No. 785,797. PATENTED MAR. 28, 1905.

F. B. COOK.

THERMAL CUT-OUT FOR ELECTRICAL CIRCUITS.

APPLICATION FILED MAR. 9, 1904.

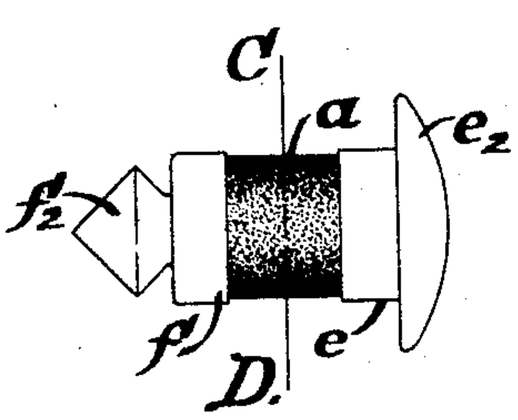

Fig. 1.

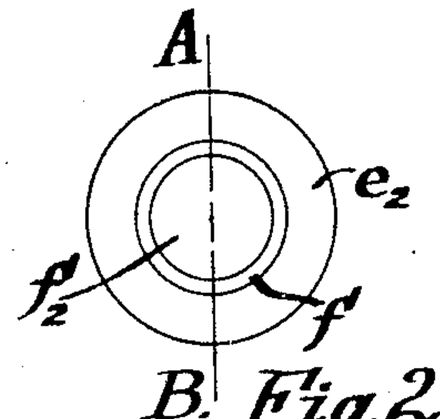

Fig. 2.

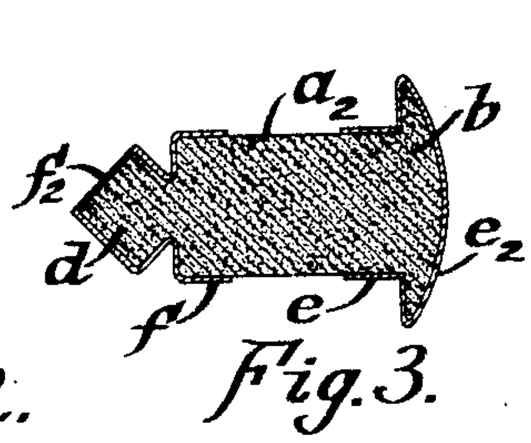

Fig. 3.

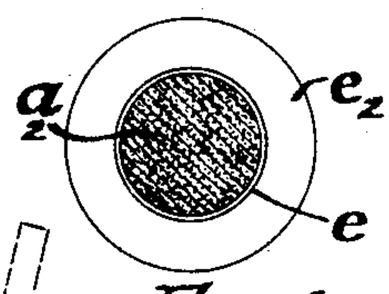

Fig. 4.

