

July 9, 1929.

F. J. BAST

1,719,959

ELECTRIC SWITCH

Filed March 11, 1927

2 Sheets-Sheet 1

Fig. 1.

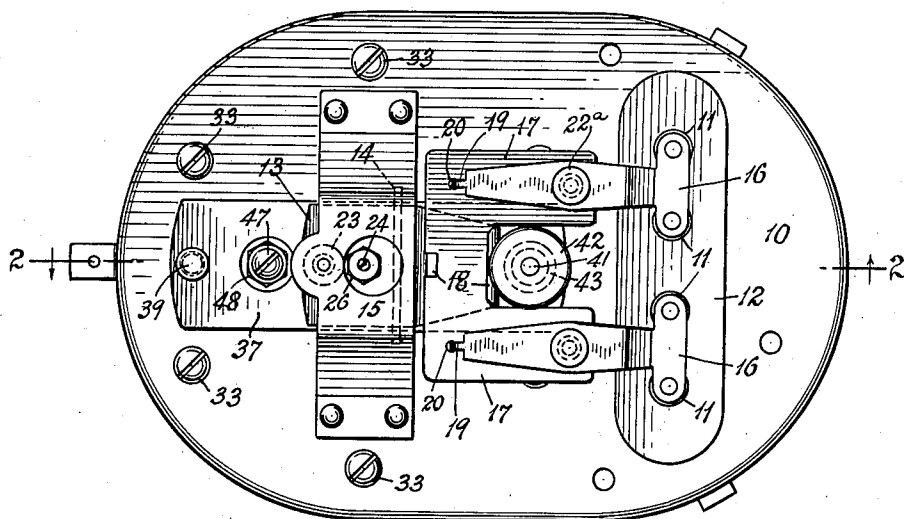


Fig. 2.

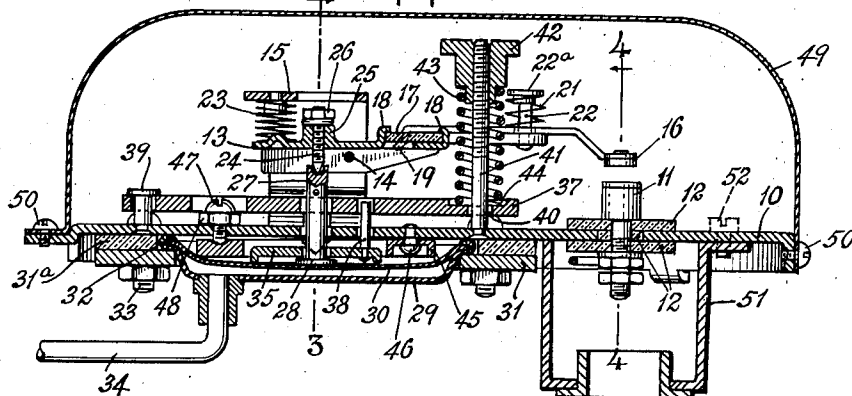
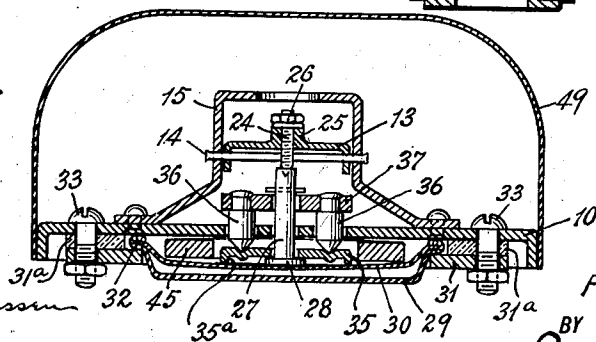


Fig. 3.



WITNESS

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Fig. 4.

