(No Model.)

C. O. C. BILLBERG & P. A. N. WINAND.

AUTOMATIC ELECTRIC SWITCH.

No. 455,092. Patented June 30, 1891.

Fig. 1.

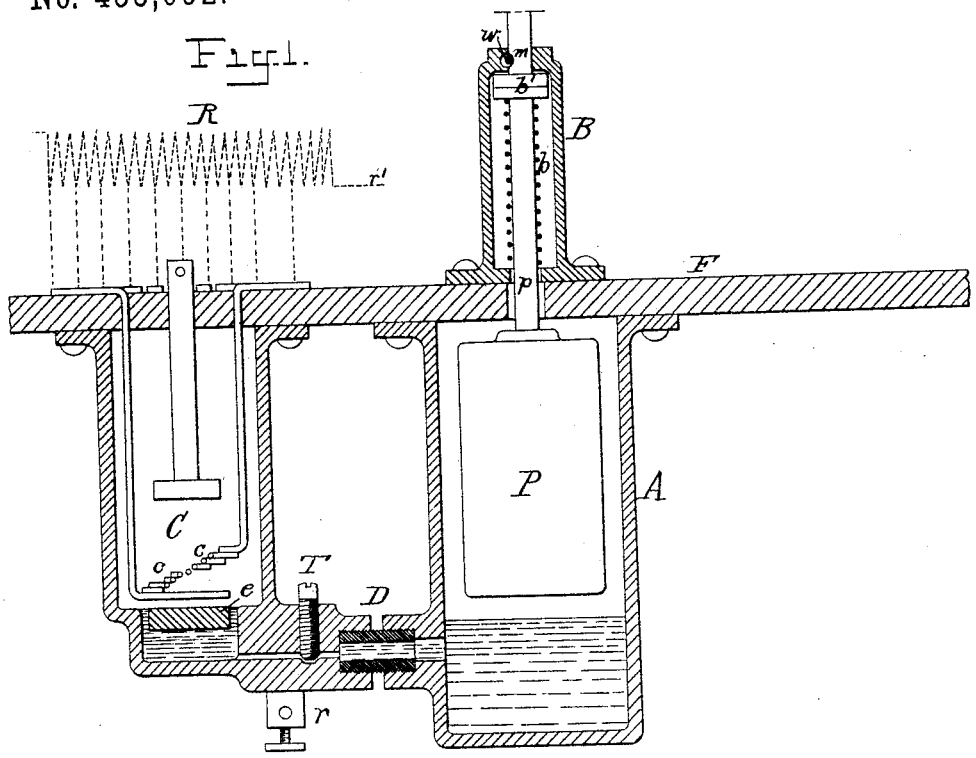
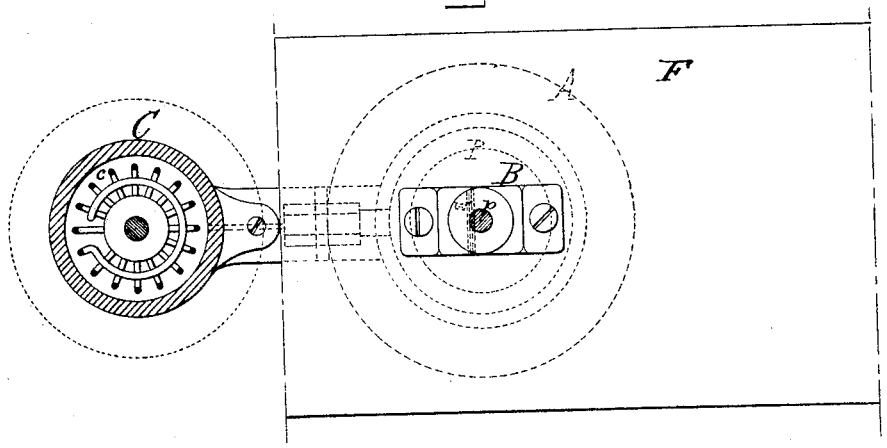


Fig. 2.



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UNITED STATES PATENT OFFICE.

CARL O. C. BILLBERG AND PAUL A. N. WINAND, OF PHILADELPHIA, PENNSYLVANIA.

AUTOMATIC ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 455,092, dated June 30, 1891.

Application filed November 11, 1890. Serial No. 371,022. (No model.)

To all whom it may concern:

Be it known that we, CARL O. C. BILLBERG, a subject of the King of Sweden, and PAUL A. N. WINAND, a subject of the King of Belgium, and both residents of Philadelphia, Pennsylvania, have invented certain Improvements in Electrical Switches, of which the following is a specification.

The object of our invention is to provide an improved electrical time-switch to be operated by hand or means independent of the circuit to be controlled, the purpose being to make it very simple in construction and easily adjusted to determine the length of time to be allowed for the gradual throwing on or off of the current in closing or opening an electrical circuit carrying either direct or alternating currents. This regulation of the gradual throwing on or off of the current is especially desirable in the working of electric motors, for with motors when used for some purposes or in some connections it is important to throw on the current quickly, while with motors when used for other purposes or in other connections it is desirable to throw on the current more slowly. We accomplish this object by providing a switch having a series of contacts in a chamber, causing a determined quantity of mercury or equivalent fluid electrical conductor to flow into the chamber to close the circuit through the contacts successively, and controlling the speed at which this is accomplished by throttling the flow of such mercury to that chamber.

