(No Model.) 2 Sheets—Sheet 1.

L. T. STANLEY.

AUTOMATIC ELECTROMAGNETIC CUT-OUT.

No. 521,423. Patented June 12, 1894.

Fig. 1

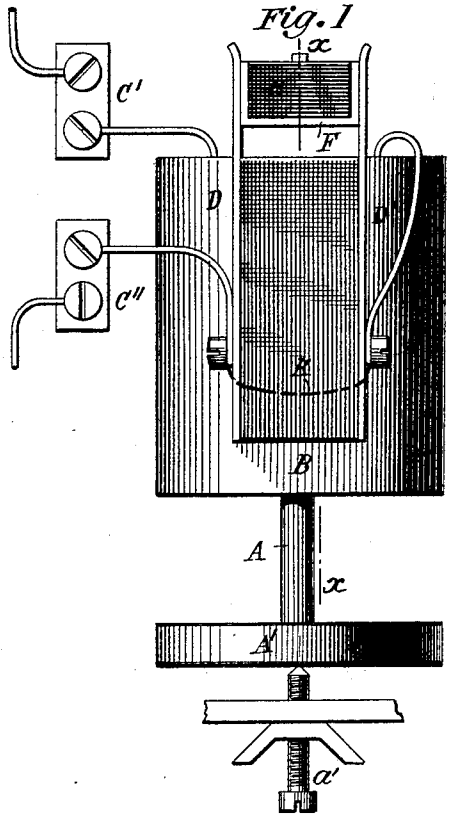


Fig. 2

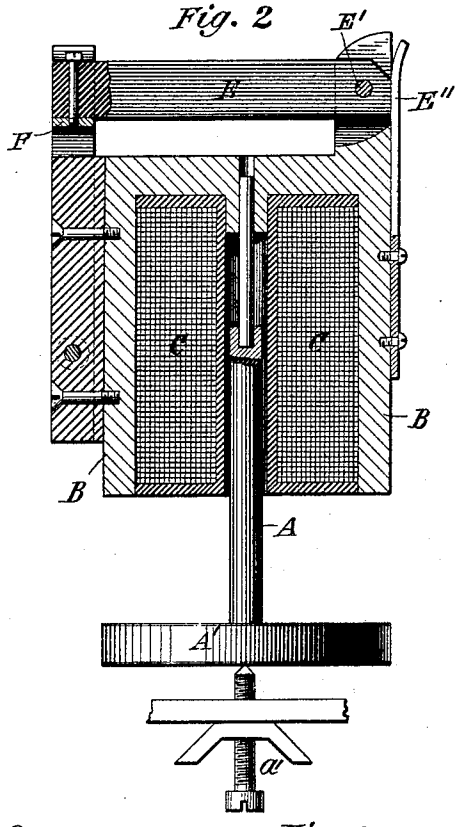


Fig. 6

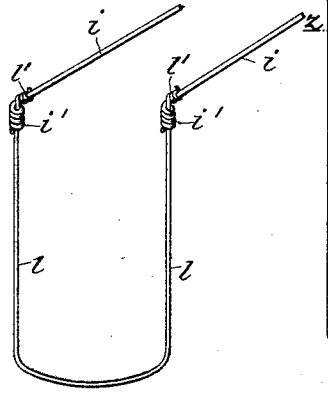


Fig. 3

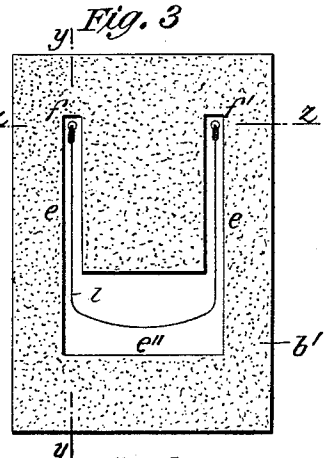


Fig. 4

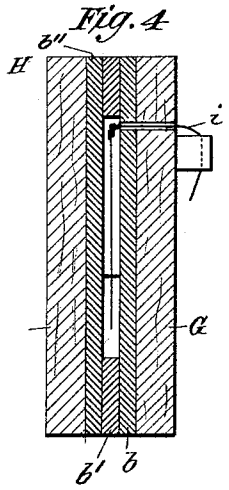
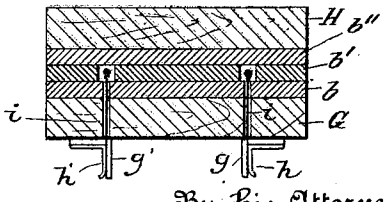


Fig. 5



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(No Model.) 2 Sheets—Sheet 2

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AUTOMATIC ELECTROMAGNETIC CUT-OUT.

