June 17, 1958 J. C. CLARK 2,839,634

ELECTRIC SWITCH

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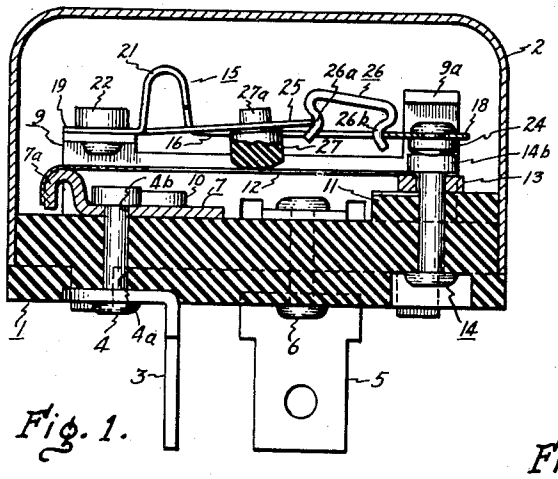


Fig. 1.

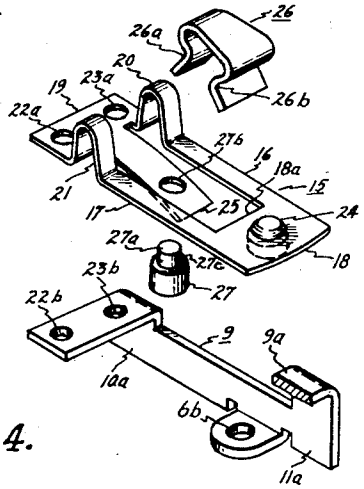
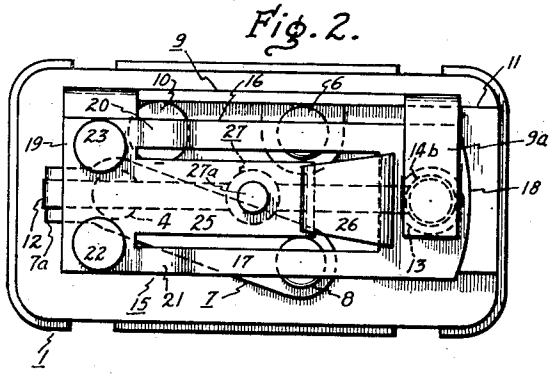
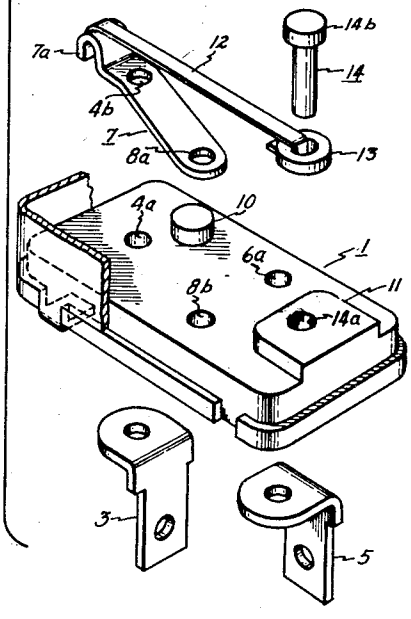


Fig. 4.

Fig. 2.





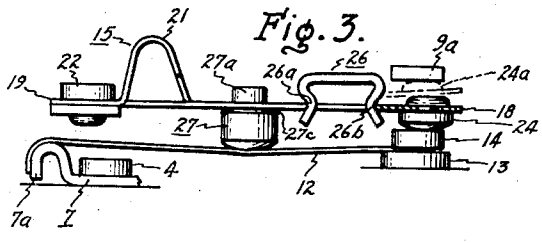


Fig. 3.

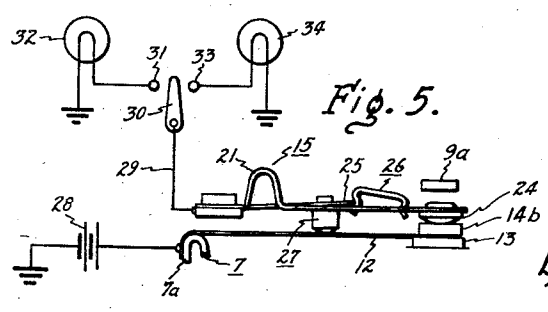


Fig. 5.

