Dec. 31, 1957 J. A. VOLK 2,818,479

TRANSIENT SWITCH

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Fig. 1.

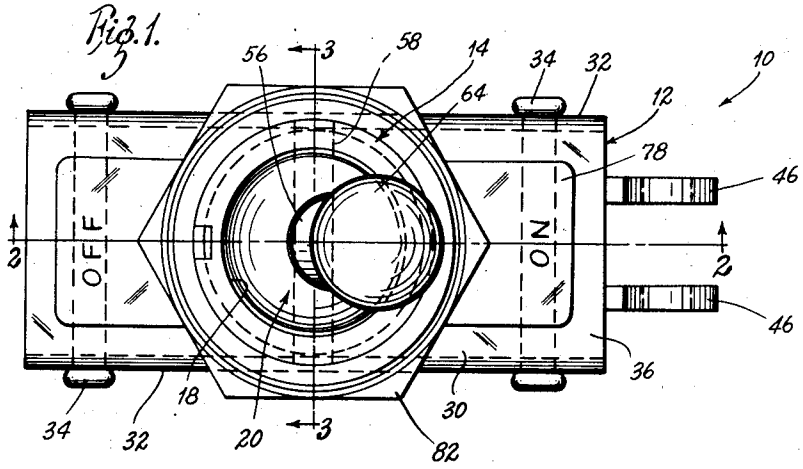


Fig. 2.

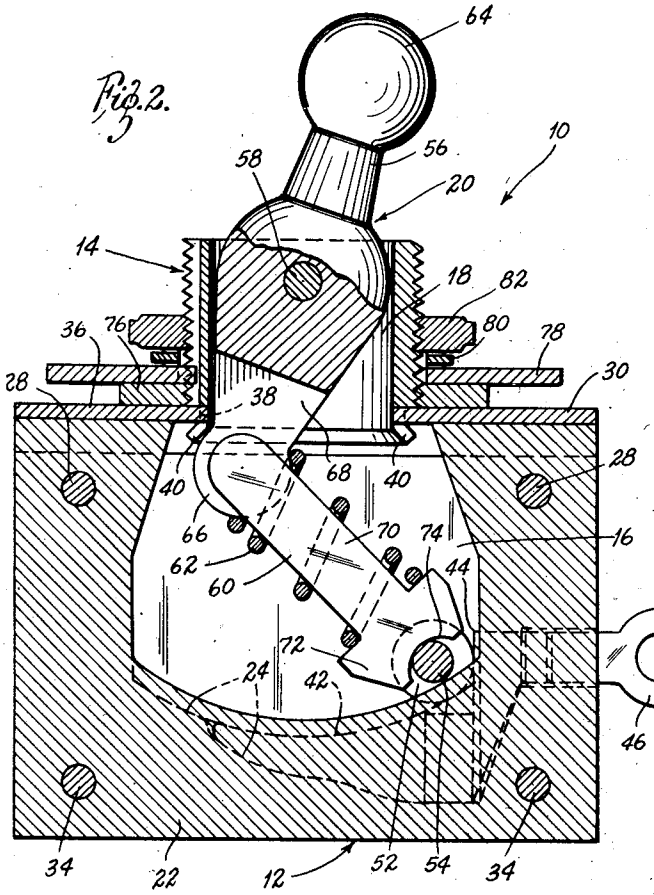
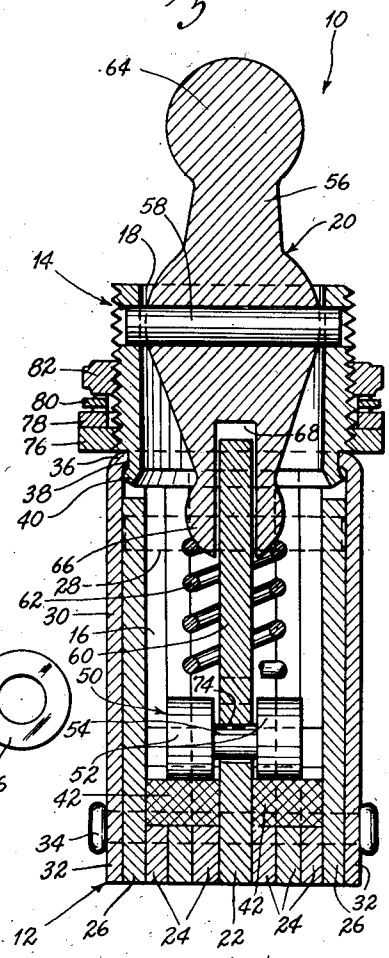


Fig. 3.