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Fig. 7

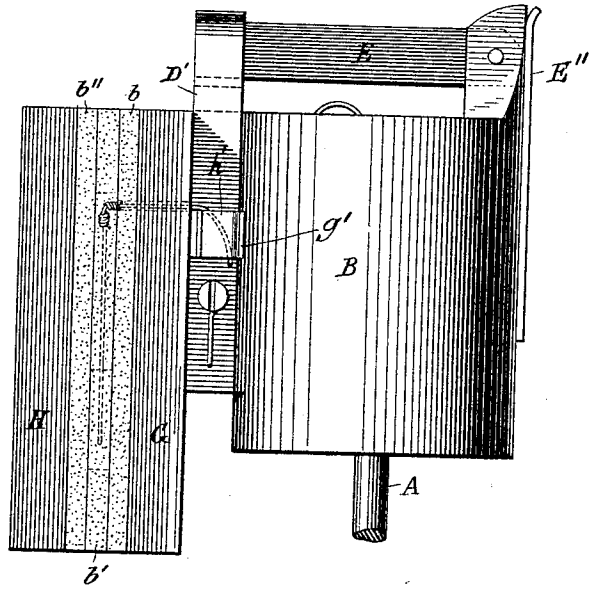
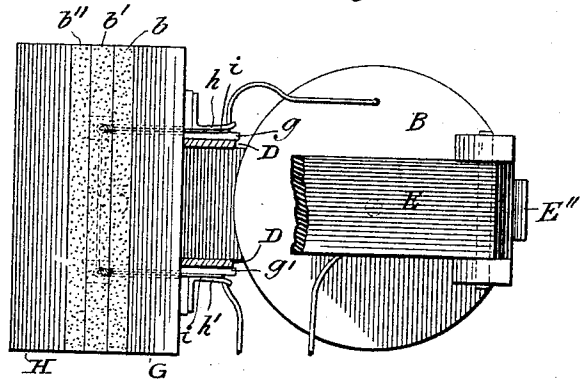


Fig. 8



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AUTOMATIC ELECTROMAGNETIC CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 521,423, dated June 12, 1894.

Application filed July 18, 1893. Serial No. 480,845. (No model.)

To all whom it may concern:

Be it known that I, LUCIUS T. STANLEY, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Automatic Electromagnetic Cut-Outs, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

The invention which forms the subject of my present application, consists in improvements in the construction of a device heretofore known and comprising an electro-magnetic cut-out or device for automatically interrupting a circuit upon any abnormal increase in the current flowing therein, and a fusible conductor in shunt to the terminals of said cut-out, and of a capacity considerably below what would be necessary to carry either the normal current of the circuit or any increase thereof.

My invention resides in a new and improved electro-magnet; in improvements in the fuse and fuse chamber and in the manner of attaching or applying the same, and will be described by reference to the accompanying drawings.

Figure 1 is a front elevation of my improved apparatus. Fig. 2 is a sectional view of the same on line *x*—*x* of Fig. 1. Fig. 3 is a plan view of the part constituting or containing the fuse chamber. Fig. 4 is a cross-section of the same on line *y*—*y*. Fig. 5 is a section on line *z*—*z* of Fig. 3. Fig. 6 is a view of the fuse and its terminals. Fig. 7 is a view in side elevation, and Fig. 8 a top plan view partly in section showing the apparatus complete with its several parts connected.

The cut-out mechanism is to be mounted on or attached to any suitable base or support.

A is an iron core provided at its lower end with a pole plate A′ which is a circular disk of iron. From the upper end of the core A extends a non-magnetic guide rod A″ which serves as a hammer or pusher to the switch lever or other mechanism which the magnet is intended to operate. The core A is surrounded by and plays vertically within a coil C, which in turn is surrounded by and inclosed within an iron jacket B which forms a return circuit for the magnetic flux. The proper position of the core and pole plate with relation to the coil C is determined by the adjustment of a screw *a*′ placed under the plate.