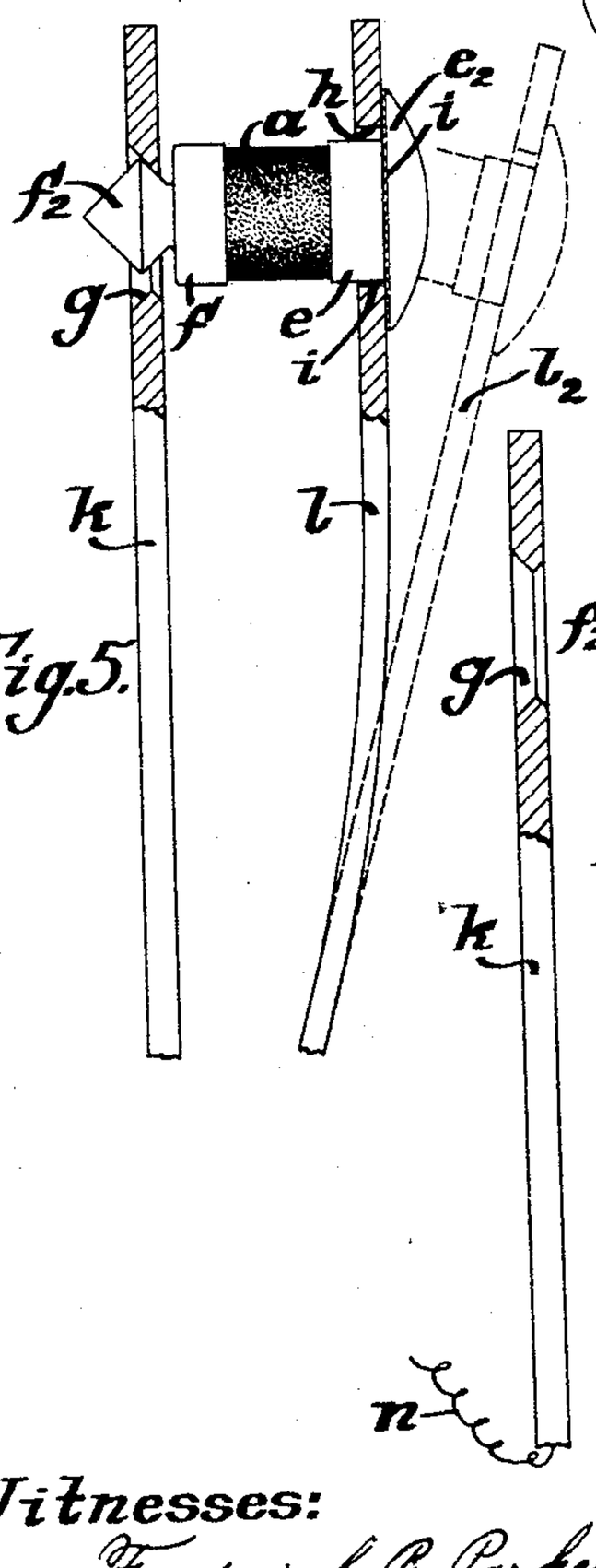

Fig. 5.

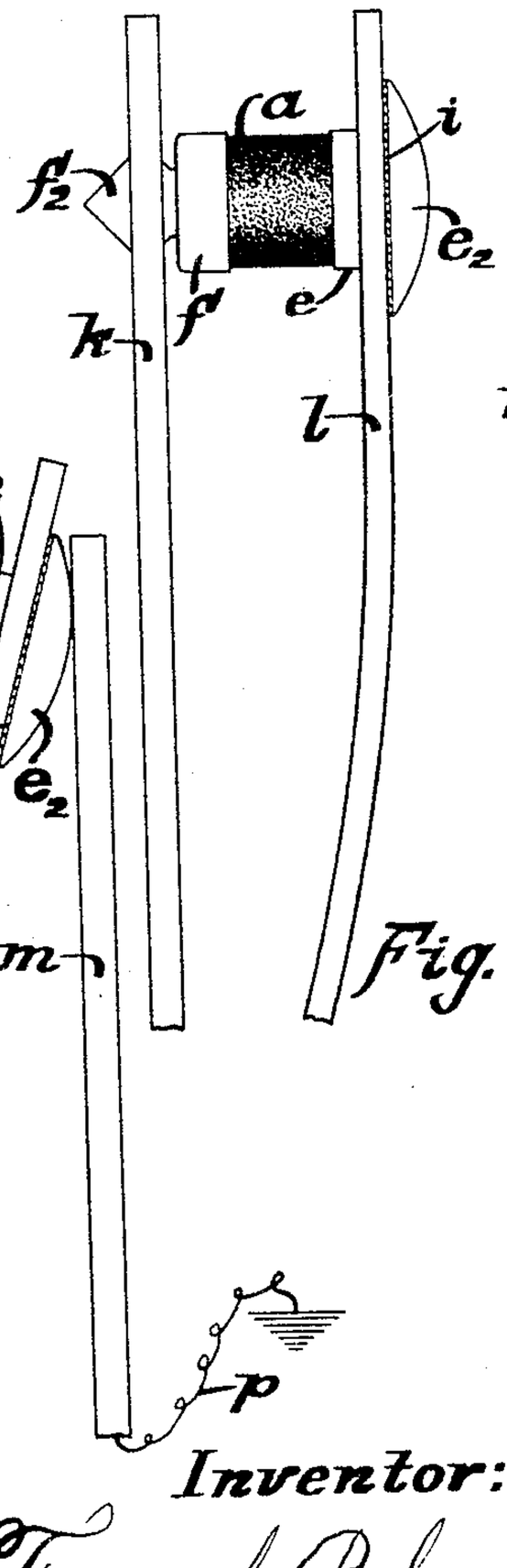

Fig. 6.

