Feb. 21, 1933. G. SCHÄFER 1,898,691

ELECTRIC SWITCH

Filed Dec. 3, 1930

Fig. 1.

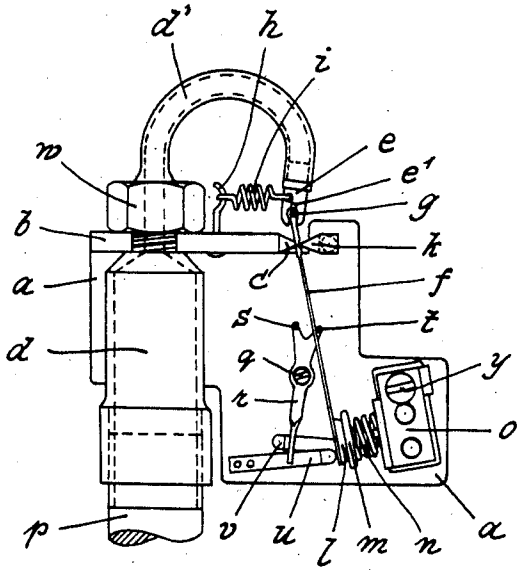
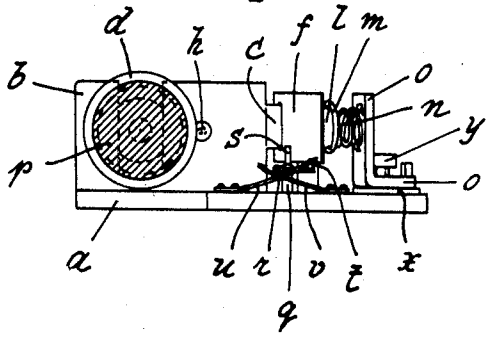



Fig. 2.




Inventor:
Gustav Schäfer.

Patented Feb. 21, 1933 1,898,691

# UNITED STATES PATENT OFFICE

GUSTAV SCHÄFER, OF STUTTGART, GERMANY

## ELECTRIC SWITCH

Application filed December 3, 1930, Serial No. 499,787, and in Germany December 2, 1929.

The known automatic switches for electrically heated implements suffer from the drawback that their sensitiveness to temperature is too slight and that dimensions are too large for many purposes of use. The present automatic switch is distinguished by its high sensitiveness; it operates, for instance, at a difference of temperature of 3° C. Besides, it can be made so small that it can be inserted, for instance, into the plug of an electric smoothing-iron. This improved switch is provided with an expansible member that expands when it becomes hot and is formed by a closed tube containing a liquid substance. I am aware of the existence of such tubes, but the tube used in my improved switch is particularly small and consists of a comparatively wide, short and rigid part and of a comparatively narrow, semi-circular tubular spring which joins said first-mentioned part axially and is at its free end connected with a switch lever formed by a turnably arranged leaf spring, the free end of which acts upon a contact or contacts and co-operates with two other, but smaller leaf springs by which it is retained or checked in the one and the other of its two switching positions (that in which the current is switched on and that in which it is switched off) until it is released by reason of its increasing bending through, whereafter the changing-over takes place instantaneously, said bending through becoming effective by the intermediary of a lever, as is all more fully described hereinafter.

My invention is illustrated diagrammatically and by way of example on the accompanying drawing on which Figure 1 is a plan of a switch designed according to this invention, and Figure 2 is a front-view thereof. The construction is as follows:

In the augularly bent part *b* of the base plate *a* is supported the comparatively large, rigid container *d* from which extends forth axially the tublar spring *d'* which, in contradistinction to the known tubular springs used in connection with electrically heatable implements, is semi-circularly shaped. Both parts *d* and *d'* are filled with a suitable liquid substance, for instance mercury. The container *d* is held in proper position by a nut *w*. The parts *d* and *d'* consist preferably at least partly of a good conductor of heat, for instance copper, which is in intimate contact of the liquid substance enclosed in them. At the closed end of the tubular spring is an eye *e* that is subjected to the action of a helical spring *i*, the other end of which is attached to a hook *h*. The eye *e* has an oblong slot *e'* through which extends a bolt *g* that is connected with one end of the leaf spring *f*. Near the place of connection of the eye *e* with the leaf spring *f* this latter passes through between two abutment members formed by edges or wedges *c* and *k* between which said spring can turn or oscillate like a two-armed lever. To the free end of the leaf spring is attached a contact piece *l* which may be ball-shaped and co-operates with a concave contact member *m* which it has engaged in the position shown in Fig. 1.

The contact piece or member *m* is connected with a bracket *o* by means of a helical spring *n*, and this bracket is firmly secured to the base plate *a*, an insulating plate *x* being provided between these two parts. *y* is a screw for connecting up one of the conducting wires, and *q* denotes a pivot extending forth from the base plate and supporting a two-armed lever *r*, one arm of which is forked and provided with two pins *s* and *t*, the arrangement of which relatively to the leaf spring is such that this latter passes through between them. The other end of said lever *r* which is preferably rounded lies over the ends of two small leaf springs *u* and *v* which are secured to the base plate and extend obliquely from the same to opposite directions which appears from Fig. 2 which also shows that these springs cross one another.

