, a dielectric base; a substantially flat vane of electrically conductive resilient material having a substantially linear preset deformation extending thereacross, said deformation being interrupted intermediate its ends at points substantially equi-distant from the vane center to leave the central area of the vane free of preset deformation; a first terminal on said base; an elongated electrically conductive bracket secured at one end to said vane at a vane mounting point spaced laterally from said deformation, and secured at its other end to said first terminal; means operable to alternately apply and release vane bending stresses at points adjacent the outer ends of said deformation to effect snapping of the vane between a stress-deformed position in which the vane is bent along a line substantially perpendicular to said deformation and a preset restored position in which the vane is bent along said deformation; the free portion of the vane, during such snapping action, pivoting about such mounting point, and the ends of said deformation moving substantially relative to said base during the snapping action of the vane; a first contact on said vane adjacent an end of said deformation; a second terminal on said base; and a second contact secured to said second terminal and disposed in the path of movement of said first contact for engagement with the latter in one of said vane positions and disengagement therefrom in the other of said vane positions.

2. A snap action electric switch comprising, in combination, a dielectric base; a substantially flat and rectangular vane of electrically conductive resilient material having a substantially linear preset deformation extending thereacross along a diagonal, said deformation being interrupted intermediate its ends at points substantially equi-distant from the vane center to leave the central area of the vane free of preset deformation; a first terminal on said base; an elongated electrically conductive bracket secured at one end to said vane at a vane mounting point spaced laterally from said deformation, and secured at its other end to said first terminal; means operable to alternately apply and release vane bending stresses at points adjacent the outer ends of said deformation to effect snapping of the vane between a stress-deformed position in which the vane is bent along the other diagonal of the vane and a preset restored position in which the vane is bent along said deformation; the free portion of the vane, during such snapping action, pivoting about such mounting point, and the ends of said deformation moving substantially relative to said base during the snapping action of the vane; a first contact on said vane adjacent an end of said deformation; a second terminal on said base; and a second contact secured to said second terminal and disposed in the path of movement of said first contact for engagement with the latter in one of said vane positions and disengagement therefrom in the other of said vane positions.

3. A snap action electric switch comprising, in combination, a dielectric base; a substantially flat vane of electrically conductive resilient material having a substantially linear preset deformation extending thereacross, said deformation being interrupted intermediate its ends at points substantially equi-distant from the vane center to leave the central area of the vane free of preset deformation; a first terminal on said base; an elongated electrically conductive bracket secured at one end to said vane at a vane mounting point spaced laterally from said deformation, and secured at its other end to said first terminal; means operable to alternately apply and release vane bending stresses at points adjacent the outer ends of said deformation to effect snapping of the vane between a stress-deformed position in which the vane is bent along a line substantially perpendicular to said deformation and a preset restored position in which the vane is bent along said deformation; the free portion of the vane, during such snapping action, pivoting about such mounting point, and the ends of said deformation moving substantially relative to said base during the snapping action of the vane; a first contact on said vane adjacent an end of said deformation; a second terminal on said base; and a second contact secured to said second

terminal and disposed in the path of movement of said first contact for engagement with the latter in the restored position of the vane and disengagement therefrom in the stress-deformed position of the vane.

4. A snap action electric switch comprising, in combination, a dielectric base; a substantially flat and rectangular vane of electrically conductive resilient material having a substantially linear preset deformation extending thereacross along a diagonal, said deformation being interrupted intermediate its ends at points substantially equi-distant from the vane center to leave the central area of the vane free of preset deformation; a first terminal on said base; an elongated electrically conductive bracket secured at one end to said vane at a vane mounting point spaced laterally from said deformation, and secured at its other end to said first terminal; means operable to alternately apply and release vane bending stresses at points adjacent the outer ends of said deformation to effect snapping of the vane between a stress-deformed position in which the vane is bent along the other diagonal of the vane and a preset restored position in which the vane is bent along said deformation; the free portion of the vane, during such snapping action, pivoting about such mounting point, and the ends of said deformation moving substantially relative to said base during the snapping action of the vane; a first contact on said vane adjacent an end of said deformation; a second terminal on said base; and a second contact secured to said second terminal and disposed in the path of movement of said first contact for engagement with the latter in the restored position of the vane and disengagement therefrom in the stress-deformed position of the vane.

