K. F. RICHMOND.

ELECTRIC TIME SWITCH.

APPLICATION FILED AUG. 26, 1914.

1,162,516.

Patented Nov. 30, 1915.

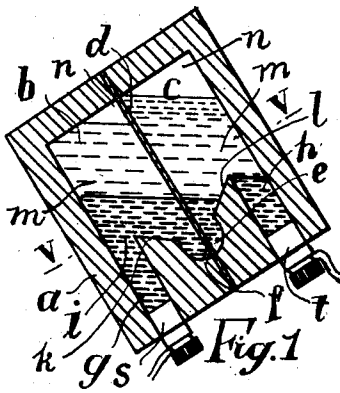


Fig. 1

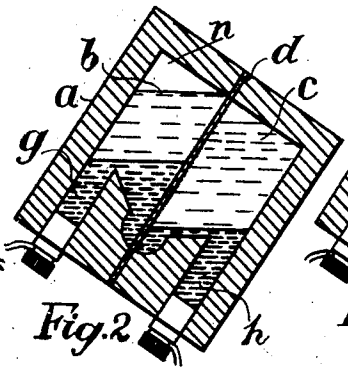


Fig. 2

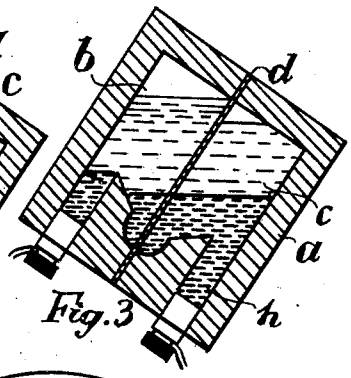


Fig. 3

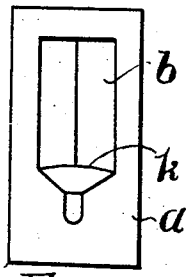


Fig. 4

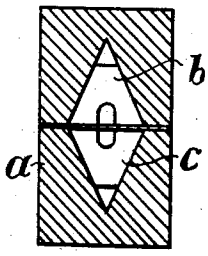


Fig. 5

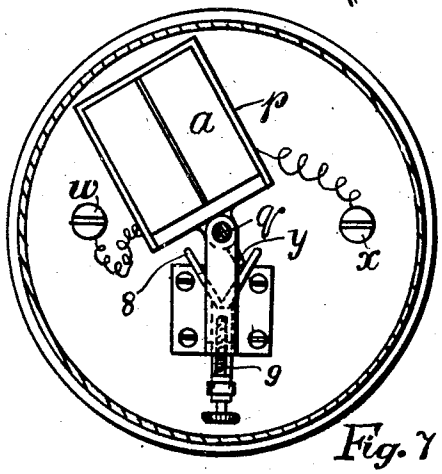


Fig. 7

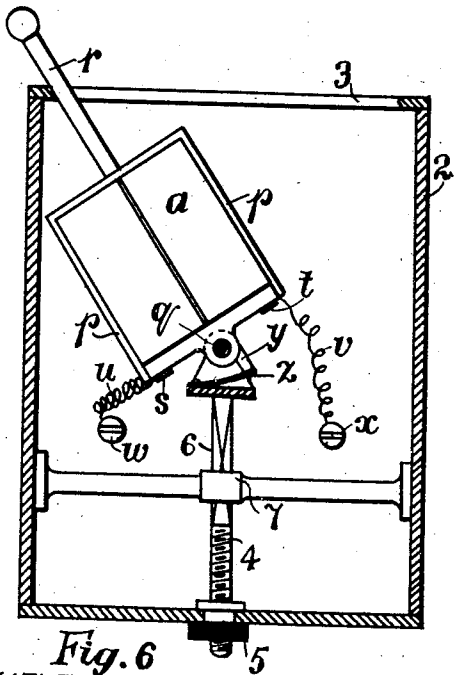


Fig. 6

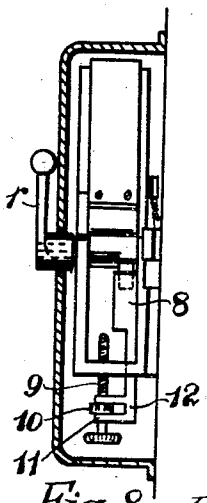


Fig. 8

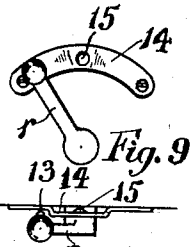


Fig. 9

Fig. 10

Witnesses
Floyd R. Conwall
W. A. Williams.