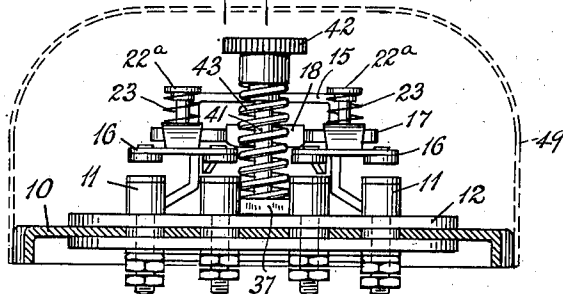


Fig. 5.

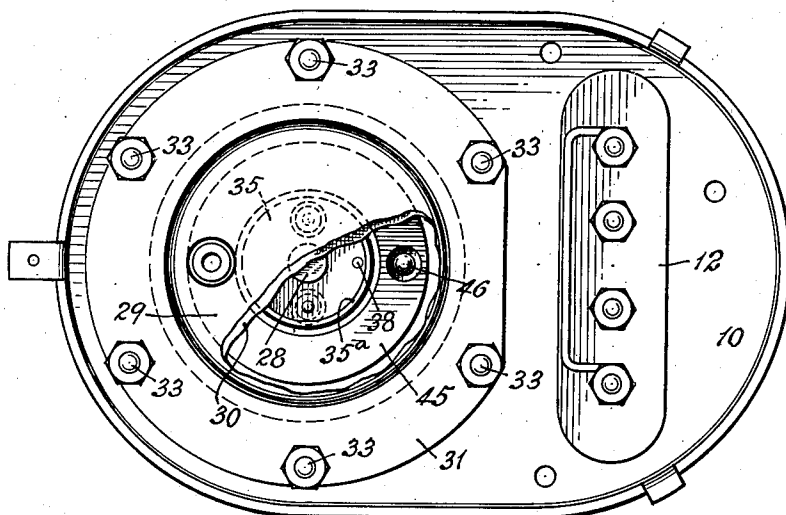
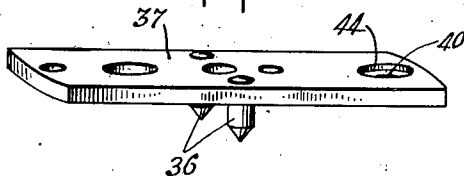


Fig. 6.



WITNESS

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ELECTRIC SWITCH.

Application filed March 11, 1927. Serial No. 174,436.

My invention relates to electric switches and has for its object to provide an automatically controlled switch of simple construction whereby the making and breaking of the circuit is accomplished by sudden and abrupt movements of the controlling elements without arcing or sparking at the contact points. Other more specific objects will appear from the description hereinafter and the features of novelty will be pointed out in the claims.

In the accompanying drawings, which illustrate an example of the invention without defining its limits, Fig. 1 is a plan view of the novel switch; Fig. 2 is a sectional elevation on the line 2—2 of Fig. 1; Fig. 3 is a cross section on the line 3—3 of Fig. 2; Fig. 4 is a similar view on the line 4—4 of Fig. 2; Fig. 5 is an inverted plan view, and Fig. 6 is a detail perspective view of one of the elements of the switch.

As shown in the illustrated example, the switch includes a base or support 10 of suitable material and dimensions, and provided with contact studs 11 or the like forming part of the electrical circuits for which the switch is designed. If the material, of which the base 10 is made, is a conductor of electricity, the contact studs 11 are insulated therefrom and from each other by means of any conventional insulating material 12 as shown in Figs. 1 and 2. A switch lever 13 is pivoted at 14 upon a bracket 15 fixed upon the base 10 as by riveting and carries contact members 16 arranged for cooperation with the contact studs 11 to control the opening and closing of the electrical circuits in which said studs are included. In the preferred form the lever 13 is made in two sections, one of which, that is the section 17, is made in suitable form of any customary insulating material and is secured in place to form a rigid part of the lever 13 in any convenient manner as by means of lugs 18 comprising integral parts of the lever 13 and bent over the section 17 as shown in Figs. 1 and 2. In order to provide a construction of maximum efficiency which at the same time will accommodate itself to varying degrees of movement of the lever 13 with respect to the studs 11, it is preferred to mount the contact members 16 in a resilient manner upon the section 17 of the lever 13. For this purpose the contact members 16, in the illustrated