INVENTOR:
JOSEPH A. VOLK,
BY Kingsland, Rogers & Ezell
ATTORNEYS

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TRANSIENT SWITCH

Joseph A. Volk, Normandy, Mo., assignor, by mesne assignments, to Mandrel Industries, Inc., Grand Rapids, Mich., a corporation of Michigan

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8 Claims. (Cl. 200—144)

The present invention relates to electrical switches, and more particularly to a novel electrical on-off switch which, upon being actuated, effects a progressive variation of electrical impedance between its terminals prior to establishment of an open or closed condition as desired. Such a switch finds important application in high frequency, high voltage circuits as employed for television, radar, and the like.

Briefly, the switch of the present invention, considered for example in the form of a single pole, single throw type, comprises a pair of parallel elongated "contact" elements each connected at one end to a respective switch terminal and having the property of tapered electrical resistance over its length. A movable "pole" element is provided for selectively interconnecting the "contact" elements at corresponding points along the length of the latter, and a novel manually controlled actuating mechanism is adapted to move the pole element over substantially the full length of the contact upon each actuation of the switch.

It is an object of the present invention to provide a novel electrical on-off switch adapted to produce, upon actuation thereof, a transient variation of electrical resistance in an associated electrical circuit.

It is another object of the invention to provide a novel electrical on-off switch which incorporates resistance elements for transient insertion in an associated electrical circuit upon each actuation of the switch.

It is another object of the invention to provide a novel electrical on-off switch which is adapted automatically to increase the electrical resistance of an associated circuit prior to opening the same.

It is another object of the invention to provide a novel electrical on-off switch which is adapted automatically to close an associated electrical circuit through a current limiting resistance and, thereafter, to reduce the current limiting resistance to zero value.

It is another object of the invention to provide a novel electrical on-off switch having a toggle mechanism adapted to maintain pressure contact between a moving pole element and a stationary resistance element.

The foregoing, and additional, objects and advantages will be apparent from the following description of a specific embodiment of the invention taken in conjunction with the accompanying drawings, in which:

Figure 1 is a plan view of an electrical switch conforming to the teachings of the present invention;

Figure 2 is a sectional view taken generally along the line 2—2 of Figure 1, a fragmentary portion, however, being shown in elevation; and

Figure 3 is a sectional view taken generally along the line 3—3 of Figure 1.

Directing more specific attention to the drawings through reference to the numerals applied thereto, a switch designated by the numeral 10 exemplifies the teachings of the present invention. The switch 10 comprises a body section 12 surmounted by a barrel section 14. The body section 12 has an inner cavity 16 which communicates

with a bore 18 in the barrel section 14, and a toggle mechanism shown generally as 20 is movably disposed within the cavity 16 and the bore 18 as will be more fully explained hereinafter.

Referring to Figure 3, it will be noted that the body section 12 comprises a plurality of laminations, including a center lamination 22, intermediate laminations 24, and outer laminations 26. The laminations 22, 24 and 26 are preferably of sheet material having the property of electrical insulation. The center lamination 22 is formed as clearly illustrated in Figure 2. The intermediate laminations 24 have the same general configuration as the center lamination 22, except that the inside lower edge is formed to the irregular shape also indicated in Figure 2. The outer laminations 26 are rectangular in shape and are disposed outside the laminations 24, as best indicated in Figure 3. The stacked laminations, assembled as here described, are retained in position by means of pins 28 inserted through the upper portions thereof on either side of the cavity 16 formed thereby, and the whole group of laminations is embraced by a casing 30 having parallel side plates 32 in embracing relation with the stacked laminations. Rivets 34 inserted clear through this assembly are peened over so as to maintain a solid block-like construction.

The casing 30 includes an upper plate portion 36 having a central aperture 38 into which the lower end of the barrel 14 is inserted and secured by staking as indicated at 40.

