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F. B. COOK.

SELF SOLDERING HEAT CARTRIDGE AND PROTECTIVE APPARATUS.

APPLICATION FILED NOV. 26, 1904.

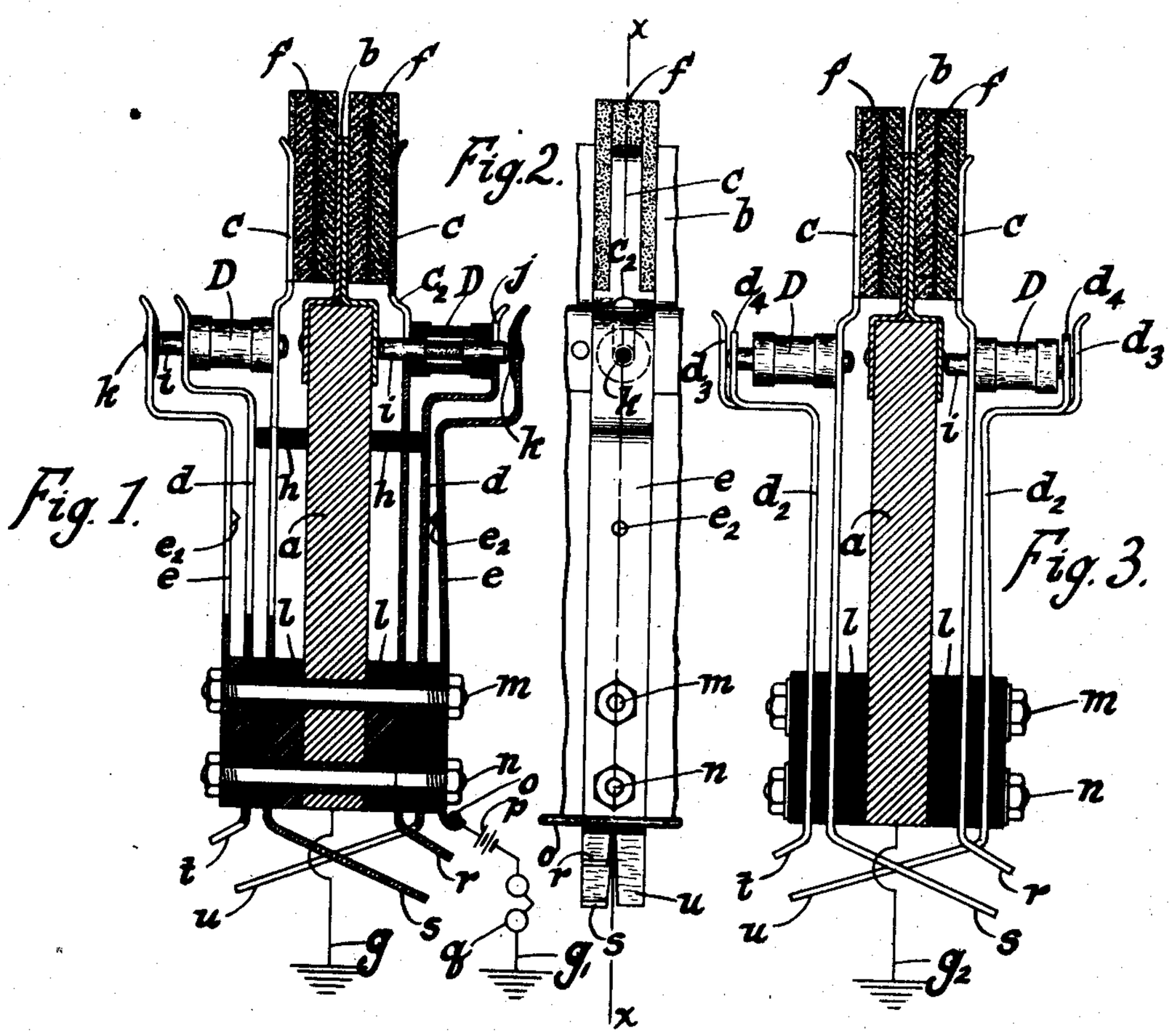

Fig. 1.