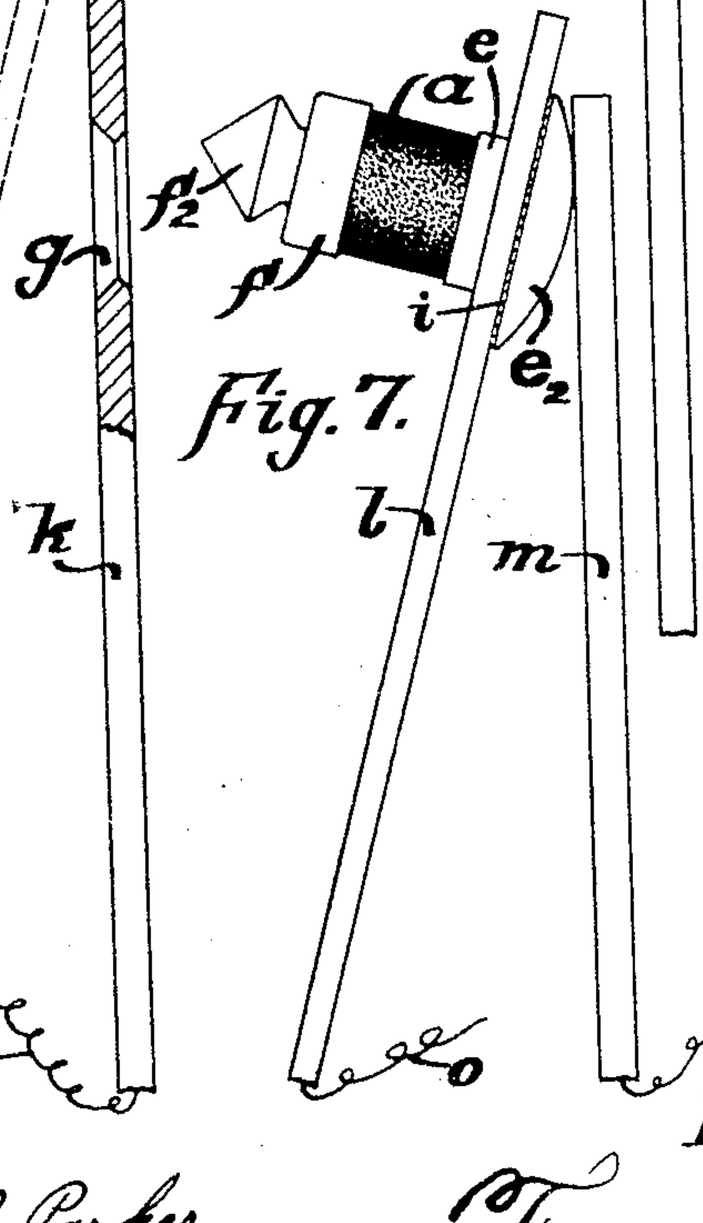

Fig. 7.

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UNITED STATES PATENT OFFICE.

FRANK B. COOK, OF CHICAGO, ILLINOIS.

THERMAL CUT-OUT FOR ELECTRICAL CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 785,797, dated March 28, 1905.

Application filed March 9, 1904. Serial No. 197,293.

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 Thermal Cut-Outs for Electric Circuits, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to that class of thermal protectors known as the "self-soldering" type, and has for its object, first, the adaptation of a homogeneous resistance-body as such a protector, and, second, the provision of an efficient, compact, and durable arrangement of the parts thereof.

I employ a piece of resistance material, preferably graphite, secured to a spring member by a heat-susceptible material and conductively engaging a contact member, from which it is permitted to disengage upon the passage of an abnormally large current through the resistance material. When the heat-susceptible material is softened by the abnormally large current, thus allowing the protector to operate, the spring member operates the resistance-body and brings it in contact with a restoring member, which restores the said resistance-body to its normal relative position upon its support, where it is again secured by the heat-susceptible material becoming cool. Thus restored to its operative condition, the protector is again ready to be replaced to its operative position in the circuit of which it is a protector.

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

Figure 1 is a side elevation of the protector. Fig. 2 is an end elevation of Fig. 1. Fig. 3 is a cross-sectional view of the protector, taken on line A B of Fig. 2. Fig. 4 is a cross-sectional view of the protector, taken on line C D of Fig. 1. Fig. 5 is a view of the protector and its connecting-springs with portions of the springs shown in section. Fig. 6 is a side elevation of the protector and connecting-springs shown in an operative position, and Fig. 7 is a side elevation of the protector and connecting-springs shown in an operated position.