example, are pivotally connected with the section 17 for instance by being provided at one end with lugs 19 projecting into apertures 20 of the section 17 as shown in Figs. 1 and 2. Springs 21 serve to yieldingly press the members 16 toward and to maintain them in surface engagement with the section 17, said springs being mounted upon pins 22 extending through openings in said members 16 and carried by the section 17, the heads 22^a of said pins forming abutments for the springs 21 at one of their ends as illustrated in Fig. 2. A spring 23 bears with its one end against the bracket 15 and with its other end against the lever 13 and in the illustrated example serves to normally maintain the latter in a position in which the contact members 16 are out of engagement with the contact studs 11 or their equivalent as illustrated in Fig. 2. The lever 13 carries a stop which preferably is adjustable thereon and in the illustrated example is shown in the form of a screw 24 mounted in a boss 25 and locked in place by means of a lock-nut 26, said screw having its lower end pointed or otherwise shaped to fit into the recessed end of a stem 27 which passes loosely through an opening in the base 10. The lower end of this stem 27 preferably is provided with a head 28 which rests against the controlling device which is responsible for the development of the sudden and abrupt movements necessary for connecting and disconnecting the contact members 16 with and from the contact studs 11 or their equivalent. The controlling device, in the illustrated example, comprises a hollow member 29 of any suitable shape but preferably circular in form and having its one wall 30 in the nature of a metal disk possessing the inherent properties necessary to produce the results hereinafter set forth. The member 29 may be fixed in place upon the support 10 in any convenient manner and preferably so as to be removable at will, the illustrated example showing a retaining ring 31 for this purpose. The ring 31 engages an annular flange 32 with which the member 29 in such case is provided and clamps it against the lower face of the support 10, the ring 31 itself being detachably secured in place by means of bolts 33 or their equivalent as shown in Figs. 2, 3 and 5; if necessary or desirable insulation 31^a

of such type or of such dimensions as not to interfere with the clamping functions of the ring 31, may be located between the latter and the support 10 as shown in Figs. 2 and 3.

5 The disk 30 is of dished form and at an intermediate point hammered, stretched or otherwise treated and hardened to provide an active section which, after being developed, possesses the inherent tendency of abruptly snapping from its normal concave position to an opposed concave position upon the application to the inner surface of said disk of pressure in a predetermined manner. That is to say, the physical characteristics of the disk 30 are such that the active section, without any substantial preliminary movement, will snap into a concave position opposite to that in which it is normally located if sufficient pressure is exerted upon the convex surface of said section, the latter automatically and instantly returning to its initial position as soon as the aforesaid pressure is relieved; in other words the major movement of the active section in either direction is in the snap so that it is not necessary to first adjust the disk, in preliminary gradual movements, to a central position before the snapping movements are developed. The pressure whereby the described movement of the active section of the disk 30 is effected may be developed in any suitable manner and by means of any convenient instrumentalities adapted to automatically actuate the particular switch. For instance as shown in the drawings the interior of the member 29 may be connected by means of an armored or other capillary tube 34, which leads to a thermodynamic bulb of any conventional type, the member 29, tube 34 and bulb in such case being wholly or partly filled with a fluid which exerts various pressures in response to variations in temperature externally effective upon the aforesaid thermodynamic bulb.

