Dec. 2, 1924. 1,517,532

G. BÜSCHELBERGER

AUTOMATIC INTERRUPTER FOR ELECTRIC CONDUITS

Filed Dec. 2, 1921 2 Sheets-Sheet 1

Fig. 1.

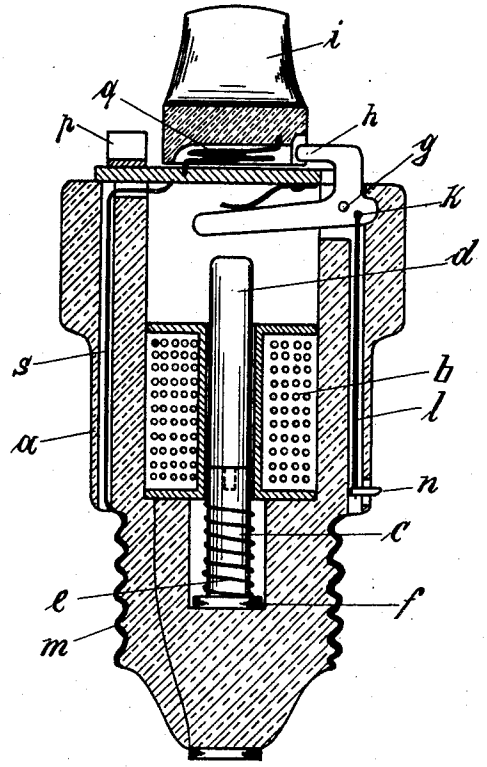
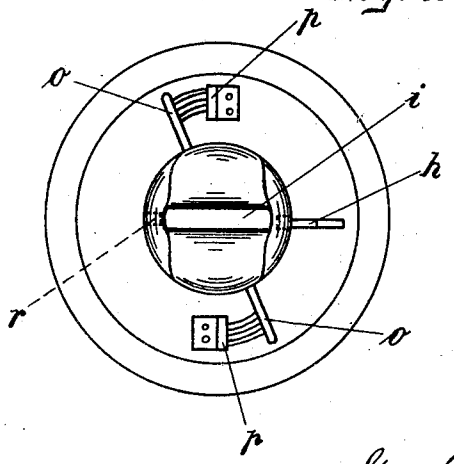


Fig. 2.



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Filed Dec. 2, 1921 2 Sheets-Sheet 2

Fig. 3.

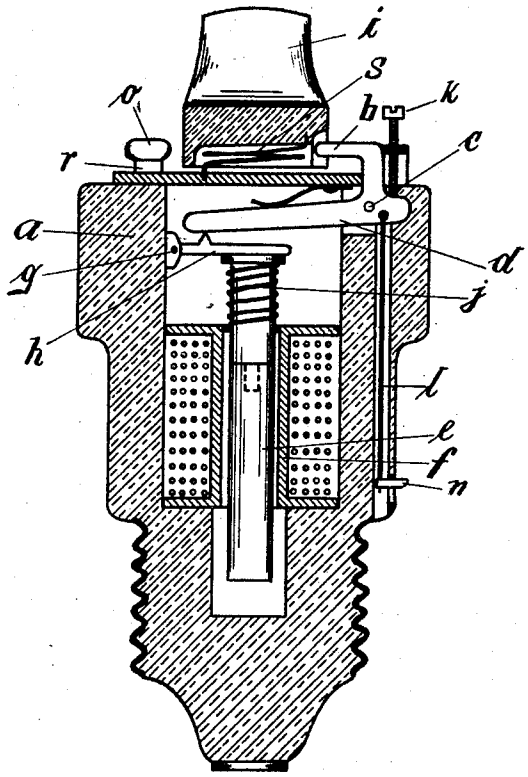
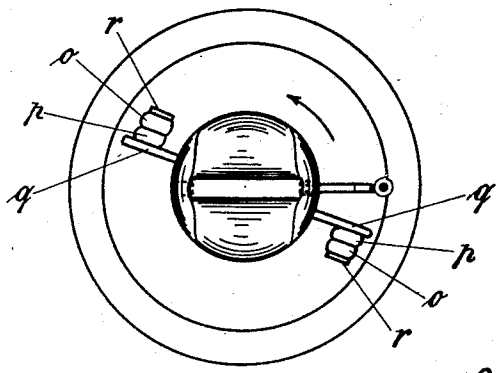


Fig. 4.