Inventor
Joseph C. Clark,
by George H. Baldwin
His Attorney.

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ELECTRIC SWITCH

Joseph C. Clark, Orlando, Fla., assignor to Johnson Electronics, Inc., Casselberry, Fla., a corporation of Florida

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This invention relates to electric switches and more particularly to self-actuating intermittently operable switches comprising a thermally expansible element such as are used as flasher switches in automobile turn indicator signal lamp arrangements.

It is well known that electric arcs drawn between relatively movable contacts tend to corrode and pit the contact surfaces. Such deleterious effects, if prolonged, tend to impair the efficiency of the contacts as a current conducting medium when closed and also tend to interfere with the operation of the contacts both during switch opening and switch closing operations. It is also well understood that a wiping action of the contacts when opening and closing tends to prevent pitting and the formation of corrosion at the contact surfaces. Furthermore, snap action opening movement of relatively movable contacts is known to aid in reducing arcing time and thereby to tend to prevent damage to the contacts due to arcing.

A principal object of this invention is to provide an improved highly durable switch of the above-mentioned type which is capable of quickly separating its contacts and which is arranged to perform a unique contact wiping action both during switch opening and switch closing operations.

Another object of the invention is the provision of an improved switch of the type above-mentioned which is compact, sturdy, reliable, readily adjustable, and capable of performing a great many circuit opening and closing operations without requiring maintenance or repairs and thereby to enhance the safety of automobile operators and passengers.

The invention in one form comprises a movable switch arm on which an electric contact is mounted and which is provided with a yieldable portion for accommodating relative movement of the ends of the arm in a direction longitudinally thereof, an electroresponsive element adjacent the switch arm, overcenter toggle means having a part biased into following engagement with the electroresponsive device and operable thereby to impart snap action operating movement to the switch arm in a direction generally transverse thereto and simultaneously to move the contact longitudinally of the switch arm thereby to cause the contact to perform a wiping action.

The invention will be better understood from the following detailed description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a cross-sectional side view of a switch embodying the invention;

Fig. 2 is a plan view of the arrangement depicted in Fig. 1 but with the cover removed;

Fig. 3 is a front or side view of the essential operating elements of the invention;

Fig. 4 is an exploded perspective view of a switch embodying the invention, such as is shown in Figs. 1, 2, and 3; and

Fig. 5 is a schematic representation of a signalling system embodying the switch depicted in Figs. 1–4.

With reference to Fig. 1 the numeral 1 designates the

base portion of the switch which is made of suitable insulating material molded to the shape depicted in the drawings. Overlying and surrounding the switch and removably mounted to the base 1 is a metallic cover 2. A first terminal 3 is affixed to the base 1 by conductive metal pin 4 while a second terminal 5 is affixed to the base 1 by means of a conductive pin 6. In addition to acting as a supporting means for terminal 3, pin 4 also aids in securing the support 7 in position on base 1 since pin 4 extends, as seen in Fig. 4, through an opening 4*a* formed in base 1 and a corresponding opening 4*b* formed in support 7. A pin 8 extends through the opening 8*a* also formed in support 7 and through the opening 8*b* formed in base 1 thereby securely to anchor the support 7 in position. Pin 6 in addition to acting as a supporting means for terminal 5 also supports the bracket 9 since pin 6 extends through opening 6*a* in base 1 and through opening 6*b* in bracket 9. For affording additional support to bracket 9 a projection 10 formed integrally with base 1 is provided together with a similar projection 11. Projection 10 engages the portion 10*a* of bracket 9 while the projection 11 engages portion 11*a* of bracket 9 thereby to affix the bracket 9 securely in position on the base 1.

Secured as by welding or other suitable metal amalgamation process or by mechanical means to the support 7 is a condition responsive means 12 in the form of an electrothermalresponsive ribbon, the other end of which extends through the opening in an annular, grommet-like conductor 13 affixed by pin 14 to the base 1, the pin 14 extending through the opening 14*a* formed in base 1. Since the head portion 14*b* of pin 14 engages the ribbon 12 so as to clamp a portion thereof between the grommet 13 and the head 14*b* of the pin 14, the ribbon 12 is maintained securely affixed to the pin 14. As will be more apparent as the description proceeds, the head portion 14*b* of the pin 14 constitutes a fixed contact forming one of the main contacts of the switch.