In any case, as pressure in the member 29 is developed by heating the fluid in the bulb, this pressure will be effective upon the inner surface of the disk 30 and as soon as said pressure reaches a predetermined point the active section of the disk 30 will be pressed outwardly and almost instantly will snap into a concave position opposite to that normally occupied by said section; at this stage, the disk 30 or the active section thereof, instead of bulging inwardly accordingly bulges outwardly with respect to the member 29 or its equivalent. As soon as the pressure is reduced or released to a predetermined extent in said member 29, the disk 30 because of its inherent characteristics immediately snaps back to its initial position because atmospheric pressure acts thereon. The above snapping action of the disk, in which the major portions of its operative movements are in the snap, is in contradistinction to a device in which the active element is first required to be adjusted in gradual move-

ments to a central position before any snapping movement takes place. With the instant arrangement gradual separation or connection of electrical contacts are positively avoided and such separation and connection is brought about abruptly and suddenly.

With the arrangement shown in the drawings the pressure in the member 29 whereby the disk 30 is caused to snap outwardly is developed as a result of increased temperature at the bulb to which the capillary tube 34 leads so that the aforesaid operations of the disk 30 are brought about by variations in the temperature which is externally effective upon said bulb. The movements of the disk 30 as pressure is applied thereto and removed therefrom are abrupt and sudden as will be clear from the above description. As the disk section 30 snaps from its normal position to an opposed position, by the action of pressure developed as explained above, the stem 27 or its equivalent will be correspondingly forced outward, and by acting upon the stop or screw 24 will swing the lever 13 and its associated parts upon the pivot 14 and force the contact members 16 into engagement with the contact studs 11 and thereby close the electric circuit of which said contact studs form a part; the circuit may include an alarm or any device capable of being electrically actuated for a predetermined purpose when the circuit is closed. If the pivotal movement of the lever 13 induced by the action of the disk 30 continues after the contact members 16 have come into engagement with the contact studs 11, the springs 21 will be compressed and thereby permit excessive independent movement of said lever 13 without injury to the contact members 16 and without subjecting the same to undue strain. As soon as the pressure in the member 29 drops, as a result of a predetermined decrease in temperature at the bulb, the disk 30, because of its inherent characteristics, will at once snap back to its initial position in a direction away from the stem 27. By the action of the spring 23 upon the lever 13 the screw 24 will exert a pressure upon the stem 27 to cause the latter to follow the return movement of the disk 30, and at the same time will pivotally swing the lever 13 and its associated elements in the reverse direction to disengage the contact members 16 from the contact studs 11 and thereby break the electric circuits. The operative movements of the disk 30 being abrupt and sudden over a large fraction of the total movement, the engagement of the contact members 16 with, and their disengagement from the contact studs 11 will be correspondingly sudden and abrupt, so that arcing and burning of the contact members and contact studs is positively avoided. It will be obvious that the arrangement may be such that the electrical circuit is broken when the disk 30 is bulged from its normal position by the application of pres-

sure and closed when said section snaps back into place as the pressure is relieved without in any way departing from the inventive idea.

For the purpose of changing the setting of the switch or to enable the snapping instant, at which the disk 30, under the influence of applied pressure, snaps from its normal concave position to an opposed concave position, to be controlled, a suitable setting or adjusting means is provided. Through this adjusting means, the range of temperatures may be varied while maintaining the temperature differential substantially constant. As shown in the drawings this means consists of a pressure member 35 preferably circular in form and provided with an annular flange 35^a in engagement with the disk 30 approximately in registry with the peripheral boundary of the active section thereof as shown in Figs. 2 and 3. The pressure member 35 includes an axial opening through which the stem 27 passes, and further is provided with recesses for the reception of the tapering ends of lugs 36 rigidly carried by and projecting from a pressure lever 37; in addition a positioning pin 38 may project upwardly from the member 35 and through a suitable opening in the support 10 and into an aperture formed in the lever 37. The latter is pivotally mounted upon a headed stud 39 fixed upon and projecting perpendicularly from the base 10 and at its free end is provided with an opening 40 through which a rod 41 fixed upon the base 10 extends as shown in Fig. 2. The upper end portion of said rod 41 is screw-threaded for the accommodation of an adjusting or setting nut 42 which constitutes an abutment for one end of a spring 43 mounted upon the rod 41, the other end of said spring 43 engaging the lever 37 near the free end thereof, and preferably is seated in a recess 44 formed in said lever.