In the accompanying drawings, Figure 1 is a vertical section of a simple form of our improved switch, and Fig. 2 is a sectional plan view.

It should be observed that we do not wish to restrict ourselves to the particular form of switch illustrated in the drawings, and which we are about to describe, as its construction may be varied in many respects without departing from our invention. In the particular construction shown, however, A is a reservoir containing a suitable supply of mercury or equivalent fluid electrical conductor, and this reservoir is adapted to receive a plunger P, carried by a handle or stem *p*, passing up through the frame F, which carries the device. The upper part of this stem passes through and is guided in a bracket B. A spring *b* around the stem, resting at its lower end upon the bottom of the bracket or upon the frame, while its upper end bears against a collar *b'* upon the handle or stem of the plunger, may be employed to tend to counterbalance the plunger. A spring cross-wire *w* in the upper part of the bracket may be employed to engage with notches *m* on the stem (only one shown) to keep the plunger in either of its two positions—that is, either raised out of the fluid or at the bottom of the reservoir. By pulling or pushing on the handle, as the case may be, the plunger may be raised or depressed to either position.

The lower part of the mercury-reservoir A communicates through a passage D with the bottom of a contact-chamber C, and this passage is provided with a screw or other valve or stop T, by which the opening in the passage may be increased or diminished to throttle the flow of mercury through the passage when the plunger P has been depressed in the mercury-reservoir, or the determined body of mercury is otherwise caused to flow into the contact-chamber. Within this contact-chamber C are suitably arranged a number of terminals or contacts *c* at different heights in the chamber, and the conductors of these terminals lead out through the upper part of the contact-chamber and may be electrically connected to successive coils of a resistance or resistances R in the circuit or in a shunt connected to the circuit which it is desired to control by this switch.

We do not wish to limit ourselves in any way to any specific arrangement of circuits, and it will not be necessary to describe them, as they are well known for electric motor and other uses where hand-switches are needed. It will suffice to say that the circuit to be regulated may be connected to a binding-post *r* on the chamber, and through the metal body of that chamber to the mercury, while the coils R are also connected in the regulating-circuit, say at *r'*.

In applying our invention to a direct-cur-

rent system ordinary resistance-coils R may be used; but with an alternating-current system choking-coils R or transformer-coils or other such counter-electro-motive-force devices will preferably be employed; but in this specification and in our claims we will for the sake of simplicity use the term "resistance" in a sufficiently wide sense to include choking-coils and other counter-electro-motive-force devices as well as plain resistance-coils.

It will be seen from the foregoing description that whenever the operator desires to close the circuit—as, for instance, to start his motor—he pushes down the plunger P from its elevated position (shown by full lines) to its depressed position in the mercury, as shown by dotted lines; or other suitable means are employed to cause the definite quantity of mercury in the reservoir to flow into and rise in the contact-chamber C, first closing the armature or other circuit through all or most of the coils R. The mercury rising cuts out successive coils of the resistance, and the speed at which this is done is determined by the adjustment of the valve or stop T.

We are aware of the use of mercury flowing from one chamber to another to throw in or out resistances in automatic regulators; but in such cases the amount of mercury is automatically controlled by the circuit to throw in or out more or less resistance. Our time-switch is not a regulator in any such sense. Each time the switch is opened or closed by the operator a determined body of liquid is caused to flow in one direction or the other to throw the full current on or off, and it is a time-switch because the adjustment of the valve determines at pleasure the time to be allowed for the definite body of mercury to flow through. Where a plunger is used, (but, as we have said, we may use other means,) the plunger is moved by hand or means uncontrolled by the circuit, and has only two positions, either elevated out of the fluid or wholly depressed into the liquid, to cause the definite quantity to flow through.

In order to prevent sparking and consequent oxidation of the mercury in the contact-chamber when the circuit is broken again, a piece or pieces of carbon *e* may be employed in this contact-chamber to float on the mercury, so that the circuit will be broken between the carbon and the contact *c* and not between the latter and the mercury.

We claim as our invention—

1. The herein-described time-switch for electric circuits, consisting of a contact-chamber containing electrical contacts at different points therein and adapted to be connected to resistances, with a mercury-reservoir connected to the contact-chamber, a device for throttling the passage between the reservoir and the chamber, and means uncontrolled by the circuit to cause a determined quantity of mercury to flow into or out of the chamber, all substantially as described.

2. The herein-described time-switch for electrical circuits, consisting of a contact-chamber containing contacts at different points and adapted to be connected to resistances, with a mercury-reservoir in communication with the contact-chamber, a hand-controlled plunger to cause a determined quantity of mercury to flow from the reservoir into the contact-chamber, and a valve to throttle the flow of mercury, substantially as set forth.

3. The herein-described time-switch for electrical circuits, consisting of a contact-chamber with contacts at different points adapted to be connected to resistances, with a mercury-reservoir in communication with the contact-chamber, and a piece or pieces of carbon to float in the mercury in the contact-chamber in communication with one or more of the contacts, all substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CARL O. C. BILLBERG.
PAUL A. N. WINAND.

Witnesses:
H. F. REARDON,
HUBERT HOWSON.