Fig. 2.

Fig. 3.

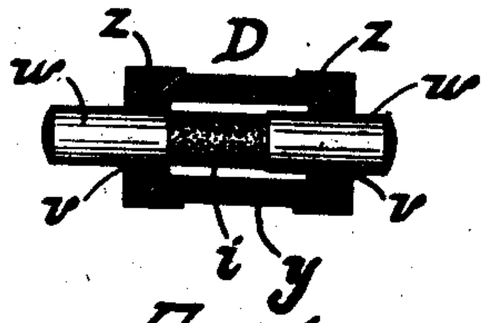

Fig. 4.

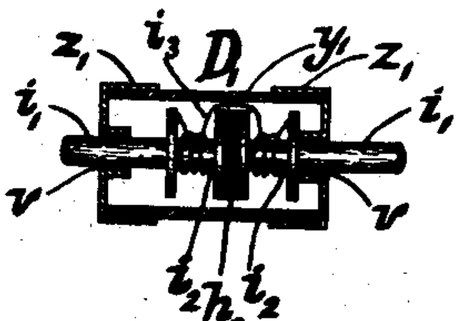

Fig. 5.

WITNESSES:

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SELF-SOLDERING HEAT-CARTRIDGE AND PROTECTIVE APPARATUS.

No. 812,980. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed November 26, 1904. Serial No. 234,359.

To all whom it may concern:

Be it known that I, FRANK B. COOK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Self-Soldering Heat-Cartridges and Protective Apparatus, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to thermal protectors and protective apparatus used in connection with telephone or telegraph systems or the like, my object being, first, to provide a self-soldering heat-cartridge which is very efficient, durable, and simple in construction; second, to simplify the apparatus used in connection with such heat-cartridges; third, to provide improved means for closing an alarm-circuit when a protector operates, and, fourth, to provide improved and simplified means for operating the thermal protector where no alarm-circuit is required.

In my present invention I provide spring contact members adapted to hold the heat-cartridges in operative position in the circuit and to cause each said cartridge to establish a connection from the said circuit to ground when the cartridge operates. Protective devices of the class herein shown usually open the line-circuit and also connect a portion thereof to ground when operated; but in this present invention I merely ground the line-circuit without opening same. In connection with telephone systems I find this arrangement to be very satisfactory, as when the ground connection is established through the protector it forms a short-circuit from the line to earth, which shunts the switchboard-circuit, and hence prevents the objectionable "sneak-current" from passing to or through the switchboard.

I employ the usual mounting-plate, which is also the ground-plate, for mounting the protector-springs thereon, and also the usual lightning-arresters, which are held in place against the ground-plate by certain of the protector-springs.

I will more particularly describe my invention by reference to the accompanying drawings, in which—

Figure 1 is a plan view of a duplicate set of the protective apparatus mounted on opposite sides of the ground-plate, with portions shown in cross-section taken on line *x x* of Fig. 2. Fig. 2 is a side elevation of the protective apparatus shown in Fig. 1. Fig. 3 is a plan view of a modified form of a duplicate set of the protective apparatus, taken the same as Fig. 1, there being no provision for an alarm-circuit. Fig. 4 is a cross-sectional view of the heat-cartridge of the invention, taken through the axis thereof, with portions shown in elevation; and Fig. 5 is a cross-sectional view of a modified form of heat-cartridge, taken the same as Fig. 4, with portions shown in elevation.

Like characters refer to like parts in the several figures.