D D′ are the terminal plates of the switch between which is the make and break plate or bridge F attached to or carried by a switch arm E which is of insulating material or insulated from the part F. The switch arm is a lever pivoted at E′ and held in an elevated or depressed position by the action of a flat spring E″ that bears against the squared end of said lever in the rear of its pivoted support. The device is included in a circuit by attaching one of the line terminals to a binding post C′ which forms one terminal of the coil C. The opposite end of the coil is connected to one of the switch plates D′ from whence the circuit is made through the bridge piece F to the plate D and thence to the other binding post C″.

The operation of this device is as follows: The weight of the core or plunger and its connected parts and the distance between the coil or iron jacket and the pole plate are so adjusted relatively to the number of ampère turns in the coil that the plunger will be drawn up into the coil only when the volume of current for which the adjustment is made is flowing through the coil. For example, should the device be placed locally in the motor circuit of a street car, which it is desirable to open and thus cut out the car when one hundred ampères are passing, then the parts are so adjusted as to operate only when one hundred ampères or more are passing. The hammer at the upper end of the plunger is so arranged that its extreme end is at such a distance from the switch bar with which it engages, that, when the plunger is drawn into the coil, it gains such momentum before the hammer comes into contact with the bar, that a quick percussive blow is given the bar and it is thus driven away from contact with the brushes and the circuit is opened. When the bar is thus drawn away from the brushes, it is held away from them by the action of the spring E″, as above explained.

In practice, for a current of moderate volume and pressure, say five thousand watts, more or less, according to the size and arrangement of the switch terminals and bridge, this device as above described is capable of breaking the circuit without dangerous sparking at the switch terminals, but when currents of many times such volume are to be dealt with, it is necessary to provide an attachment auxiliary to the ordinary switch mechanism in order to divert the sparking from the actual make and break portion of the switch. Several auxiliary arrangements of this character have been devised. Among these, one of the most convenient in application is shown by the dotted line K in Fig. 1, which is a fuse wire connecting the two switch plates D and D′ in such manner that there are two parallel pathways between the two plates; one through the break piece or bridge and one through the fuse wire. This fuse wire is, ordinarily, of a carrying capacity about ninety-five per cent less than the overload to be provided for. For instance, if the extreme load to be carried is fifty thousand watts,—the fuse wire provided for the shunt circuit would have a capacity of two thousand five hundred watts, or, if a fuse of one hundred ampères capacity is capable of carrying this overload, a fuse of about five ampères capacity would be placed in the shunt circuit. The result is that when the overload comes the circuit is first broken without spark at the switch terminals by the action of the magnet, then for a short time the entire overload is carried by the fuse, and until it is "blown," but the tremendous energy expended upon the small fuse causes it to "blow" with great sparking and the production of highly heated gas which, unless the terminals are well protected against it, will carry an arc between the terminals, and it is the province of my improved fuse chamber and its accessories to provide against this sparking and arcing caused by the "blowing" of this small fuse under great pressure and current. For convenience I make this fuse chamber in the following specific manner, but I may make it in any manner that will comply with the spirit of my invention.

Upon a block of wood or other suitable material G is laid a sheet of asbestus or other insulating material *b*. This sheet completely covers the entire surface of the block. Upon the surface of this sheet of insulating material is firmly affixed another sheet of the same material *b′*, which is cut away as shown in Fig. 3. That is, it is cut away so as to form a U-shaped chamber, the two arms *e e′* being long and narrow, and the bottom being formed of the comparatively broad pocket *e″*. At the points *f f′* at the extremities of the arms *e* small holes are made through the sheet *b* and the block G. Thus the fuse chamber is formed. The cover to this chamber, which seals it, is made by affixing to the under side of the block H a sheet of insulating material *b″*. The two parts of this fuse chamber may be made as I have described, or they may be molded in any suitable insulating material. Where the holes *f f′* come through at the under side of the block G, are the clips which serve to hold the fuse terminals, also to connect the fuse terminals to the brushes D, D′ of the switch.

