March 16, 1965 W. B. ALMASSY 3,174,015

THERMORESPONSIVE SNAP SWITCH HAVING SEPARATE CERAMIC HEATER MEANS

Filed June 1, 1962

Fig. 3.

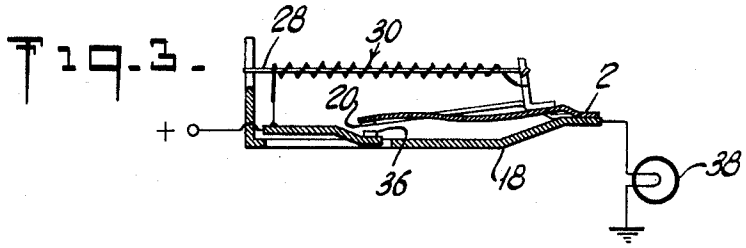


Fig. 1.

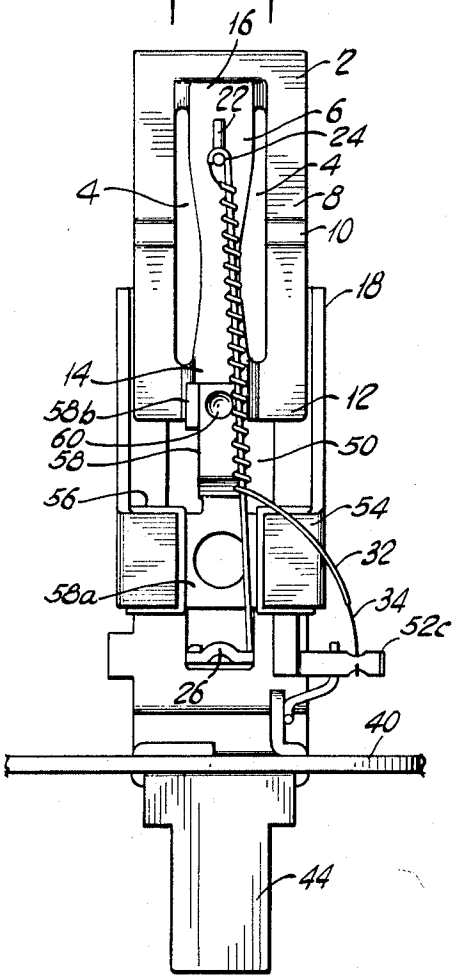
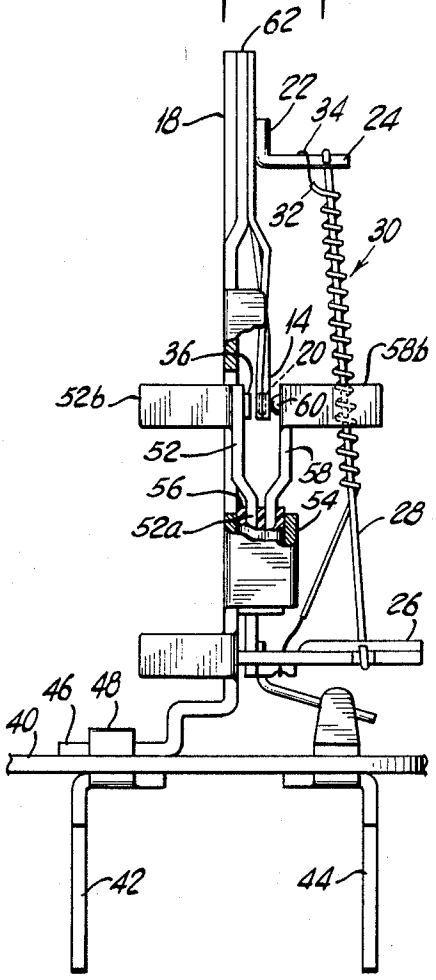


Fig. 2.



INVENTOR.
WILLIAM B. ALMASSY

BY
Eyre, Mann & Lucas

ATTORNEYS

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THERMORESPONSIVE SNAP SWITCH HAVING SEPARATE CERAMIC HEATER MEANS

William B. Almassy, Pine Brook, N.J., assignor to Tung-Sol Electric Inc., a corporation of Delaware

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The present invention relates to expansible wire controlled snap switches, more particularly to the type wherein an expansible wire moves the free end of a snap member to different circuit controlling positions with a snap action, and comprises a novel switch of this type which is simple to construct, precise in operation, of long useful life and of a wide field of application. The new switch, which may be operated as a flasher, a relay, a time switch, an overload protector or a voltage regulator depending upon the circuit conntctions, is an improvement over the wire controlled snap switch disclosed and claimed in Schmidinger Patents No. 2,761,931 dated September 4, 1956, and No. 3,037,102, dated May 29, 1962.