Inventor:
K. F. Richmond.
By Johnson Atty.

UNITED STATES PATENT OFFICE.

KENNETH FORBES RICHMOND, OF LONDON, ENGLAND.

ELECTRIC TIME-SWITCH.

1,162,516. Specification of Letters Patent. Patented Nov. 30, 1915.

Application filed August 26, 1914. Serial No. 858,771.

To all whom it may concern:

Be it known that I, KENNETH FORBES RICHMOND, a subject of the King of Great Britain, residing at London, England, have invented certain new and useful Improvements in Electric Time-Switches, of which the following is a specification.

Tilting time switches, more especially two-way tilting switches are known in which the break in the continuity between electrical poles is effected by a conducting liquid flowing from one chamber to another through a small orifice. Regulation of the timing by variation in the size of the orifice in order to control the flow of the conducting liquid is difficult. Another defect is the tendency to undue vaporization and oxidation of the conducting fluid when the break in the continuity is being effected.

The object of the invention is to provide a tilting time switch in which the above mentioned difficulties are avoided.

In a tilting time switch according to the invention the flow of conducting liquid from one chamber to another, when the switch is tilted, is controlled by the corresponding flow of an insulating liquid through a restricted passage between the chambers, and the break in the continuity between the poles is preferably effected by division of the conducting liquid over a sharp edge or ridge.

The invention also comprises the use of a liquid such as paraffin oil, in conjunction with air to act as the insulating fluid and of a porous diaphragm to act as the restricted passage, so that the timing may be regulated initially by varying the volume of the air spaces, or during use by altering the angle of tilt, whereby the area of the diaphragm in contact with the oil and consequent rate of percolation of the oil may be varied.

The invention further comprises details hereinafter referred to.

Referring to the accompanying drawings: Figure 1 is a sectional elevation of the tilting receptacle of one form of switch according to the invention, the conductive liquid being shown in the position assumed after equilibrium has been established, and the current interrupted. Fig. 2 is a sectional elevation of the same receptacle tilted in an opposite direction, and showing the conductive liquid in the position assumed immediately after the tilt, while current is flowing. Fig. 3 is a similar view to Fig. 2, showing the conductive fluid again in a state of equilibrium, indicating an interruption in the current. Fig. 4 is a side elevation of one half of the receptacle. Fig. 5 is a cross section on V—V Fig. 1. Fig. 6 is a sectional elevation illustrating one mode of mounting the tilting receptacle and of regulating the angle or tilt thereof. Fig. 7 is a front elevation illustrating another mode of mounting the receptacle and of regulating the angle of tilt thereof, Fig. 8 being a part sectional elevation corresponding thereto. Figs. 9 and 10 show details.

In carrying out the invention according to one mode a receptacle *a*, of porcelain or other suitable material and of prismatic cross section, is divided into two chambers *b*, *c*, by a diaphragm *d* arranged diagonally with respect to said casing. Free communication between the two chambers *b* and *c* is effected by a channel *e*, the diaphragm *d* having an orifice *f* adjacent thereto. A restricted passage between the two chambers is provided by using a diaphragm *d* of porous material, for example, porous paper.

For convenience of manufacture, the receptacle *a* is made in two pieces, which are adapted to be secured together by an adhesive material, the paper diaphragm being held between them at their meeting edges and secured by the same adhesive material.

The chambers *b* and *c*, are provided with passages *g* and *h*, to receive iron plugs or other pole pieces between which the heavy conductive liquid, such as mercury *i*, is to make an electrical connection.

The passages *g* are separated from the channel *e* by ridges *k*, *l*, having sharp edges as shown. These ridges are immersed when the casing or receptacle *a* is in a vertical position.

Any suitable insulating liquid above the conductive liquid may be used, for instance, a liquid such as oil. It is preferred to use a layer of paraffin *m*, and to leave a space *n* for air. The air space may be varied in size and in some cases may be dispensed

with, that is, the whole space above the mercury may be filled with oil. The chambers *m* are preferably of triangular cross section as shown in Fig. 5, as this enables the volume of the chambers to be reduced without unduly reducing the area of the diaphragm, and, therefore, insures a large area of contact between the insulating liquid and diaphragm relative to the volume of liquid. It also insures an adequate cross sectional area of conductive liquid when the switch is tilted, and further it facilitates the escape of bubbles of insulating fluid which may be formed in the passages containing the pole pieces, as a result of agitation. By dividing the conductive fluid by sharp ridges as hereinbefore described not only is a quick break insured but the tendency for the fluid to be drawn over from the passages containing the pole pieces is minimized, thus practically eliminating both irregularities in timing and the inclusion of bubbles of insulating fluid in said passages. By regulating the angle of tilt the area of the diaphragm in contact with oil may be further varied, and as the head of mercury will also be varied, the period of time taken in establishing equilibrium and interruption of the current can thus be regulated to some extent after the apparatus has been set up and the volume of the air spaces determined.