The container *d* is closed at its lower end by means of a threaded plug *p* which also serves for adjusting the switch by screwing it in more or less so as to act thereby upon the tubular spring. In the position of the parts as shown in the drawing the current is switched on, in that the contact members *l* and *m* contact with one another. Supposing, the temperature of the air or other gas surrounding the switch rises, the liquid substance enclosed in the parts *d* and *d'* will expand

whereby a pressure is exerted upon the tubular spring so that its free end moves to the right, in consequence whereof the main portion of the leaf spring (below the abutment members $c$ and $k$) will be bent to the left. More precisely, said leaf spring portion will be bent through to the left, as its lower end is retained or checked by the small leaf spring $u$. In the same measure in which the temperature of the air surrounding the switch rises, the bending through of the large leaf-spring $f$ increases and this spring finally contacts with the pin $s$ of the lever $r$ whereby this latter will be turned and the small leaf spring $u$ will be depressed so that the lower end of the large leaf spring will be released. Simultaneously therewith the contact piece $l$ leaves the contact piece $m$ so that the current is broken. The released end of the spring $f$ flies forward with a jerk so much that it gets behind the free end of the other small leaf spring $v$ by which it is then checked and retained. If thereafter the temperature of the surrounding air decreases, as does consequently, also the temperature of the liquid substance in the parts $d$ and $d'$, the tubular spring will contract and the large leaf spring $f$ will now be bent through to the right and will continue so until it contacts with the pin $t$. Then the lever $r$ will again be turned, the small leaf spring $v$ will be depressed, the large leaf spring will again be released and the contact members $l$ and $m$ will again close the circuit, as will now be clear without further details of the movements and the operation of the parts concerned.

The other conducting wire can be connected with any desired part of the switch, especially the base plate thereof, but if the current is not to flow through the switch said other wire can be connected with the contact member $l$ by means of a flexible spring or the like, in which case this contact member must be insulated from the spring $f$.

I claim:

1. An automatic switch for electrically heatable implements, comprising, in combination with a closed receptacle enclosing a liquid substance and being composed of a rigid vessel and of a practically semi-circular tubular spring, firmly connected, and communicating at one of its ends, with said vessel, this latter having a large diameter and being short in comparison with said tubular spring, and vice versa, an elastic switching lever coupled with the other end of said tubular spring and being formed of a leaf spring so arranged as to be adapted to be moved when the curvature of said tubular spring is changed; a contact piece at the free end of said leaf spring; another contact piece opposite said first-mentioned one; two smaller leaf springs so arranged relatively to the first-mentioned leaf spring that one thereof is adapted to check this latter spring in one of its end positions, and the other thereof is adapted to check the said first-mentioned leaf spring in the other of its end positions; and a lever coupled with the first-mentioned leaf spring and adapted to depress the other two leaf springs alternately according to the position of the first leaf spring as determined by the said tubular spring, substantially as set forth.

2. An automatic switch for use in connection with electrically heatable implements, comprising, in combination, a closed receptacle enclosing a liquid substance filling the receptacle, and being composed of a rigid vessel and of a practically semi-circular tubular vessel designed as a tubular spring and being at one of its ends firmly connected with, and communicating with, said rigid vessel, this latter having a large diameter and being short in comparison with said spring, and vice versa; an elastic switching lever coupled with the other end of said tubular spring and being constituted by a leaf-spring so arranged as to be adapted to be moved when the curvature of the tubular spring varies; abutment members located on the two sides of said leaf spring and making it a two-armed lever; a contact member at the free end of the leaf-spring and another contact piece arranged opposite thereto; two smaller leaf springs so arranged with respect to the first-mentioned leaf spring that they can check it in its end positions; and a rigid lever coupled with the first-mentioned leaf spring with dead play and being inserted between it and said two smaller leaf springs and being adapted to depress them alternately, substantially and for the purpose set forth.

3. An automatic switch for use in connection with electrically heatable devices, comprising, in combination, a closed receptacle with a liquid substance therein and composed of a comparatively short and wide rigid vessel, and a circularly curved elastic tube extending forth axially from the rigid vessel; and an elastic switching lever coupled with the free end of the elastic tube and being formed by a leaf spring; a rigid two-armed lever and pins projecting forth from one arm thereof, said leaf spring passing through between said pins; two smaller leaf springs located below the other arm of said rigid lever and being so arranged with respect thereto as to be adapted to be depressed alternately by the same according to the position of the first-mentioned leaf spring as determined by the said tubular spring; a contact member attached to the free end of said first-mentioned leaf spring, and another contact member arranged opposite to said first contact member and being in contact with it at one of the two end positions of said leaf spring, as set forth.

In testimony whereof I affix my signature.

GUSTAV SCHÄFER.