Like the switches of the above mentioned Schmidinger patents, the new switch comprises a metal strip adapted to be mounted at one end and carrying one or more contacts at its free end, the strip being provided with two generally longitudinal slots which terminate short of the ends of the strip and define a central vane. The central vane is biased at both ends, and a pull wire, which is secured to the strongly biased section of the vane adjacent the fixed end of the plate, extends substantially parallel to the strip to hold the vane in compression. The bias of the two ends of the vane is such that the vane assumes a natural bow shape before the wire is tensioned. When the wire is tensioned, the vane assumes the form of a generally M-shaped curve with the initially unstressed intermediate portion of the vane forming the depression of the M. During operation of the switch, the radii of curvatures of the parts of the vane vary in magnitude but not in sign. One or more fixed contacts or stops are positioned adjacent the free end of the strip for engagement therewith, the free end snapping into and out of contact closing position with change in tension in the pull wire.

The new switch differs from that of the Schmidinger patents, however, in that the change in tension in the pull wire is not brought about as a result of passage of current through the pull wire. Instead, a separate heater, consisting of a ceramically coated highly resistive wire wrapped around the pull wire, is provided. Indirect heating of the pull wire in this manner has many advantages. For instance, the variations in the period of the snap cycle or rate, and variations in ratio, or dwell time in each of the circuit controlling positions are much smaller with this indirectly heated unit. Further, the consumption of electrical energy is approximately one fourth that of a unit with a directly heated pull wire and the new switch has shown increased load carrying capacity and an unusual stability with variations in load when compared with comparable switches with directly heated pull wires. In addition, the insulating ceramic bead shown in the Schmidinger patents may be eliminated since the pull wire does not form part of the electrical circuit, and a ballast resistor and heat baffle are not necessary with the present device.

For a better understanding of the invention and of a switch embodying the invention reference may be had to the accompanying drawing of which:

FIGS. 1 and 2 are respectively front and side views of the new switch; and

FIG. 3 is a cutaway side view of an adjusted switch connected in a circuit with a lamp and a power supply.

In the illustrated embodiment of the invention, a rectangular plate 2 is provided with two slots 4—4 which extend for the major length of the plate. The slots 4—4 define a central vane 6 which varies in width from a minimum adjacent the central section to a maximum at the closed ends of the slots. Each side portion 8 of the plate is provided with a crimp 10 which shortens its length relative to that of the central vane 6. One end 12, which when the plate is mounted becomes the free end of the plate, is formed with a central raised section 14 which merges into the adjacent end of the central vane 6. This raised portion 14 provides the bias at the free end of the plate and insures against reversal of curvature of the central vane during operation of the device. The raised portion or bias 14, in conjuction with the crimps 10, causes the adjacent end of the central vane to curve outwardly from the body of the plate. The metal of the plate adjacent the other end of the central vane 6 is also forced outwardly away from the plane of the plate as indicated at 16 to provide a bias at that end of the plate which likewise insures that the strip adjacent that end will bow outwardly from the plane of the plate. Preferably, as shown best in FIG. 1, the width of the central vane 6 is slightly greater at the end adjacent the bias 16. This end of the plate is welded or otherwise secured to a frame element 18 of the switch and the other or free end of the plate carries a contact member 20. An L-shaped anchor member 22 of round stock has one leg welded to the convex side of the vane 6 adjacent the fixed end of the plate with its other leg upstanding. The frame 18 has a finger 26 bent out therefrom with the free end of the finger in general alignment with the upstanding end 24 of the anchor member. An expansible pull wire 28 is secured under tension to the finger 26 and to the upstanding end 24 of the anchor member. The pull wire is provided with an insulated heating wire 30 which is wound around it. The difficulty in using such an insulated heating wire is that the insulation prevents the transfer of heat to the pull wire and it was difficult to obtain units for automobiles that would start flashing in less than 4 to 5 seconds after the application of current to the heating wire. The present device overcomes this by the use of a thin ceramic coating 32 which is applied to the wire for insulation. In the illustrated embodiment the heating wire is a high resistance wire 34 approximately .00275" in diameter, made out of an alloy composed of 73% nickel, 20% chromium and the balance aluminum and iron. An example of such an alloy is Karma produced by Driver-Harris Co. As for the insulation, a quartz coating .0006" thick was found to give good results. With this quartz coating the flashing operation started within 1.5 seconds after current was applied to the heating wire and the insulated coating showed high resistance to peeling during winding and handling operations.