The mounting-plate *a*, preferably a part of the iron framework of a cross-connecting board or the like, is provided with a ground-strip *b*, suitably secured to one edge thereof and adapted to accommodate lightning-arresters on each side thereof. On each side of the ground-plate *a* are mounted springs *c*, *d*, and *e* by double-ended bolts *m* and *n*, which extend through the ground-plate and are insulated therefrom. The said springs are suitably insulated from each other and from the ground-plate by insulating-bushings and washers *l l*. Each heat-cartridge D is inserted between springs *c* and *d*, which hold the cartridge in an operative position, the pin *i* of the cartridge being inserted through a hole c^2 in spring *c* and through a slot *j* in the free end of spring *d*. Lightning-arresters *f f*, comprising the usual carbon blocks and an interposed dielectric, are inserted between the ground-strip *b* and the free ends of springs *c c*, respectively, which hold the lightning-arresters in place against the strip *b*. The alarm-springs *e e* are mounted outside of springs *d d*, respectively, and are conductively connected with each other through bolts *m* and *n*. Each spring *e* is provided with a contact e^2, adapted to engage spring *d* when the thermal protector operates, and with an insulating-bushing *k*, which rests against the pin *i* to operate same, and also insulates spring *e* from pin *i*. On each side of plate *a* is provided an insulating-pin *h*, extending through spring *c* and adapted to support spring *d* when the heat-cartridge D is removed from the circuit. Line-terminals *s* and *r* are preferably continuations of line-springs *c c*, respectively, and switchboard-terminals *t* and *u* are preferably continuations of switchboard-springs *d d*, respectively, terminals *s* and *u* being crossed over to opposite sides of plate *a* through space to arrange like

terminals on the same side of the mounting-plate *a*. This crossing over of terminals *s* and *u* is a marked improvement over transferring the connections through the bolts *m* and *n*, respectively, as sometimes is done, as it does away with extra parts and all loose contacts between the bolts and springs. Conductor *o* is soldered to the terminal end of one spring *e* and extends parallel with plate *a*, so as to be soldered to a series of alarm-springs *e e* in the respective sets of the protective apparatus to connect all of the alarm-springs in common. The battery *p* and signaling device *q* are preferably connected from the conductor *o* to earth at *g'*.

The heat-cartridge D of Fig. 4 preferably comprises an insulating-sleeve *y*, a conducting-cap *z* for each end thereof and secured thereto, and a resistance-pin *i*, preferably of graphite or carbon, extending completely through the shell *y* and end caps *z z* and soldered to the caps *z z* by an easily-fusible solder *v v*. Each end of pin *i* is preferably covered with a metallic plating *w*, which provides a suitable surface for soldering the pin *i* to caps *z z* and which also provides a good conductor from one cap *z* to the ground-strip *b* when the heat-cartridge operates, as shown on the right-hand side of Figs. 1 and 3. In constructing the pin *i* the metallic plating *w* may be applied so as to completely cover the surface of the pin, and then a portion of same may be removed from the center to provide the required amount of heat-producing material in the circuit. When this plating *w* is thus removed, the pin *i* may also be turned down until the resistance of same is adjusted to the required amount. By this method the resistance of the heat-cartridges may be brought to any desirable amount, thus making the operation of the cartridges very uniform. If desired, a portion or all of the plating *w* may be removed from the ends of pin *i*, so as to cause same to establish a ground connection from a line-spring *c* to the ground-plate *b* through any required resistance when the cartridge operates.

The circuit through one of the heat-cartridges D is from the line-spring *c*, through one end cap *z*, heat-susceptible material *v* and one plated end *w* of pin *i*, the central heat-producing portion of pin *i*, the other plated end portion *w* of pin *i* and heat-susceptible material *v*, and the other end cap *z*, to switchboard-spring *d*. An abnormal electric current traversing this circuit or through the pin *i*, such current being generally termed a "sneak-current," heats the pin *i*, due to the resistance thereof, and when the heat is sufficient the heat-susceptible material or solder *v v* fuses or softens and allows spring *e* to slide the pin *i* through the heat-cartridge D and cause it to come in contact with ground-strip *b*, thereby grounding the line-spring *c*, and thus switching the objectionable current to earth, the contact e^1 of alarm spring *e* at the same time engaging spring *d*, and thereby closing the alarm-circuit from ground-strip *b*, through pin *i*, spring *d*, contact e^2, spring *e*, conductor *o*, battery *p*, and signaling device *q*, to ground at *g'*. The abnormal current now flows from line-spring *c*, through one end of pin *i* and the plating *w* thereof, to the ground-strip *b* and thence to earth, thereby stopping the flow of current through the heat-producing portion of pin *i* and allowing the heat-cartridge to cool. When the cartridge D becomes cool, the heat-susceptible material *v v* hardens, and thereby solders the pin *i* to the conducting-caps *z z* in this new relative position. To reset the apparatus, the heat-cartridge may be removed, turned end for end, and reinserted between springs *d* and *c*, as originally. The cartridge D and the apparatus may now be operated again as originally, the operation of the cartridge D now being the reverse of the first operation. The apparatus may be operated again and again as many times as desired, each operation of the cartridge being the reverse of the preceding one. It will be noted that when the heat-cartridge starts to operate the circuit is not opened through the heat-producing pin *i*, and consequently the heat-cartridge does not cool when partly operated. It will also be noted that at no stage of the operation of the cartridge is the circuit through the heat-producing pin *i* opened. Thus the pin *i* continues to produce heat to operate the device until the pin *i* actually comes in contact with the ground-strip *b*.