Pins such as 4, 6 and 14 of course can be of any known construction. Preferably these pins are of a hollow construction and one end thereof is provided with a head portion and the other end thereof is mechanically flanged outwardly or upset in the manner of a rivet so as to constitute a fastening means for the pin after it is inserted into its service position during assembly of the switch.

For the purpose of forming an electrical connection between the bracket 9 and the fixed contact 14*b* a switch arm generally designated in Fig. 4 by the numeral 15 is provided. Switch arm 15 comprises a pair of spaced side pieces 16 and 17 and a pair of spaced end pieces 18 and 19. Preferably though not necessarily the spaced side and end pieces are formed integrally out of a single piece of resilient sheet metal, such as spring bronze, and the spaced side pieces 16 and 17 are provided with resiliently yieldable looped portions 20 and 21 whereby relative movement of the ends of the switch arm 15 in a direction longitudinally thereof may be accommodated. Switch arm 15 is affixed to the bracket 9 by pins 22 and 23. Pin 22 extends through opening 22*a* in switch arm 15 and through opening 22*b* in bracket 9. Similarly the pin 23 extends through the opening 23*a* in switch arm 15 and through the opening 23*b* in bracket 9. The swing end 18 of switch arm 15 is interposed between the fixed contact 14*b* and an overhanging portion 9*a* of the bracket 9. From the description thus far it will be understood that the movable contact 24, which is affixed to the end piece 18 of the switch arm 15, is arranged for limited movement between fixed contact 14*b* and stop 9*a*.

The circuit through the switch comprises terminal 3, pin 4, support 7, electroresponsive device 12, fixed contact 14*b*, movable contact 24, switch arm 15, bracket 9, pin 6, and terminal 5.

For the purpose of imparting operating movement to

the switch arm 15 and the movable contact 24, overcenter toggle means is provided in the form of a first toggle link 25, which if desired may be integrally formed with the end piece 19 of the switch arm 15, and a second toggle link 26 which if desired may constitute a generally U-shaped element the prongs of which are provided with grooves 26*a* and 26*b* for respectively receiving the end portion of the toggle link 25 and the edge portion 18*a* of end piece 18. As is indicated in Figs. 1 and 5 the toggle comprising links 25 and 26 is an overcenter device, and each toggle link is substantially incompressible. Spring tension to effect the over center operation of the toggles is afforded by loops 20 and 21 which are in tension, drawing edge 18*a* in the direction tending to compress the links. Furthermore, loops 20 and 21 serve in the nature of hinges for the swinging of end 18, distributing the bending of the member and minimizing any tendency toward fatigue failure at any localized area of the member.

An insulating knob 27 is provided with an extension 27*a* of reduced diameter which fits in the opening 27*b* formed in toggle link 25. The knob 27 engages the electroresponsive ribbon 12 and the toggle link 25 of spring material is formed in such a way that it comprises a leaf spring biased in the direction of the electroresponsive ribbon 12. That is, at rest link 25 would assume the downwardly curved position and shape shown in Fig. 5.

Thus with the switch parts occupying the positions represented in Fig. 1, for example, that is with the movable contact 24 in the closed position, a predetermined magnitude of current flowing through the switch parts including the elongated, thin, expansible strip element 12 will cause the element 12 to heat, in accord with its electrical resistance, and to become elongated and the bias of toggle link 25 will cause the knob 27 to remain in following engagement with the electroresponsive ribbon 12. As the ribbon 12 increases in length and as the toggle link 25 moves downwardly, eventually a point is reached at which the toggle comprising links 25 and 26 will move downwardly through dead center to another overcenter position and in so doing will cause the right-hand extremity of the switch arm 15 and the movable contact 24 to move quickly upwardly with a snap action until the contact 24 engages the stop 9*a*. During the toggle movement from the starting position of Fig. 1 to the dead center position of Fig. 3 the movable contact 24 is moved toward the right, this wiping action being understood from a comparison of Figs. 1 and 3. This movement in a longitudinal direction of the switch arm 15 is made possible due to the fact that the looped portions 20 and 21 of the side pieces 17 and 16 respectively are resiliently yieldable and resulting from the use of incompressible links 25 and 26. In this way and in accordance with a feature of the invention a wiping action of the contacts is achieved during a switch opening operation. Obviously when the element 12 cools due to the interruption of current flow upon snapping of contact element 24 into its open position indicated in broken lines at 24*a* in Fig. 3, ribbon 12 will again contract, thereby to cause an upward force to be exerted on the follower 27 which in turn, and after a predetermined interval, causes the toggle to move through dead center again in an upward direction until the parts occupy the positions indicated in Figs. 1 and 5, the movable contact 24 being moved again with snap action. Again, since operation of the toggle through dead center is accompanied by opening of the loops 20 and 21, contact 24 wipes on contact 14*b*.

