(No Model.)

A. S. WILLIAMS.

ELECTRICAL PROTECTIVE APPLIANCE.

No. 596,197. Patented Dec. 28, 1897.

Fig. 1.

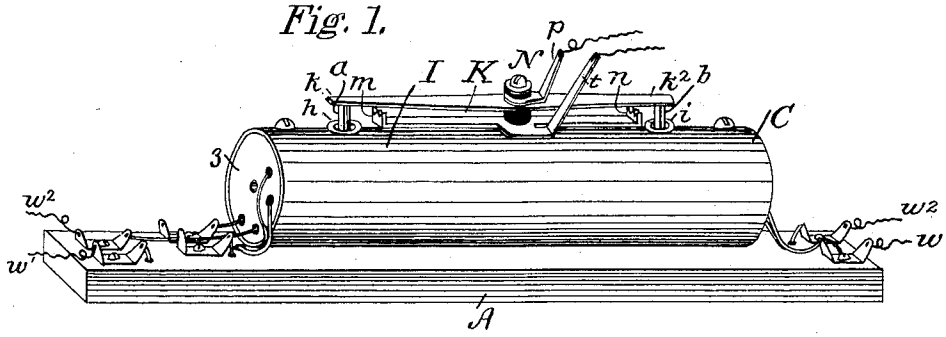


Fig. 2.

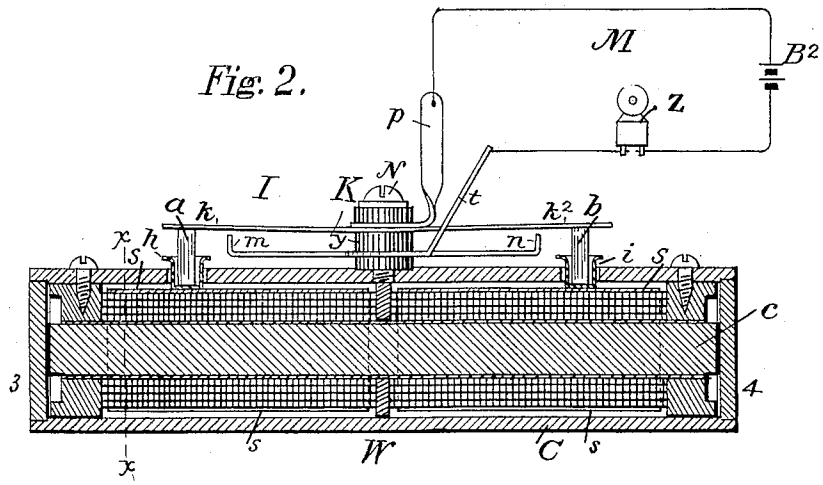
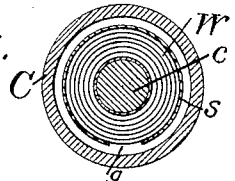
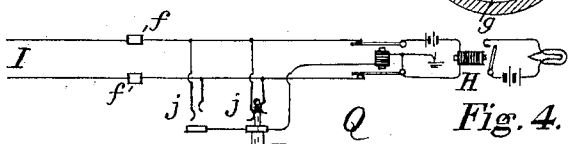


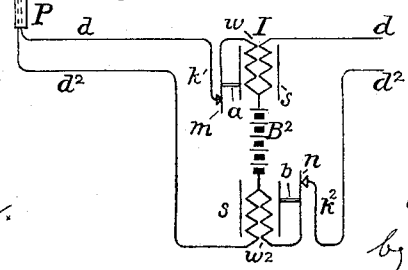
Fig. 3.





Q

Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL PROTECTIVE APPLIANCE.

SPECIFICATION forming part of Letters Patent No. 596,197, dated December 28, 1897.

Application filed August 26, 1897. Serial No. 649,597. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR S. WILLIAMS, residing at Newton, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Electrical Protective Appliances, of which the following is a specification.

This invention relates to the protection of electromagnetic apparatus from the destructive or injurious effects which result from the passage through circuits with which said apparatus is associated of abnormally strong or powerful electric currents or discharges.

The protective devices proper are of that general class in which a sufficient increase of temperature in the winding or helices of the electromagnetic coil to be protected causes a mass of easily-fusible or easily-softened material to become plastic and yield, thereby releasing a spring which performs the mechanical operations necessary to effectuate the desired protection.

The invention consists generally in improvements and details of construction whereby the communication of heat generated in any part of the coil of the apparatus to be protected to the fusible material is facilitated and expedited.