In Fig. 3 I have shown a modified form of protective apparatus used in connection with the heat-cartridges D D. In this form of my invention I dispense with the alarm-springs *e e* and adapt the switchboard-springs d^2 d^2 to bear against the pins of the respective heat-cartridges and operate same to ground the line-circuit when an abnormal electric current traverses the said cartridges. One end of pin *i* of each heat-cartridge D is inserted through a hole in spring *c*, the same as in Fig. 1, and the other end of pin *i* is pressed into a slot in the free end of spring d^2, there being a tongue portion d^3 formed on spring d^2 to engage the end of pin *i* and depress the latter against the ground-strip *b* when the device operates. This type of my invention is particularly adapted for smaller exchanges, where no alarm for the protective apparatus is required, the construction of the apparatus being very simple and the number of spring contact members being reduced to a minimum.

In Fig. 5 I have shown a modified form of heat-cartridge D'. The construction of this cartridge D' is similar to that of cartridge D, (shown in Fig. 4,) except that instead of using a graphite or carbon pin *i* I use a metal pin *i' i'*, the ends of which are insulated from each

other by an insulating-disk h^2, provided with a heat-producing winding i^3, wound around the pin i' i', preferably as shown, and adapted to heat the said pin, and thereby soften the fusible material v v to allow the device to operate. Each metallic end portion of the pin i' i' is provided with a spool i^2, adapted to receive its portion of the winding i^3, which heats its corresponding end of the pin i' i' when an abnormal current traverses the winding i^3. This heat-cartridge D′ may be reversed and operated again, the same as the cartridge D of Fig. 4.

While I have shown and described particular details of construction in this invention, I do not wish to limit same entirely to such details, as slight modifications in the protective apparatus and heat-cartridge proper would not be a departure from the scope of the invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a device of the character described, an inclosing shell, suitable conducting end caps therefor and secured thereto, and a heat-producing member extending completely through the said shell and end caps and projecting from at least one end of the device.

2. In a heat-cartridge of the character described, a heat-producing member extending completely through and projecting at one end of the cartridge, whereby when operated, the cartridge is conditioned for another operation in a reversed position.

3. A thermal protector having a heat-producing, circuit-controlling member extending completely therethrough and projecting from at least one end thereof, the operation of which places the device in condition for another operation in a reversed position.

4. In a heat-cartridge, suitable terminals for connecting the cartridge in a circuit which it is to protect, a circuit-controlling operating member normally extending completely through the cartridge and in electrical connection with the said terminals, and means for operating the said circuit-controlling member to control a circuit and condition the cartridge for another operation in a reversed position.

5. In a device of the character described, an incased resistance member normally extending completely through the casing and operable longitudinally in either direction under abnormal current conditions, a support for the device, and means for operating the said resistance member and insulated therefrom, the said resistance member and casing constituting a device detachable from its support for reversal after each operation for a repetition thereof.

