Dec. 8, 1936. R. KELLENDORFER 2,063,813

ELECTRIC SAFETY CUT-OUT

Filed Feb. 14, 1934

Fig. 1

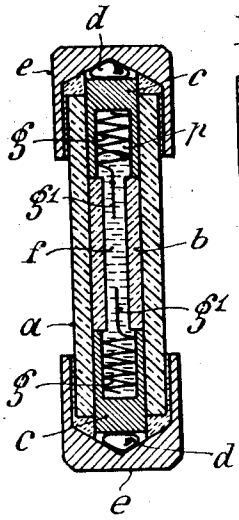


Fig. 4.

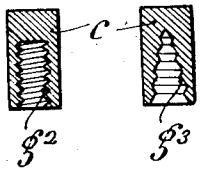


Fig. 5.

Fig. 2

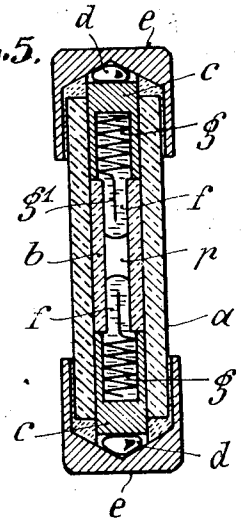
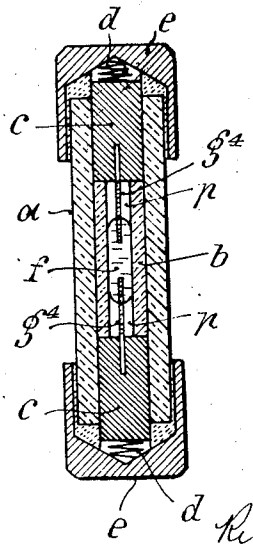


Fig. 3



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ELECTRIC SAFETY CUT-OUT

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11 Claims. (Cl. 200—113)

Electric safety cut-outs with a conductor consisting of a column of liquid adapted to be temporarily evaporated and expanded by a short circuit or overload and thereby to break the circuit, are already known. In these cut-outs the liquid and a gas buffer are hermetically enclosed in a channel or tube and the ruptured liquid column can be again restored to its initial state by mechanical means, for instance by outer pressure, whereby the cut-out is again made ready for use.

The present invention relates to a cut-out of the above described kind, in which the conducting column of liquid is held in its temporary position, either as conductor or as ruptured column, by suitable frictional or braking means, in order to prevent accidental or unintentional rupturing or closing of the circuit. By this means cut-outs subjected to continual vibration will be prevented from accidentally breaking or closing the circuit in consequence of these vibrations and independently of the electric conditions temporarily existing in the circuit. For this reason the cut-outs according to the present invention are specially adapted for use in the electric system of motor vehicles of all kinds, such as automobiles, aeroplanes and the like. After a short circuit or overload, the ruptured column can be again closed and the device again restored to its initial state by simply shaking the tube or tapping it against a hard surface; the life of the device and its capability of restoration after overload are practically unlimited. The individual parts of the cut-out are in no way impaired by the high temperature ensuing when the circuit is broken.

Referring to the accompanying drawing, Figs. 1 and 2 illustrate one form of construction of the new safety cut-out in longitudinal section and on an enlarged scale, Fig. 1 showing the cut-out ready for use, that is, with the liquid column intact, and Fig. 2 the cut-out with the column ruptured after a short-circuit or overload. Fig. 3 shows another form of construction, also in section. Fig. 4 illustrates a screw-threaded form of braking means for the column. Fig. 5 illustrates a second type of screw-threaded braking means for the column.

As may be seen from Figs. 1 and 2, the conducting liquid, *f*, for instance, mercury or a mercury compound, is hermetically enclosed, together with a gas buffer *p*, between two electrodes *c* in a transparent insulating tube *b* of fire-proof material with a bore varying according to the strength of current the device is intended to carry. Tube *b* and the electrodes *c*, which abut against the former, are in their turn enclosed in a second transparent insulating tube *a*, cemented at each end into metal terminal caps *e*. Conductors *d* serve to make contact between the electrodes *c* and caps *e*, said conductors *d* being adapted to ensure good electric contact under varying degrees of expansion of the individual parts of the cut-out. These conductors *d* may, for instance, consist of a mercury filling, as shown in Figs. 1 and 2, or of springs, as shown in Fig. 3.