It will be noted that the toggle links 25 and 26 are approximately aligned with the swingable arms 16 and 17; that is, the links comprise an overcenter mechanism which, as it is operated overcenter, becomes elongated, as measured between stationary base portion 19 of link 25 and arm-engaging portion 26*b* of link 26, substantially in a plane generally perpendicular to the up and down direction in which end portion 18 and contact 24 swing. In the switch shown, the end portion 18 and contact 24 swing generally vertically, while the links expand in a substantially horizontal direction against the yielding bias of springs 19 and 20.

The tension of the electroresponsive element 12 and the resulting adjustment of the device is manually controllable since the downturned end portion 7*a* of the support 7 affords a convenient means for adjusting the tension of the element 12, it being simply necessary to grip the downturned element 7*a* with a suitable gripping device such as pliers and thereafter to impart a twisting motion either counterclockwise to increase the tension or clockwise to diminish it.

It will be noted in the drawing that the insulating button member 27, which constitutes the portion of link 25 which is in contact with element 12, is formed to have a bevelled or rounded annular surface 27*c* engaging the under surface of the body of toggle link 25. Bevelling or rounding of surface 27*c* permits a slight rocking movement of button 27 with respect to the body of the toggle link as the thermal element 12 expands and contracts, thereby to eliminate any rubbing of the button along element 12 which might otherwise occur during each cycle of operation.

From Fig. 5 it is apparent that a system embodying the switch of this invention may comprise a source of energy 28, electroresponsive element 12, fixed contact 14*b*, movable contact 24, switch arm 15, conductor 29, manually operable selector switch arm 30, which is movable to the left to engage a fixed contact 31 to complete a circuit to a left-hand indicating signal lamp 32 and which is movable to the right to engage a fixed contact 33 thereby to establish a circuit with the right-hand indicating lamp 34. The electroresponsive device 12 will heat and expand when the contact 24 is in the closed position and thereafter the toggle means comprising links 25 and 26 will operate to open contact 24 and after suitable time delay and the resulting cooling and shrinking of element 12 the bias of toggle element 25 will cause the toggle to move upwardly through dead center thereby to close the contact 24. After suitable time for the subsequent heating and expansion of element 12, the above described cycle will repeat itself. In this way the signal lamp selected such as either 32 or 34 will flash on and off intermittently thereby to warn other motorists of the intentions of the driver. The switch contact 24 may break and make the circuit in a system of the type shown in cycles of about one second duration, and it will be noted that, when switch 30 is closed, the signal light becomes immediately energized.

While I have shown and described a particular embodiment of my invention I do not wish to be limited thereto and intend in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A self-actuating flasher switch comprising an insulating base, an elongated conductive switch arm having spaced flexible and resiliently extensible side pieces interconnected by a pair of spaced end pieces, first connecting terminal means affixing one of said end pieces to said base, a movable electric contact affixed to the other of said end pieces, a second connection terminal on said base, a stationary contact on said base engaged by said movable contact, elongated electroresponsive means supported at one end by said stationary contact and at the other end by said second connection terminal and disposed adjacent and extending generally parallel to said switch arm, a first incompressible toggle link formed integrally with one end piece and disposed generally between said side pieces and having a movable end portion spaced from said one end piece, an insulating button rockably attached to said movable end portion and engaged against said electroresponsive means, said first toggle link being biased in a direction to cause said button to deflect said electrore-

sponsive means upon expansion thereof, and a second incompressible toggle link interposed between said first toggle link and the other of said end pieces, said second toggle link being provided with spaced grooves for respectively receiving said first toggle link and said other end piece, said toggle links constituting a toggle movable from one overcenter position to another for imparting transverse snap action movement to said movable contact alternately to and from said stationary contact in a direction generally opposite to the direction of overcenter movement of said toggle and for wiping said movable contact on said stationary contact.