More particularly it consists in combining the fine-wire winding of an induction-coil or other electromagnetic appliance and with an associated protective device of the above-mentioned type with a screen or envelop of sheet metal or metal foil almost completely surrounding the said winding and in metallic contact with the said fusible material. Thus when by reason of a cross with the conductor of a heavy-current circuit or otherwise an abnormally or dangerously strong current begins to flow through the coils of the electromagnetic apparatus to be protected the heat generated thereby in all portions of the winding will tend to pass to the said metal screen and being concentrated therein will be enabled to expend itself promptly and freely in fusing or softening the fusible material governing the protective circuit-controller.

The sheet-metal screen or envelop is preferably formed of copper-foil and may encircle the coil except for a slight gap in its continuity between its two edges.

The electromagnetic coil to be protected may be inclosed in an iron sheath completing the magnetic circuit of the core. The circuit controller or changer controlling a protective or alarm circuit for the said coil may be mounted upon and secured to this iron sheath and maintained with its contact springs and points in their normal and inoperative relation by means of short rods, pencils, or masses of some suitable alloy, metal, or other material solid at normal temperatures, but melting or becoming soft when exposed to a moderate advance in temperature, which rest in metal cups placed in recesses or apertures of the iron sheath and resting on the foil screen. The said easily-fusible rods are held in place under pressure of the spring elements of the circuit-changer and normally maintain the same out of contact with their several complementary points, so that the protective or alarm circuit is inactive; but when the coil is heated by the passage of a dangerous current and transfers its heat to the screen of metal foil the said rods become soft and permit the contact-springs to move into contact with their respective points. The closing of these contacts may close a local circuit containing a battery and bell, thereby giving an alarm, or it may short-circuit the coil and thus drain the abnormal current therefrom, or in a well-understood manner it may by a slightly different arrangement of parts be enabled to open the working circuit of the coil.

I have shown the invention as applied to the repeating induction-coil of a telephone system, but it is of course equally applicable to induction-coils of any kind when connected with main electric circuits, or in fact to electromagnetic appliances of all kinds.

In the drawings, Figure 1 is a perspective view of the invention applied to and embodied in an iron-clad repeating induction-coil. Fig. 2 is a longitudinal central section of the said induction-coil and its associated protecting devices and an alarm-circuit controlled thereby. Fig. 3 is a cross-section of the said coil; and Fig. 4, a diagram of a portion of a subscriber's-telephone circuit and a central-office connecting-cord, the induction-coil and its associated protector being incorporated in said cord connections and shown as involving my invention.

I is a repeating induction-coil mounted on

a base A, having a central iron core *c*, iron end plates 3 and 4, and a cylindrical iron sheath C, so that it has a magnetic circuit and may be called an "iron-clad" coil. W is its winding as a whole, which in the present instance consists of two fine-wire coils *w* and w^2, both opened about the middle part and having the severed ends joined, as shown in Fig. 4, each with the end of its inductively-related wire, and then together with the battery B connected between. The six terminals of the coil of Fig. 1 are provided for such an arrangement. It is obvious, however, that this is not a necessary mode of winding, and that for the purposes of this invention any winding of either one, two, or more wires can be adopted. Over the winding a sheet of metal (preferably copper) foil *s* is closely enwrapped and is made to almost completely surround the said coil, there being a gap or space *g* left between the edges. This sheet of foil is intended to operate as a heat-collecting screen or envelop for a purpose presently to be pointed out. In the particular form of induction-coil shown the said screen is divided transversely into two substantially equal portions; but such division is by no means essential and is merely a matter of convenience.

K is a circuit-changer or circuit-controller mounted on the iron sheath of the induction-coil I and secured thereto by the screw N. In Fig. 2 it is shown as controlling the continuity of the local circuit M, which contains a battery B^2 and an alarm-bell *z*. The said circuit-controller is represented as having practically-fixed contact-points *m n* and movable contacts or contact-springs *k* k^2, normally in separated relation, so that the local circuit is normally open. The said points and springs are all secured in their places by the screw N, and electrically insulated from each other by suitable interposed non-conducting washers *y*. The fixed contacts *m n* by the conducting-strip *t* are terminals of one pole of the local battery B^2, and the spring-contacts *k* k^2, by means of the strip *p*, form the terminals of the other pole.

In small metal cups *h i*, which also are preferably made of copper, are seated rods, pencils, or small masses *a b* of easily-fusible alloy, metal, or other material. These cups pass through holes or apertures in the iron sheath C of the induction-coil and rest on the surface of the metal-foil screen *s*, and the fusible rods being solid at normal temperatures stand under the ends of the contact-springs *k* k^2 and are sufficiently long to hold the said springs above their several fixed contact-points, thus serving as mechanical obstacles in their path, maintaining the separate relation of the circuit-controller terminals.