6. A thermal protector comprising a sleeve, supporting means therefor, a heat-producing pin extending completely through the sleeve, heat-susceptible material normally holding the pin in operative position, and suitable means for operating the pin to control a circuit and condition the device for another operation in a reversed position.

7. A thermal protector comprising a sleeve, end caps therefor, a heat-producing pin extending completely through the sleeve and end caps and projecting from at least one end cap, and heat-susceptible material normally securing the said pin to the said end caps.

8. In a thermal protector of the character described, the combination of an insulating-sleeve, end caps therefor, and a spring-pressed resistance member normally extending completely through the sleeve and end caps, being normally secured to the latter by heat-susceptible material, and operable longitudinally in either direction, relatively to the remainder of the protector, to control a circuit, when the heat-susceptible material is softened.

9. The combination with an electric circuit including at least one spring-support, of an incased resistance member supported by said spring-support, normally extending completely through its casing and operable in either direction under abnormal current conditions, heat-susceptible material normally holding the resistance member against operation, and a spring member for operating the said resistance member but insulated therefrom, the said incased resistance member constituting a detachable device capable of reversal after each operation for a repetition thereof.

10. In a thermal protector of the class specified, an insulating-casing, a conducting end cap for each end thereof and secured thereto, a pin of resistance material extending completely through said casing and end caps, a metallic plating for each end of said pin, and heat-susceptible material normally securing the said plated portions of said pin to the respective end caps.

11. In a thermal protector of the character described, an insulating-sleeve, a conducting end cap for each end thereof and secured thereto, a resistance member extending completely through the sleeve and end caps, arranged to generate heat under abnormal current conditions to operate the device and operable longitudinally in either direction to render the device reversible, under abnormal conditions, and heat-susceptible material normally securing the said resistance member to the end caps.

12. A heat-cartridge of the character described, comprising a shell, a piece of homogeneous resistance material extending completely through the cartridge and operable in either direction under abnormal conditions, and heat-susceptible material normally holding the said piece of resistance material against operation.

13. A heat-cartridge of the character described comprising a shell, a piece of graphite normally extending completely through the shell and operable in either direction under abnormal current conditions to control a circuit and to render the device reversible for another operation, and heat-susceptible material normally holding the said graphite against operation.

14. In a heat-cartridge of the character described, a heat-producing pin extending completely through the cartridge and operable endwise, and heat-susceptible material normally securing the pin in a fixed position.

15. In apparatus of the class specified, a ground-plate, a pair of springs mounted thereon, a heat-producing member electrically connected in circuit with the said springs and adapted to engage the ground-plate when the device operates, and means for operating the heat-producing member to bring same in contact with the ground-plate without opening the said circuit between the said springs.

16. In apparatus of the class specified, a ground-plate, a pair of springs mounted thereon, a heat-producing member electrically connected between the pair of springs, an alarm-spring mounted outside of the pair of springs and adapted to operate the heat-producing member under abnormal conditions and cause same to contact the ground-plate to ground the circuit, and a contact on the alarm-spring adapted to contact one of the pair of springs to close an alarm-circuit upon the operation of the device.

17. In apparatus of the class specified, a ground-plate, a pair of springs for each side of the ground-plate and suitably mounted thereon, a heat-cartridge for each pair of springs, comprising a heat-producing pin extending completely through the cartridge and electrically in circuit with the pair of springs, an alarm-spring for each side of the ground-plate and mounted outside of the pair of springs, said alarm-spring being insulated from said pin and provided with a contact adapted to engage one of the pair of springs when the device operates, and lightning-arresters inserted between the respective inner springs of the pairs and the ground-plate, abnormal current conditions in either heat-cartridge causing its corresponding alarm-spring to bring the heat-producing pin in contact with the ground-plate to ground the line-circuit, the said alarm-spring also closing the alarm-circuit, the heat-cartridge being reversible after operation for another operation thereof.

As inventor of the foregoing I hereunto subscribe my name, in the presence of two subscribing witnesses, this 23d day of November, A. D. 1904.

FRANK B. COOK.

Witnesses:
H. B. HALL,
FREDERICK R. PARKER.