2. A self-actuating flasher switch comprising a base, a switch arm mounted on said base and having a swingable portion, a pair of relatively movable contacts, one of said contacts being movable with said swingable portion of said switch arm, an electrothermal extensible element connected in series with said contacts and disposed generally parallel to and adjacent said switch arm, a leaf spring substantially aligned with said arm and on the same side of said element having a base portion fixed to said base and an end portion opposite an intermediate portion of said element and biased toward and into operative engagement with said element thereby to furnish a biasing force to said element effective to bow said element upon expansion thereof, a link coupling said spring and said switch arm for imparting swinging motion to said swingable portion of said switch arm responsive to alternate heating and cooling of said element to open and close said contacts, said bowing of said element being effective to open said contacts to discontinue the flow of current through said element and the consequent cooling and contraction of said element being effective to swing said spring against said spring bias thereof in a direction again to close said contacts to reestablish the flow of current to heat said element.

3. A self-actuating flasher switch comprising an insulating base, a thin electrothermalresponsive expansible strip having respective ends, connection means fixed to said base rigidly supporting one of said strip ends, a conductive support element fixed to said base supporting the other said strip end, said element comprising a fixed switch contact, a leaf spring generally parallel to and spaced from said strip, means fixed to said base rigidly supporting one end of said leaf spring, insulating knob means interposed between the other end of said leaf spring and a portion of said strip between its said ends, the spring force of said leaf spring urging said knob means against said strip and forcing said strip to bow upon expansion of the strip, whereby said expansion of said strip causes said other end of said spring to move from a first to a second position and subsequent contraction of said strip forces said other end to return to its said first position, a resilient switch arm having one end fixed to said base adjacent said one end of said strip and carrying a movable contact at its other end engageable with said fixed switch contact at said other end of said strip, said arm extending generally in alignment with said leaf spring and having a tension spring portion between its said ends, a rigid link coupling said other end of said leaf spring and said other end of said arm operable upon contraction of said strip to snap said other end of said arm overcenter to engage said contacts and upon expansion of said strip to snap said other end of said arm overcenter to disengage said contacts, and two external circuit connection terminals connected to said one end of said strip and to said arm respectively.

4. A self actuating flasher switch comprising a base at least in part of insulating material, a pair of spaced supports mounted on said base, an elongated electrothermalresponsive element suspended between said supports and electrically connected therewith, one of said supports constituting a first terminal for said switch and the other of said supports constituting a fixed switch contact, a switch arm disposed in spaced generally parallel relation with said electrothermalresponsive element, means constituting a second terminal disposed adjacent said first terminal supportingly attaching one end of said switch arm to said base, said switch arm having a swingable portion at its other end, a movable contact mounted on said swingable portion of said switch arm and engageable with said first contact, a spring having one end supportedly attached to said base and having a portion spaced from said one end engaging and applying resilient biasing force against a portion of said electrothermalresponsive element between the ends fo said element, a toggle link mechanically connected between said portion of said spring and said portion of said arm for swinging said arm in response to movement of said portion of said spring, and means including said contacts for supplying current to said element under the control of said contacts to cause said portion of said element to yield to said bias and thereby to cause said spring portion to move in following relation to said portion of said element.

5. A self-actuating flasher switch comprising a base, a switch arm mounted on said base and having a portion swingable between two respective predetermined positions, a pair of relatively movable cooperating contacts, one of said contacts being attached to said swingable portion of said switch arm and movable with said swinging thereof alternately into and out of engagement with the other contact, an electrothermal extensible element disposed generally parallel to and adjacent said switch arm, a leaf spring substantially aligned with said arm and on the same side of said element having a base portion fixed to said base and an end portion opposite an intermediate portion of said element and biased toward and into operative engagement with said element thereby to furnish a biasing force to said element effective to bow said element upon expansion thereof, a link coupling said spring and said switch arm for imparting swinging motion to said swingable portion of said switch arm responsive to alternate heating and cooling of said element to swing said arm portion between its said predetermined positions, electric circuit means including and controlled by said contacts connected to supply heating current to said element in response to swinging of said arm portion into one of its said predetermined positions thereby to cause said element to expand, and to interrupt the supply of current to said element in response to swinging of said arm portion into the other of said predetermined positions thereby to cause cooling of said element, said bowing of said element being effective to cause swinging of said arm portion into its said other predetermined position thereby to cause said element to cool and contract and such contraction of said element being effective to swing said arm into its said one predetermined position.

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