In the constructional examples illustrated in Figs. 6, 7 and 8, means for regulating the tilt are provided. In the example shown in Fig. 6, the receptacle *a*, is mounted in a metal frame *p*, pivoted at *q*, and adapted to be tilted about the pivot *q*, by a hand lever *r*. Iron pole pieces *s*, *t*, are connected by flexible wires *u*, *v*, to binding screws *w*, *x*. Means may be provided to avoid the possibility of the receptacle *a* being left in an upright position, for instance, as is commonly adopted in tumbler switches, a lug *y*, may be adapted to bear on a spring *z*. Means may also be provided whereby the receptacle *a*, may be fixed at will in an upright position, thus establishing a continuous circuit, when this is desired.

The switch is inclosed in a suitable casing 2 having a slot 3 for the passage of the hand lever *r*. The angle through which the hand lever *r* can be oscillated is limited by the length of the slot 3, but in order to permit of the angle being varied to regulate the angle of tilt, and thereby to regulate the timing of the switch, the pivot *q* is adapted to be moved vertically relatively to the slot 3. For this purpose it is carried by a screwed rod 4 which can be raised and lowered by a nut 5 fitted in the bottom of the casing. The rod 4 has a squared portion 6 passing through a guide 7, by which it is prevented from rotating.

In the other constructional example shown in Figs. 7 and 8, the pivot *q*, of the receptacle *a*, is fixed to the frame *p* and is extended to receive a small hand lever *r*, by which it can be oscillated about its axis. The angle of oscillation is limited by a lug *y* engaging with a V-shaped piece 8 adapted to be raised and lowered by a screw 9. The screw 9 has a collar 10 engaging with a fork 11 on the stem 12 of the piece 8.

In order that the receptacle *a* may be fixed in an upright position, when it is desired to establish a continuous circuit, the hand lever *r* may be provided with a small projection 13 adapted to engage with a spring plate 14 screwed on to the front of the casing, the plate having a central recess 15 to receive the projection 13.

It will be understood that the above constructions are given by way of example, only, and that any suitable means may be used for tilting the receptacle and for regulating the angle of tilt. Similarly the porous diaphragm is only one example of a restricted passage between the two chambers, as a very fine capillary tube or aperture may be used with a non-porous diaphragm, although the porous diaphragm is preferred.

I claim:—

1. A tilting time switch having a movable casing of prismatic cross section, a porous diaphragm arranged across a diagonal plane and dividing said casing into separate chambers of triangular cross section, a conducting liquid distributed in said chambers, terminal poles connecting with the conducting liquid in said separate chambers and insulating liquid in said chambers.

2. A tilting time switch having a pivoted casing, a porous diaphragm dividing said casing into separate chambers, a ridge having a sharp angular edge in the base of each chamber, said ridges forming pockets in the said base, conducting liquid in said base and in which said ridges are immersed during passage of current, pole pieces connecting with the liquid pockets to the side of said ridges remote from said diaphragm, and insulating liquid in said chambers.

3. A tilting time switch having a pivoted casing, a diaphragm dividing said casing into separate chambers, pole pieces connected to said chambers, conducting liquid in said chambers, insulating liquid in said chambers and means for controlling the tilting movement of said casing.

4. A tilting time switch having a pivoted casing, a diaphragm dividing said casing into separate chambers, pole pieces connected to said chambers, conducting liquid in said chambers, insulating liquid in said chambers, means for controlling the tilting movement of said casing and means for retaining said casing in a vertical position.

5. A tilting time switch having a pivoted casing, a diaphragm dividing said casing into separate chambers, pole pieces connected

to said chambers, conducting liquid in said chambers, insulating liquid in said chambers and means for controlling the tilting movement of said casing, comprising a lug on said casing and adjustable stops adapted to engage said lug.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

KENNETH FORBES RICHMOND.

Witnesses:
A. W. MATHYS,
PETER S. H. ALEXANDER.