Any increase of temperature at any part of the coil is collected by the copper-foil screen, the presence of which greatly enhances the sensitiveness of the protecting appliance by collecting the heat from the very considerable area of the entire coil-surface, and is communicated thereby to the cups *h* and *i* and their fusible rods *a* and *b*. Thus when a dangerously strong current flows through the coil and heats it the heat developed is rapidly concentrated upon the said fusible rods, which promptly fuse or soften, releasing the contact-springs *k* k^2, which fall on the points *m n*, closing the local circuit and giving the alarm. Another function of the cups *h i* is to prevent the metal or alloy of the rods *a b* from flowing down when fused into the coil. Of course the closing of a local circuit to ring a bell or give an alarm is but an example of a great variety of mechanical or mechanico-electrical operations which can be performed by an appliance of this character. Another one is indicated in Fig. 4, wherein L is a portion of a telephone-subscriber's circuit having, as usual, ordinary protective fuses *f* at points external to the central-office apparatus. This circuit at the central office Q is provided with the regular terminal apparatus H and spring-jack plug-sockets *j*.

A pair of connecting-plugs P (one only being shown) have their respective registering conducting-surfaces united by conductors *d* d^2, the battery B^2 being bridged between them, and the induction-coil I being arranged, as already described, with one-half of each of its windings on each side of said battery. The conducting-screen *s* is also shown in two sections *s* s^2. The rods of easily-fusible material *a b* are, as in the former case, interposed between the contact-points *m n* and the contact-springs *k* k^2. In this case, however, the electrical connections are so arranged that when heat is developed in the coil the rods are consequently softened or melted, thereby permitting the contact-springs to separate and open the cord conductors *d* and d^2, whereby the cord is for its protection isolated.

In the figures two fusible rods and two sets of circuit-controlling points are shown as being associated with a single appliance to be protected. Of course in many cases one only is essential, and if desired and convenient more than two can readily be employed.

The above being a complete and correct statement of the invention, I claim—

1. In an induction-coil or electromagnetic appliance the combination with the fine-wire winding thereof, and an associated protecting appliance, consisting of circuit-changing contact points and springs, a protective or alarm circuit controlled thereby, and a rod or mass of easily-fusible material solid at normal temperature, but fusing or softening under a moderate advance, supported by the said winding and normally maintaining the said circuit-changing springs in their inoperative position, a sheet-metal heat-collecting screen interposed between the said winding and the said easily-fusible mass, and nearly enveloping the former; substantially as specified.

2. The combination of an induction or repeating coil having a fine-wire winding, and a cylindrical iron sheath, and an associated

protective appliance comprising a protective or alarm circuit, a spring circuit-controller therefor, and one or more solid rods or pencils of alloy or other material capable of fusing or softening under a moderate rise in temperature, normally maintaining the inoperative relation of the springs and points of the said circuit-controller, with a screen of metal foil interposed between the coil-winding and its iron sheath, and nearly enveloping the former, and metal cups or steps one for each fusible-alloy rod supported on the said metal screen, in recesses or apertures of the said iron sheath, and holding the said rods normally in place, substantially as described.

3. The combination in an induction or repeating coil, of the fine-wire winding thereof, a copper-foil screen or envelop nearly surrounding the said winding, a circuit-changer comprising contact points or springs mounted on the said coil, protective or alarm devices for the said induction-coil controlled by said circuit-changer, one or more copper cups resting on said copper-foil envelop, and a corresponding number of rods or pencils of easily-fusible material supported in said cups under pressure of the said contact-springs, and normally maintaining the inoperative condition of said circuit-changer, but adapted to fuse or soften with the heat produced by a current of abnormal strength flowing through the winding and thereupon to yield and permit the operation of said circuit-changer, and the protective devices controlled thereby; substantially as specified herein.

4. In an electromagnetic appliance the combination of the winding thereof, a mass of easily-fusible material in juxtaposition thereto, and suitable circuit-changing protective devices controlled by the said material, with a sheet-metal heat-collector interposed between the said winding and the said fusible mass, to more effectually and promptly conduct heat developed by the former into position to act upon the latter; substantially as and for the purposes set forth.

5. The combination in an electromagnetic appliance, of the winding thereof; a mass of easily-fusible material, contiguous thereto; a sheet-metal heat-collector contiguous to the said winding and also to the said fusible mass; and circuit-changing devices, controlling protective connections, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of August, 1897.

ARTHUR S. WILLIAMS.

Witnesses:

GEO. WILLIS PIERCE,

FRANK C. LOCKWOOD.