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Patented Dec. 2, 1924. 1,517,532

UNITED STATES PATENT OFFICE.

GEORG BÜSCHELBERGER, OF FRANKFORT-ON-THE-MAIN, GERMANY, ASSIGNOR TO LEONHARD KAHN, OF FRANKFORT-ON-THE-MAIN, GERMANY.

AUTOMATIC INTERRUPTER FOR ELECTRIC CONDUITS.

Application filed December 2, 1921. Serial No. 519,377.

To all whom it may concern:

Be it known that I, GEORG BÜSCHELBERGER, engineer, a citizen of Germany, and resident of Frankfort-on-the-Main, with the post-office address Hanauerlandstrasse 132, Germany, have invented certain new and useful Improvements in Automatic Interrupters for Electric Conduits; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

It has already been proposed to mount in a fuse plug an automatic interrupter but this arrangement has not been successful as the interrupter with the coil could not be mounted in the fuse plug in such a solid construction that an absolutely secure action was assured. I have now improved fuse plugs of this type, in order to give to all parts specially to the coil the size which is necessary to produce a sufficient electromagnetic switching off energy, in such a manner that essentially the coil is only mounted in the plug, the switch proper being arranged outside the plug in the lid of the plug.

In this manner there is not only obtained the advantage that a larger coil which is better insulated can be used but the further advantage that the switching off contacts are arranged separately from the coil and that the interrupting of current does not take place inside the usual porcelain plug and in the immediate neighbourhood of the coil so that the danger of explosion of the plug as well as the damaging of the coil by the arc is suppressed. The switch proper is preferably of the rotating type, wherefrom results the further advantage that the contact surfaces, the breaking distance and the breaking speed can be considerably increased without considerable increase of the switch. All parts can be made sufficiently strong to ensure great durability of the switch. Finally the switch and particularly the contacts of the same are easily accessible so that the presence of molten drops can be easily ascertained and these drops can be removed. The locking device for the rotating switch is arranged in such a manner that it locks the knob of the rotating switch even in the switching off position and this locking can be released only if the fuse plug is completely screwed out of its mounting in the board, whereby the switching in, under short-circuiting is avoided. If the speed plug after having been switched in is reinserted in the mounting it switches itself out immediately whilst the short-circuiting is still in existence. In case the interrupter should fail occasionally an additional melting fuse is arranged in the well known manner. This auxiliary fuse is however not located simply in the plug in which case when the fuse melts the switch parts and the coil could be damaged but it is arranged in a separate channel in the wall of the plug so that it cannot influence the inner parts of the fuse plug. According to a second form of construction an intermediary lever or any other convenient transmission is inserted between the lever of the locking device for the rotating switch and the core. This transmission can consist either of a lever or of toothed wheels, pneumatic piston or the like and it is arranged in such a manner that it increases the energy radiating from the core, whereby the releasing of the locking device is improved. The releasing can be further adjusted according to this invention by adjusting the locking tooth in its position with regard to the slot of the rotating switch, whereby it is possible to make the interruption more sensitive if required.

It is further advisable to make the interrupter equally sensitive for alternating current as for continuous current so that the same plug can be used for both kinds of current. Owing to this arrangement the coil need not be made as usual from wood or from cardboard but it can be made from copper or brass. The eddy-currents which are produced by the alternating current in this sleeve and which are not produced with continuous current are the reasons that the switch works with alternating current at the same voltage as with continuous current. Instead of making the entire sleeve from copper, brass or similar material it may be lined inside or outside with a mantle of such material or the core itself may be surrounded by a similar mantle which can con-

sist eventually of electro-plating or of a coil wound around the core and short-circuited in itself.

In order to obtain the braking of the movement of the core it can be sunk in oil, glycerine or another convenient liquid or the distance between core and inner wall of the coil can be made so small that an air resistance is produced when the core is being moved.

In order that the invention may be clearly understood, I shall proceed to describe the same with reference to the two forms of construction shown by way of example on the accompanying drawings, wherein:—

Fig. 1 shows in longitudinal section a first form of construction.