After mounting the snap plate on the frame element and attaching the pull wire taut between the anchoring finger 26 and the upstanding leg 24 of the L-shaped anchor member, the switch is adjusted by bending or moving the finger 26 to increase the tension in the pull wire. The introduction of tension into the pull wire through movement of the L-shaped anchor member on the vane, provides a longitudinal pull on the central vane which causes the intermediate central section of the vane to go into concavity while the end sections of the vane remain in convexity. In this position pressure begins to build up between contact 20 and a contact 36 which is fixed to the support 18. When the tension is further increased by movement of the finger 26, sufficient force is provided to cause the central portion of the vane 6 to pass beyond the plane of the plate and assume the contour of a relatively flat M. At a given tension in the pull wire the central part of the plate is forced through a position

of unstable equilibrium at which instant some of the force accumulated in the vane by the longitudinal pull of the wire is released and operates to snap the free end of the plate with the contact **20** away from contact **36**.

A switch so adjusted may be connected in a circuit such as that shown diagrammatically in FIG. 3. As shown in that figure the fixed contact **36**, which is insulated from the frame, is connected to a grounded source of positive potential indicated by the plus sign. The frame **18** and the metal plate **2** welded thereto are connected through a load **38**, illustrated as a lamp or lamps to be flashed, to ground. The heating wire **30** is coupled between the fixed contact **36** and the plate **2** so it is connected in series with the lamp load **38** across the grounded source of positive potential. Thus current flows through the lamp load **38** and the heating wire, and though this current is insufficient to light the lamp **38**, it will cause the heating wire **30** to heat the pull wire **28** and permit it to expand. Expansion of the pull wire releases the tension therein sufficiently to permit the plate **2** to snap to close contacts **20** and **36**. With the contacts closed the heating wire **32** is shunted from the circuit and current flows directly from the contact **36** through the plate **2**, frame **18** and the lamp **38** to ground. With the heating wire **30** out of the circuit, the current through the lamp is sufficient to light it. Also with shunting of the heating wire **30** the pull wire **28** starts cooling and contracting. With contraction, tension in the pull wire returns to its initial value causing the plate **2** to snap contact **20** away from contact **36** putting the heating wire again in the circuit and returning the snap switch to its initial position.

The switch is supported on a base **40** of insulating material, such as phenol formaldehyde resin, in which are anchored two prong terminals **42** and **44** by means of lugs or tongues which extend through the base **40**. The frame **18** has an offset lower portion **46** which rests on the base **40** over the terminal **42** and is clamped to the base by the lugs **48** of that terminal. The frame is provided with a generally square opening **50** within which a support **52** for the fixed contact **36** is disposed. Support **52** includes a lower generally square plate element **52***a* which is clamped to the lower part of frame **18** by inturned flanges **54** of the frame, spacers **56** of mica or the like on each side of the palte element electrically insulating the element from the frame. The contact **36** is welded to one face of the support **52** within the opening **50** of the frame. A rearwardly extending tab **52***b* on the support **52** provides means for adjusting the position of the fixed contact. For electrical connection of the contact **36** to the terminal **44** and the heater winding **30**, the support **52** is provided with an outwardly extending finger **52***c*.

Also clamped between the flanges **54** and electrically insulated therefrom and from the plate element **52***a* by mica spacers **56**, is a plate element **58***a* forming a lower extension of a support arm **58** for a stop **60**. The stop **60** is aligned with contact **36** and has an outwardly extending tab **58***b* thereon for adjustment of the spacing of the stop from the snap plate **2**. The upper end of frame **18** is formed along its sides with portions **62** offset from the plane of the frame to provide spaced areas in which the snap plate **2** is welded. The lower end of the snap plate extends between the contact **36** and stop **60** with the plate carried contact **20** aligned with the contact **36**. A suitable cover (not shown in the drawing) is crimped to the periphery of the base **42** to complete the assembly.

In use, the grounded source of positive potential is connected through a suitable switch to terminal **44** and the load **38** is connected to terminal **42**. Operation of the device so connected has been discussed previously with respect to FIG. 3 and a further discussion of it at this time is deemed unnecessary.

The improved heater of the invention and of a specific flasher construction embodying the same has now been described. Obviously various features of the described flasher could be changed without departing from the spirit of the invention or the scope of the accompanying claim.

The following is claimed:

In a snap switch of the type comprising: a frame; two spaced apart stops attached to said frame; a resilient metallic strip having one end fixedly secured to the frame and the other end freely movable between the spaced apart stops, said strip having two substantially longitudinal slots therein which define a bowed centrally located vane; and expansible pull wire which is tensioned between the frame and the strip to hold the centrally located vane in compression so that the strip contacts the first of the spaced apart stops when the pull wire is cold and contacts the second of the spaced apart stops when the pull wire is heated and expands; and a heating wire wrapped around the pull wire to cause its expansion, the improvement which comprises a thin quartz coating for said heating wire for electrically insulating each portion of the heating wire wrapped around the pull wire from the pull wire and from each adjacent portion of the heating wire wrapped around the pull wire, said thin quartz coating being substantially thin with respect to the heating wire whereby electrical shorts in the heating wire are prevented but rapid heating of the pull wire is obtained.

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