With this arrangement the spring 43 exerts a resilient pressure upon the pressure lever 37 and thereby, through the medium of the lugs 36 transmits such pressure to the pressure member 35 to develop a resistance to the snapping of the disk 30 induced by the application of pressure thereto as hereinbefore described. The degree of resistance interposed by the member 35 to the aforesaid snapping, may be varied by adjusting the nut 42 upon the rod 41 and thereby changing the tension of the spring 43 upon the lever 37.

In addition to the parts so far described the device includes means for changing the "differential" of the snapping pressures. In the illustrated example this means comprises an annular member 45 surrounding the pressure member 35 and loosely and pivotally mounted upon the base 10 for instance by means of a pin 46. At a point diametrically opposite to the pivot pin 46, the member 45 is provided with a recess for the reception

of the end of an adjusting screw 47 screw-threaded in the base 10 and secured in an adjusted position by means of a lock-nut 48 as shown in Fig. 2. The annular member 45 is made of such thickness as to permit the disk 30 to assume its maximum convex form in an outward direction and to form a positive stop against which the convexed disk abuts and which prevents any outward bulging thereof beyond this point.

In the illustrated example of the device a differential exists between the outward snapping pressure of the disk 30 and its inward or return snapping pressure; this differential is capable of being varied or adjusted in the following manner. Assuming that when the annular member 45 is in surface engagement with the disk 30, the latter will snap outwardly at 30° F. and back again or inwardly at 20° F., then if the screw 47 is turned inward to bring the annular member 45 into closer engagement with the disk 30 it will snap outwardly at 30° F. as before, but will snap inwardly at 25° F. thereby making the aforesaid differential less.

By operating screw 47 and nut 42 so as to vary the pressure of the annular member 45 and the pressure member 35 on the diaphragm or disk 30, the differential can be changed without changing the mean temperature. For example, if the parts are so adjusted that the disk will snap outwardly at 30° F. and inwardly at 20° F., giving a mean temperature of 25° F., the nut 42 can be turned so as to increase the compression in spring 43 so that the disc will snap outwardly at 35° F., while the screw 47 can be turned so as to cause the member 45 to move away from the disk so that the latter will snap inwardly at 15° F., so that the mean temperature of 25° F. will be maintained.

In its finished form the switch is preferably provided with a cover 49 of suitable form detachably secured in place upon the support 10 by means of screws or the like 50, an apertured cover 51 being likewise fastened in place over the binding ends of the contact stubs 11, by means of a screw 52 as shown by dotted lines in Fig. 2.

The device provides an automatically operated electric switch of extreme simplicity and maximum efficiency in which abrupt and instantaneous operative movements are developed as a result of the application of pressures created by suitable means for predetermined purposes and serve to efficiently make and break the electric circuits in which the switch is included.

The operative movements of the device adapt it specially for making and breaking electric circuits in which the current is of a voltage such as is commonly found in light and power circuits and do away with the possibility of arcing and injury to the contacts and avoid the necessity for the use of relays

or equivalent devices to carry the electric load.

The active device whereby these results are obtained comprises generally a metal plate or member of single thickness buckled at an intermediate point by being formed with at least two curvatures to provide an active section which, when subjected to a suitable pressure applied in a direction opposite to the normal buckle of the disk or member, will without any material initial movement, suddenly and abruptly snap to an opposed concave position and which, upon the relief of such pressure, will abruptly snap back to its initial position because of its inherent characteristics. The metal member may be made of such thickness and shape as to snap in the indicated manner at any predetermined pressure; and to snap back when such pressure is reduced. As set forth hereinbefore the range of utility of the switch may be increased by including therein adjusting means whereby the snapping instants and consequently both the temperature range and differential may be varied at will.