Fig. 2 is a plan view of Fig. 1.

Figs. 3 and 4 are corresponding views of the second form of construction.

Referring to Figs. 1 and 2 the coil *b* is mounted in the fuse plug *a*. The core for this coil *b* has its lower part *c* made of iron and its upper port *d* of brass or of another material which cannot be magnetized.

The core is continuously pulled down by a weak spring *e* bearing upon the collar *f*. Over the core a lever is fulcrumed at *g* and forms the locking device as its nose *h* is adapted to engage in slots of the rotating knob *i*. A leaf spring *j* presses the nose continuously against the knob *i*. The locking lever has further an extension *k* to which a pull rod or wire *l* is fixed which has at its lower end a small plate *n* projecting, in proximity of the threaded part *m* of the fuse plug, through a slot of the body of said plug.

The rotatable knob *i* carries two brushes *o* which are adapted to come in contact with the angular pieces *p*. The knob is controlled in the well known manner by a spiral spring *q* which has the tendency to return the same to the switching off or interrupting position.

If the brushes *o* are in contact with the contact pieces *p* the nose *h* engages with one of the slits of the rotatable knob *i* and holds the switch in this position. If short-circuiting or a considerable increase of voltage occurs the coil *b* attracts the iron core *c* while putting the spring *e* under tension, the upper part *d* striking against the locking lever so that the nose *h* consequently moves out of the slot of the rotatable knob *i*. The switch can now open under the action of spring *q* so that the brushes *o* go away from the contact pieces *p*. A separate breaking contact can be provided on the brushes. By the opening of the switch the circuit is interrupted. At the same time the nose engages with the other slot *r* of the rotatable knob and stops the same in the open position so that it cannot be turned back by hand into the closing position. In order to close the switch again the fuse plug must be screwed out and the plate *n* must be depressed so that the nose disengages from the slot and releases the knob. The switching in can take place now only by rotating the knob; the nose *h* reengaging with the first slot and securing the switch in the switching in position. At a convenient point of the plug body a melting fuse *s* is arranged which however is of such dimension that it melts only if the voltage increases in case the switch should fail to work. This is only meant as a safety device for unforeseen cases.

If the device is to be used as ordinary interruption for electric circuits, lamps, motors and the like, the threaded part *m* is suppressed and the whole body is mounted only upon a corresponding support.

In the second form of construction shown on Figs. 3 and 4 the nose *b* of the lever *d* fulcrumed at *e* engages with the rotatable switch *a* and holds the same in the locked position, the core *e* of the coil *f* does not directly act upon the end of this lever but through the intermediary of the lever *h* pivoted at *g* whose nose *i* is in contact with the lever *d*. A pressure spring *j* acts upon the core and presses the same constantly upward against the lever *h*. If the current which flows through the coil *f* reaches a determined voltage the core *e* is pulled into the coil, as its lower part is made from iron, and makes thus the leaf spring *j'* act upon the lever *d* so that the nose *b* releases the switch *a*. The position of nose *b* with regard to the slot in the rotatable switch *a* can be adjusted with the aid of a screw *k* so that the locking device can be made more or less sensitive.

The pulling back of the locking nose *b* by hand is again effected as in the first form of construction by a pull rod *l* with outwardly projecting plate or handle *n*. The coil *f* is in this case made of copper, brass or a similar material so that the switch operates always at the same voltage whether it is to be used with alternating current or with continuous current. Only the upper plate *n* of the coil is an iron plate or covered with iron. As already mentioned the coil may have an inner or outer mantle of copper or brass or the core may have a mantle of convenient material.

The fixed contacts *o* with which the contacts *p* of the rotatable switch *q* come in contact are fixed upon a blade spring *r* which is under tension in the contact giving position so that when the switch is released its movement is thus accelerated in addition to the impulse from the spring *s*.

I claim:—

1. An automatic interrupter for an electric circuit, comprising a hollow screw plug for engagement in a fuse socket, an interrupter

outside of said plug on the top thereof, an operating coil within the plug and mechanism extending from the outside to the inside of the plug and between the coil and interrupter to control the operation thereof.