The terminal clips are formed in a specific manner in order that the fuse may be conveniently placed, and that the fuse chamber may be readily connected to or disconnected from the switch brushes, so that one not mechanically expert may easily perform these operations. Said clips consist of the angle plates *g*, *g′*, which are secured to the face of the plate G and are made of stiff copper or brass so as to have comparatively little resilience. Bearing against these plates are springs *h*, *h′* forming with the former spring jaws or clamps wherein the ends or terminals of the fuse wire are forced by bending over the latter, as shown in Figs. 4, 7, and 8. The pressure of the spring plates *h*, *h′* against the stouter plates *g*, *g′* preserves good contact with the fuse wire. The distance between the two plates *g*, *g′* is slightly less than that between the outer faces of the terminal plates D, D′ but by a moderate pressure the two plates *g*, *g′* may be spread so as to pass down over plates D, D′, and to press strongly upon the same, so as to secure the fuse block firmly to the switch, as shown in Fig. 8.

The fuse is prepared in the following manner: The terminals *i i* are of copper wire with the spiral coils *i′* at the end. Through this spiral coil the end of the fuse wire *l* is passed and secured into place by coiling around the straight portion of the terminal at *l′*. The coil of the terminal is then compressed so as form a perfect electrical contact between the two parts and the coiled end of the fuse wire is fastened to the terminal by a drop of solder.

The fuse is placed in the fuse chamber in the following manner: The copper terminals are inserted in the holes at the ends of the arms of the chamber and pushed through until the junctions of the terminals with the fuse are firmly seated in the bottom of the chamber, the ends of the terminals are then inserted between the leaves of the clip. The fuse proper is then pressed down into the bottom of the chamber as shown in Fig. 3, and the cover is put on thus forming practically a sealed chamber for the fuse. The fuse box is then connected to the switch brushes by forcing the clips into proper position onto their respective brushes. It will be observed that the two arms *e e′* of the fuse chamber are but slightly larger in cross-section than the fuse itself, while the space in the chamber *e″* is relatively much greater. Now, it is a fact that when a fuse wire is attached to copper terminals fusion begins to take place at the junction of the fuse with its terminals. Hence by the use of a chamber of the character above described and

placing the terminals at the ends of the contracted passages or arms when fusion commences at *f f'*, Fig. 3, sufficient gas is formed to blow the major portion of the fuse into the pocket *e''* without volatilizing, consequently there is but a slight amount of gas evolved as compared with the operation of fusing in the open air or in a larger chamber, therefore, in this particular arrangement, the little gas that evolves is not sufficient to carry an arc through the different portions of the chamber between the terminals.

What I claim as new is—

1. In an electro-magnetic cut-out the combination of a vertically movable magnetic plunger having a pole plate at its lower and a non-magnetic extension at its upper end, a coil surrounding said plunger, a magnetic casing or jacket surrounding the coil, and a pivoted switch lever in position to be encountered and raised by the non-magnetic extension of the core, on the upward movement of the same.

2. In an electro-magnetic cut-out, the combination of a vertical coil or helix inclosed at its top and sides by a magnetic jacket, a core movable therein and provided at its lower end with a magnetic pole plate, an adjusting screw for regulating the position of the core and pole-plate, and a pivoted switch lever above the coil adapted to be shifted by the engagement therewith of a non-magnetic extension of the core, as set forth.

3. In an electro-magnetic cut-out, the combination with a magnetic coil, a movable core, a pivoted switch lever and two switch plates or terminals normally bridged by the switch lever, of a fuse box having stationary and slightly resilient terminals adapted to mechanically engage with the switch plates and connect the box to the same, as set forth.

4. In an electro-magnetic cut-out the combination with the strips or plates forming or connected with the switch terminals, of a fuse box having slightly resilient projections thereon adapted to engage with the switch plates and mechanically secure the box thereto, and springs bearing upon the said projections and forming jaws for receiving the terminals attached to the fuse, as set forth.

5. The fuse box herein described composed of a refractory insulating substance and containing a space or chamber with two contracted arms or passages extending therefrom, a fusible strip or wire contained in the said chamber and having its ends secured to terminals at the ends of the contracted passages, as set forth.

6. The combination with a fuse box having a U-shaped chamber for containing a fuse, the arms of parallel passages of said chamber being contracted to nearly the size of the fuse wire, while the remaining portion forms a space of relatively greater capacity, of a fusible strip contained in said chamber and having its ends secured to copper terminals at the ends of the contracted arms or passages.

7. The combination with the fuse block containing an enlarged space or pocket *e''* and two contracted arms or passages *e e'* extending therefrom, of stationary terminals or clips *c c'* on the outside of the block, a fusible wire extending through the pocket and contracted passages, and having its ends attached to copper wires that pass through perforations in the block at the ends of the contracted passages and connect with the clips or terminals, as set forth.

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