When the pressure whereby the device is controlled, is created as a result of temperature variations, the gaseous fluid or volatile liquid upon which the temperature is effective may be contained directly and alone in the member 29 or its equivalent, in which case the capillary tubing of the illustrated examples and the cooperating thermostatic bulb may be omitted.

Various changes in the specific forms shown and described may be made within the scope of the claims without departing from the spirit of the invention.

I claim:

1. In an electric switch, the combination of a support, contacts carried thereby and forming part of an electric circuit, a switch lever pivotally mounted on said support for cooperation with said contacts to make and break said electric circuit, and a hollow member mounted upon said support and constituting a pressure chamber, one wall of said member, upon the development of a predetermined degree of pressure in said chamber, being adapted to develop snapping movements whereby said switch lever is abruptly actuated relatively to said contacts, a pressure member engaging said snapping wall, a pressure lever operatively connected with said pressure member, a spring bearing upon said pressure lever, and a setting nut constituting an abutment for said spring and arranged to vary the tension thereof on said pressure lever whereby the pressure of said pressure member upon said snapping wall is varied to selectively adjust the snapping instant thereof.

2. In an electric switch, the combination of a support, a contact carried thereby and forming part of an electric circuit, a switch lever pivotally mounted in association with said

support, a contact member yieldingly carried by said lever for cooperation with said contact to make and break said electric circuit, a spring effective upon said switch lever to normally maintain said contact member out of engagement with said contact, a hollow member mounted upon said support and constituting a pressure chamber, one wall of which, upon the development of a predetermined degree of pressure in said chamber being adapted to develop snapping movements whereby said switch lever is abruptly actuated relatively to said contact, a pressure member engaging said snapping wall, a pressure lever operatively connected with said pressure member, a spring bearing upon said pressure lever, and a setting nut constituting an abutment for said spring and arranged to vary the tension thereof on said pressure lever whereby the pressure of said pressure member upon said snapping wall is varied to selectively adjust the snapping instant thereof.

3. In an electric switch, the combination of a support, contacts carried thereby and forming part of an electric circuit, switching means cooperating with said contacts to make and break said electric circuit, a snapping diaphragm located in operative relation to said switching means, said diaphragm upon the application of a predetermined degree of pressure being adapted to develop a snapping movement which is communicated to said switching means, an adjustable pressure member bearing upon said diaphragm to vary the snapping pressure thereof, and an adjustable pressure element adapted to bear upon said diaphragm for limiting the snapping movement thereof, whereby the upper and lower snapping pressure limits may be adjusted.

4. In an electric switch, the combination of a support, contacts carried thereby and forming part of an electric circuit, switching means cooperating with said contacts to make and break said electric circuit, a snapping diaphragm having an active snapping portion located in operative relation to said switching means, said diaphragm, upon the application of a predetermined degree of pressure being adapted to develop a snapping movement which is communicated to said switching means, and an adjustable pressure element bearing upon said diaphragm substantially at the periphery of the active portion thereof to vary the snapping pressure thereof.

5. In an electric switch, the combination of a support, contacts carried thereby and forming part of an electric circuit, switching means cooperating with said contacts to make and break said electric circuit, a snapping diaphragm having an active snapping portion located in operative relation to said switching means, said diaphragm, upon the application of a predetermined degree of pressure being adapted to develop a snapping

movement which is communicated to said switching means, an adjustable pressure element bearing upon said diaphragm substantially at the periphery of the active portion thereof to vary the snapping pressure thereof, and an adjustable element in the path of movement of said active portion adjacent the

periphery thereof for varying the magnitude of the pressure drop requisite to effect the return snapping movement. 10

In testimony whereof I have hereunto set my hand.

FRANK J. BAST.