A pair of resistor elements 42 having a generally wedge-like shape as best indicated in Figure 2 are disposed one on each side of the center lamination 22 and define, in part, an arcuate floor for the cavity 16. At their right hand ends, as illustrated in Figure 2, the resistor elements 42 are electrically connected to individual contact elements 44, and each of the contact elements 44 is, in turn, directly connected to an individual terminal element 46. It will be understood that, whereas one or more of the intermediate laminations 24 may be cut out to accommodate the contact elements 44 and the terminals 46, the center lamination 22 constitutes an insulating barrier between these parallel sets of conducting elements. It will further be understood that each of the resistor elements 42 is of a type which provides electrical resistance in correspondence with the proportion which is included in an associated electrical circuit. In other words, the greater proportion of the resistor elements 42 which is included in an electrical circuit, the greater will be the electrical resistance established in the circuit.

A short circuiting roller 50 is formed of electrical conducting material and has parallel wheel portions 52 interconnected by an axle portion 54. As is clear from the drawing, the wheel portions 52 are adapted to engage respective resistor elements 42, as well as respective contact elements 44. In addition, it will be obvious that under certain circumstances the roller 50 may be caused to traverse the arcuate length of the floor of the cavity 16 so as to remove the roller 50 completely from the elements 42 and 44.

The toggle mechanism 20, which has for its purpose the aforementioned manipulation of the roller 50, comprises a handle 56 pivotally retained in the bore 18 of the barrel 14 by a pivot pin 58, and a toggle arm 60 having a spring 62 disposed therearound and engaging the lower end of the handle 56. A preferred shape of the handle 56 is shown in the drawing to include an upper knob portion 64 for manual actuation of the switch 10, and a lower generally spherical portion 66 which is cradled in the upper end of the spring 62. Additionally, the lower end of the handle 56 is provided with a slot 68 for accommodating the upper end of the toggle arm 60. The toggle

arm 60, itself, includes a stem portion 70 about which the spring 62 is disposed and a lower head portion 72 containing an arcuate notch 74 adapted to rest slidably upon the axle portion 54 of the roller 50.

A feature of the general arrangement of the illustrated switch 10 resides in the relationship between the arcuate floor of the cavity 16 and the position of the pivot pin 58 about which the handle 56 is adapted to pivot. Attention is therefore directed to the fact that whereas the radial center of the arcuate floor is positioned approximately at the base of the barrel 14, the pivot pin 58 is positioned well above this point in the barrel 14.

The barrel 14 is preferably threaded on the outside and may be provided with conventional accessories such as the illustrated jam nut 76, escutcheon plate 78, lock washer 80, and hex nut 82.

Operation

The illustration of Figure 2 of the drawing shows the switch 10 in closed condition, inasmuch as the electrical conducting roller 50 has its wheels 52 disposed in contact with the contact elements 44 which are in turn electrically connected with the terminal 46. Hence, these terminals 46 are short circuited through the roller 50, and the switch 10 adds no more than normal electrical switch resistance in an electrical circuit.

If now it be assumed that the knob 64 of the handle 56 is moved toward the left hand side of Figures 1 and 2, it is clear that the angle formed between the handle 56 and the toggle arm 60 will be made more obtuse, which will result in the upper end of the stem portion 70 of the toggle arm 60 being moved upwardly in the slot 68 in the lower end of the handle 56 and also in the spring 62 being compressed to a shorter length. The spherical end 66 of the handle will, however, remain cradled in the upper end of the spring 62 until eventually the stem portion 70 of the toggle arm 60 will be moved over to the right hand side of the aforementioned radial center of the arcuate floor of the cavity 16. As soon as this latter condition is realized, the spring 62 will be exerting a force against the axle portion 54 of the roller 50, which force will have a component which acts tangentially to the left relative to the arcuate floor and the roller 50 will begin to move to the left. Clearly, as the roller 50 moves to the left the tangential component increases more and more and the roller 50 is moved to the opposite end of the cavity 16. At the same time, the handle 56 and the toggle arm 60 assume a stable position which is the reverse of that illustrated in Figure 2.

In the aforementioned movement of the roller 50 from the position shown in Figure 2 to the opposite end of the arcuate floor, the initial separation of the wheels 50 from the contact elements 44 will change the conducting properties of the switch 10 from a condition in which the switch 10 offers negligible resistance in an electrical circuit to one in which only a small resistance is inserted therein. In other words, even though the roller 50 no longer directly short-circuits the contact elements 44, it does short-circuit the resistor elements 42 at points very near the right ends thereof so that only a small portion of each of the resistor elements 42 is inserted in the electrical circuit between the terminals 46. As the roller 50 traverses the arcuate floor, greater and greater proportions of the resistor elements 42 are included in the circuit and the electrical resistance therein is correspondingly increased until, finally, the wheels 50 roll completely off the left hand ends of the resistor elements 42 and rest upon the insulating laminations 24. Thus, the electrical circuit is placed in open condition only after having its electrical resistance first increased in a predetermined pattern.