2. An automatic interrupter for an electric circuit, comprising a hollow screw plug for engagement in a fuse socket, a spring-urged, manually set interrupter rotatable on a vertical axis on the outside and on the top of said plug, an operating coil within the plug and movable mechanism extending from the outside to the inside of the plug between said coil and interrupter to release the latter.

3. An automatic interrupter for an electric circuit, comprising a hollow screw plug of insulating material for engagement in a fuse socket, a cover for said plug, a spring-urged, manually set interrupter mounted on said cover on the outside of the plug rotatable on the axis of the plug, an operating coil within the plug and mechanism extending from the interior of the plug to the outside thereof between said coil and interrupter to release the latter.

4. An automatic interrupter for an electric circuit comprising in combination with a fuse plug, an interrupter consisting of a rotatable switch having two slots arranged outside the fuse plug upon the lid of the same, and the coil of said interrupter in said plug, and a locking device for said rotatable switch consisting of a spring controlled lever having a nose designed to engage with one of said slots of the rotatable switch for locking the same in the switch position and in the interrupting position.

5. An automatic interrupter for an electric circuit comprising in combination with a fuse plug, an interrupter consisting of a rotatable switch having two slots arranged outside the fuse plug upon the lid of the same, the coil of said interrupter in said plug, a locking device for said rotatable switch consisting of a spring controlled lever having a nose designed to engage with one of said slots of the rotatable switch for locking the same in the switch position and in the interrupting position, and an adjusting screw for regulating the engagement of said locking lever with said switch.

6. An automatic interrupter for an electric circuit comprising in combination with a fuse plug, an interrupter consisting of a rotatable switch having two slots arranged outside the fuse plug upon the lid of the same, the coil of said interrupter in said fuse plug, a core of said coil, a locking device for said rotatable switch consisting of a spring controlled lever having a nose designed to engage with one of said slots of the rotatable switch for locking the same in the switch position and in the interrupting position, an adjusting screw for regulating the engagement of said locking lever with said switch by adjusting the position of the nose of said lever with regard to the slots of the switch and regulating further the position of said core in vertical direction.

7. An automatic interrupter for an electric circuit comprising in combination with a fuse plug, an interrupter consisting of a rotatable switch having two slots arranged outside the fuse plug upon the lid of the same, the coil of said interrupter in said fuse plug, a core of said coil, a locking device for said rotatable switch consisting of a spring controlled lever having a nose designed to engage with one of said slots of the rotatable switch for locking the same in the switch position and in the interrupting position, an adjusting screw for regulating the engagement of said locking lever with said switch by adjusting the position of the nose of said lever with regard to the slots of the switch and regulating further the position of said core in vertical direction, and a transmission between said movable core and said locking device of the switch designed to increase the force for releasing said switch.

8. An automatic interrupter for an electric circuit comprising in combination with a fuse plug, an interrupter consisting of a rotatable switch having two slots arranged outside the fuse plug upon the lid of the same, the coil of said interrupter in said fuse plug, a core of said coil, a mantle of said core made of convenient material, a locking device for said rotatable switch consisting of a spring controlled lever having a nose designed to engage with one of said slots of the rotatable switch for locking the same in the switch position and in the interrupting position, an adjustable screw for regulating the engagement of said locking lever with said switch by adjusting the position of the nose of said lever with regard to the slots of the switch and regulating further the position of said core in vertical direction, and a transmission between said movable core and said locking device of the switch designed to increase the force for releasing said switch.

9. An automatic interrupter for an electric circuit comprising in combination with a fuse plug, an interrupter consisting of a rotatable switch having two slots arranged outside the fuse plug upon the lid of the same, the coil of said interrupter in said fuse plug, a core of said coil, a mantle of said core made by electroplating of convenient material, a locking device for said rotatable switch consisting of a spring controlled lever having a nose designed to engage with one of said slots of the rotatable switch for locking the same in the switch position and in the interrupting position, an

adjustable screw for regulating the engagement of said locking lever with said switch by adjusting the position of the nose of said lever with regard to the slots of the switch and regulating further the position of said core in vertical direction, and a transmission between said movable core and said locking device of the switch designed to increase the force for releasing said switch.

In testimony that I claim the foregoing as my invention, I have signed my name Frankfort-on-the-Main, this 2nd day of November 1921.

GEORG BÜSCHELBERGER.