5. A snap action electric switch comprising, in combination, a dielectric base; a substantially flat and rectangular vane of electrically conductive resilient material having a substantially linear preset deformation extending thereacross along a diagonal, said deformation being interrupted intermediate its ends at points substantially equi-distant from the vane center to leave the central area of the vane free of preset deformation and with curvilinear stress concentration loci concentric with the vane center; a first terminal on said base; an elongated electrically conductive bracket secured at one end to said vane at a vane mounting point on one of said loci, and secured at its other end to said first terminal; means operable to alternately apply and release vane bending stresses at points adjacent the outer ends of said deformation to effect snapping of the vane between a stress-deformed position in which the vane is bent along the other diagonal of the vane and a preset restored position in which the vane is bent along said deformation; the free portion of the vane, during such snapping action, pivoting about such mounting point, and the ends of said deformation moving substantially relative to said base during the snapping action of the vane; a first contact on said vane adjacent an end of said deformation; a second terminal on said base; and a second contact secured to said second terminal and disposed in the path of movement of said first contact for engagement with the latter in the restored position of the vane and disengagement therefrom in the stress-deformed position of the vane.

6. A snap action electric switch comprising, in combination, a dielectric base; a substantially flat and rectangular vane of electrically conductive resilient material having a substantially linear preset deformation extending thereacross, said deformation being interrupted intermediate its ends at points substantially equidistant from the vane center to leave the central area of the vane free of preset deformation and with curvilinear stress concentration loci concentric with the vane center; a first terminal on said base; an elongated electrically conductive bracket secured at one end to said vane at a vane mounting point on one of said loci, and secured at its other end to said first terminal; an expansible high resistance electric conductor secured at each end to said vane adjacent the outer ends of said deformation under tension and parallel to said deformation, to bend said vane to a stress-deformed position in which the vane is bent along the other diagonal of the vane; said vane, upon a predetermined expansion of said conductor, snapping to a preset restored position in which the vane is bent along said deformation; the free portion of the vane, during such snapping action, pivoting about such mounting point, and the ends of said deformation moving substantially

relative to said base during the snapping action of the vane; a first contact on said vane adjacent an end of said deformation; a second terminal on said base; a second contact secured to said second terminal and disposed in the path of movement of said first contact for engagement with the latter in one of said vane positions and disengagement therefrom in the other of said vane positions, said bracket extending across the central area of said vane outwardly of said conductor; a third terminal on said base; a third contact mounted in insulated relation on said bracket in alignment with said conductor and connected to said third terminal; and a fourth contact secured to said conductor intermediate the conductor ends and engaged with said third contact when said conductor is contracted to bend said vane to such stress-deformed position; said conductor, in the restored position of said vane, lying in juxtaposition to said vane and spaced sufficiently from said bracket to fully disengage said third and fourth contacts.

7. A snap action electric switch comprising, in combination, a dielectric base; a substantially flat and rectangular vane of electrically conductive resilient material having a substantially linear preset deformation extending thereacross, said deformation being interrupted intermediate its ends at points substantially equidistant from the vane center to leave the central area of the vane free of preset deformation and with curvilinear stress concentration loci concentric with the vane center; a first terminal on said base; an elongated electrically conductive bracket secured at one end to said vane at a vane mounting point on one of said loci, and secured at its other end to said first terminal; an expansible high resistance electric conductor secured at each end to said vane adjacent the outer ends of said deformation under

tension and parallel to said deformation, to bend said vane to a stress-deformed position in which the vane is bent along the other diagonal of the vane; said vane, upon a predetermined expansion of said conductor, snapping to a preset restored position in which the vane is bent along said deformation; the free portion of the vane, during such snapping action, pivoting about such mounting point, and the ends of said deformation moving substantially relative to said base during the snapping action of the vane; a first contact on said vane adjacent an end of said deformation; a second terminal on said base; a second contact secured to said second terminal and disposed in the path of movement of said first contact for engagement with the latter in one of said vane positions and disengagement therefrom in the other of said vane positions, said bracket extending across the central area of said vane outwardly of said conductor; a third terminal on said base; a third contact mounted in insulated relation on said bracket in alignment with said conductor and connected to said third terminal; a fourth contact secured to substantially the mid-point of said conductor and engaged with said third contact when said conductor is contracted to bend said vane to such stress-deformed position; said conductor, in the restored position of said vane, lying in juxtaposition to said vane and spaced sufficiently from said bracket to fully disengage said third and fourth contacts.

References Cited in the file of this patent

UNITED STATES PATENTS

2,133,309	Schmidinger	Oct. 18, 1938
2,194,999	Clark	Mar. 26, 1940
2,274,399	Cook	Feb. 24, 1942