A return movement of the knob 64 to the right in Figure 2 will result in the toggle mechanism 20 being restored to the illustrated position, and it will be obvious that initial closure of the electrical circuit which incorporates the switch 10 will be with the full resistance of the resistor elements 42 included therein, this added resistance being gradually decreased until once more the terminals 46 are short-circuited by abutment of the roller 50 with the contact elements 44.

Clearly, there has been disclosed a transient switch which fulfills the objects and advantages sought therefor.

It is to be understood that the foregoing description and the accompanying drawing are given by way of illustration and example. It is further to be understood that changes in the form of elements, the rearrangement thereof, or the substitution therefor, which will be apparent to those skilled in the art, is considered to be within the scope of the invention, which is limited only by the claims which follow.

What is claimed is:

1. A transient switch comprising, in combination, a base, a pair of terminals mounted on the base and insulated from each other, a pair of electrical conducting elements mounted in the base, each of said elements having an elongated continuous contact surface and being connected at one end to a respective terminal, said elements being parallel to each other and at least one of them having substantial electrical resistance, and movable electrical conducting means adapted for movement along said continuous elongated contact surfaces and beyond the free ends thereof, and means for selectively reciprocating said electrical conducting means.

2. The combination of claim 1 plus individual contact means connected to said terminals adjacent the connected ends of said electrical conducting elements, said movable electrical conducting means being simultaneously engageable with said contact means and said electrical conducting elements.

3. The combination of claim 2 wherein said resistance element provides infinitety variable resistance in correspondence with the instantaneous position of said movable means on said contact surface, said variable resistance being maximum when the movable means engages the free end of said contact surface and being minimum when the movable means is at the limit of its reciprocable movement adjacent the connected end of said contact surface.

4. In a transient switch, the combination of means defining a chamber having an arcuate wall, a switch pole disposed in said chamber for movement along said arcuate wall, a pivotally mounted actuating element having an end portion disposed for reciprocable movement in a radial plane of said arcuate wall, said end portion of the actuating element being generally spherical and being provided with a slot formed parallel to the reciprocable movement of the element, and means movably interconnecting said end portion and said switch pole, said latter means including an elongated toggle arm having a flat stem portion at one end slidably extended into said slot and the other end abutted against said switch pole, and a biasing spring mounted on said toggle arm and having one end disposed against said spherical end portion of the actuating element.

5. In a transient switch, the combination which includes a switch block provided with a switch chamber, means including a pair of parallel electrical resistor elements defining an arcuate wall of said chamber, each of said elements being connected at one end only to an individual electrical terminal and providing electrical resistance which varies in accordance with the portion thereof included in an electrical circuit, a switch pole disposed for movement along the arcuate extent of said parallel resistor elements and therebeyond, and means for selectively moving said switch pole from one end of said arcuate wall to the other.

6. The combination of claim 5 wherein an individual electrical contact is interposed between the connected end of each resistor and its associated terminal, said contacts being engaged by said switch pole upon movement there-

of from a position beyond the unconnected ends of the resistors substantially to the connected ends of the same.

7. The combination of claim 6 wherein said resistors have a tapered resistance characteristic.

8. A transient switch comprising, in combination, a body provided with a switch chamber, said chamber having at least one concave arcuate wall including a non-conductive portion and a plurality of arcuate conductive portions, individual conducting means including a terminal connected to each of said arcuate conducting portions, a conductive short circuiting element movably disposed within said switch chamber for movement along and beyond said arcuate conductive portions, a spring-loaded toggle mechanism for moving the short-circuiting element back and forth along the arcuate wall, said toggle mechanism including an elongated handle mounted for limited pivotal movement in said body, said limited pivotal movement being such as to define an angle

less than the angle subtended by the concave arcuate wall, an elongated arm having one end movably interengaged with said handle and its other end engaged with the short-circuiting element, and a spring interposed between said handle and said arm so as to bias the latter away from the former and generally toward the arcuate wall, the center of curvature of the arcuate wall being located between the arcuate wall and the pivotal axis of said handle.

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