Now in order to prevent an accidental or unintentional rupturing or restoration of the liquid column *f*, the electrodes *c* are provided with means to increase the friction of the column, in other words, means acting as a brake on the motion of the column within its tube. These means may be of various kinds and will depend on the form of construction of the electrodes *c*. If the latter are, for instance, recessed or hollow, as shown in Figs. 1 and 2, small spiral springs *g* may be employed as braking means, or again the internal cavity of the electrodes *c* may be provided with a cylindrical thread g^2 as shown in Fig. 4. In Fig. 5 the braking means is shown as a tapered hole with a thread or ribs as at g^3. The springs *g* (Figs. 1 and 2) may advantageously be provided with extensions *g'* protruding into the tube *b*, in order to ensure that rupturing takes place at the centre of the tube.

In the form of construction shown in Fig. 3, the electrodes *c* are massive and the braking means in this case consist of small rods g^4, which are threaded or otherwise outwardly roughened in order to increase the friction between rod and conducting liquid.

In all the above described forms of construction, the manner of operation of the device is as follows: the friction between the mercury column and the braking means is so great that the position of the liquid column can be altered only by a strong impulse, either internally by the explosive evaporation of the mercury in consequence of a short circuit or overload, or externally by severe shaking or knocking of the tube. On the other hand, ordinary vibrations or slight shocks occasioned by the running of the motor car or other vehicle will not be able to influence the position of the mercury column.

What I claim as my invention and desire to secure by Letters Patent, is:

1. In an electric safety cut-out with a liquid column as conductor adapted to interrupt the current when overloaded, said liquid column

being hermetically enclosed in a tube together with a gas buffer, the column when ruptured being restorable by outward influence, the provision of means to brake the motion of the liquid in its tube to such an extent that an accidental shifting of the liquid within the tube cannot occur, substantially as herein described.

2. A cut-out as under claim 1, in which the braking means are arranged on the electrodes hermetically closing the space containing the liquid column at both ends.

3. A cut-out as under claim 1, in which the braking means are arranged within electrodes of cup shape.

4. A cut-out as under claim 1, in which the braking means consist of springs arranged in the electrodes, said springs being provided with extensions protruding into the tube.

5. A cut-out as under claim 1, in which the braking means consist of rugations inside the electrodes.

6. A cut-out as under claim 1, in which the electrodes are massive and provided with roughened rods protruding into the tube.

7. In a device of the kind described, a transparent tube of non-conductive material, a rigid cap fixed on each end of said tube, said cap being of conductive material, an electrode in each end of said tube having conductive connection with said cap, a conductive liquid within the tube between said electrodes, and means within the tube resisting movement of said conductive liquid.

8. In a device of the kind described, a transparent tube of non-conductive material, a rigid cap fixed on each end of said tube, said cap being of conductive material, an electrode in each end of said tube having conductive connection with said cap, a conductive liquid within the tube between said electrodes, and means within the tube resisting movement of said conductive material, said means consisting of springs of conductive material carried by the electrodes.

9. In a device of the kind described, a transparent tube of non-conductive material, a rigid cap fixed on each end of said tube, said cap being of conductive material, an electrode in each end of said tube having conductive connection with said cap, a conductive liquid within the tube between said electrodes, said electrodes having confronting recesses and being provided within the recesses with means resisting the movement of said liquid, said means consisting of springs of conductive material carried by the electrodes.

10. In a device of the kind described, a transparent tube of non-conductive material, a rigid cap fixed on each end of said tube, said cap being of conductive material, an electrode in each end of said tube having conductive connection with said cap, a conductive liquid within the tube between said electrodes, said electrodes having confronting recesses and being provided within the recesses with means resisting the movement of said liquid, said means within the electrodes consisting of corrugated surfaces.

11. In a device of the kind described, a transparent tube of non-conductive material, a rigid cap fixed on each end of said tube, said cap being of conductive material, an electrode in each end of said tube having conductive connection with said cap, a conductive liquid within the tube between said electrodes, said electrodes having confronting recesses and being provided within the recesses with means resisting the movement of said liquid, said means within the electrodes consisting of corrugated and tapered surfaces.

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