Like characters refer to like parts in the several figures.

The resistance-body a, preferably of graphite, comprises a cylindrical portion a^2, a conical projection d on one end thereof, and a flange b on the other end thereof. Flange b is preferably copperplated, as shown at e^2, and conical projection d is preferably copperplated, as shown at f^2, the copperplating e^2 and f^2 extending over portions of the cylindrical portion a^2, as shown at e and f, respectively. The resistance-body a is inserted through a hole h in spring l, the flange e^2 resting against spring l and being secured thereto by a heat-susceptible material i. When the protector is placed in operative position in the circuit, the conical projection f^2 is inserted through the conical hole g in spring k, Fig. 5, thus putting spring l under tension, as shown, which causes the upper portion of projection f^2 to engage the upper portion of hole g, and thereby form a catch which holds the protector in operative position. Plate m may be a ground-plate. The copperplating e^2 and f^2 forms good contact-surfaces for springs l and k, respectively, and the plating e^2 affords a conducting-surface, with which the fusible solder i readily unites. The resistance of the protector may be varied by varying the area of the cross-section of the cylindrical portion a^2 or by varying the distance between the adjacent edges of the copperplating e and f. The neck between portions d and a^2 is preferably made large, so as to give it strength to withstand the force applied to f^2 when the protector is in operative position.

The circuit through the protector is from conductor n, through spring k, plating f^2, conical projection d, cylindrical portion a^2, flange b, plating e^2, fusible material i, and spring l, to conductor o.

When an abnormally large current traverses the protector, it heats the resistance-body a, due to the resistance of same, and this heat, when sufficient, softens the heat-susceptible material i, and thus allows the protector a to move within the hole h of spring l. The

hole *h* being somewhat larger than the portion *e* allows spring *l*, which is under tension, as in Figs. 5 or 6, to straighten somewhat, and portion *e* to slip within hole *h*, and thereby decrease the pressure between f^2 and *g*. When the pressure between f^2 and *g* is sufficiently decreased, f^2 slips from the hole *g*, and the protector and spring *l* take the position l^2 shown in dotted lines in Fig. 5 or more clearly as shown in Fig. 7. When the protector thus operates, the flange e^2 strikes against the plate *m*, which restores and holds the protector *a* to its normal position within the hole *h*, where it is again secured by the cooling action of the fusible material *i*. The protector is then ready to be reset and operated over again. The operation and restoration of the device, as just described, may be repeated again and again, as many times as desired. When the protector is in an operated position, as in Fig. 7, the circuit is broken between f^2 and *g*, and the abnormal current passes from line conductor *o* through spring *l*, fusible material *i*, plating e^2, spring *m*, and conductor *p* to ground, thus protecting conductor *n* and the apparatus connected thereto from the abnormal current.

I do not wish to limit this invention to the exact details of construction as herein shown. It is not essential that the resistance-body *a* be graphite or that the plating e^2 and f^2 be copper. Other materials may be employed for the resistance-body *a* and plating e^2 and f^2, respectively, with good results. The portion *d* may be effectively used without any plating thereon whatever.

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

1. In a thermal cut-out or protector for electric circuits, the combination of a piece of resistance material for inclusion in a circuit, means for displacing same upon an abnormal current in the circuit, and means for restoring the device to operative condition.

2. The combination of a piece of resistance material for inclusion in an electric circuit, means for opening the circuit through same upon an excess current therein, and external means for restoring the device to operative condition after operation.

3. The combination of a piece of resistance material for inclusion in an electric circuit, means for grounding the circuit upon an excess current therein, and external means for restoring the device to operative condition after operation.

4. In a thermal cut-out or protector for electric circuits, the combination of a homogeneous resistance-body for inclusion in the circuit, means for displacing same upon an abnormal current therein, and an external automatic means for restoring the device to operative condition.

5. In a thermal cut-out or protector for electric circuits, the combination of a homogeneous resistance-body for inclusion in the circuit, a circuit-controlling means adapted to displace the resistance-body upon an excess of current therein, and an automatic means for restoring the device to operative condition.

6. In apparatus of the class specified, a homogeneous resistance-body for inclusion in a circuit, a circuit-controlling means tending to break the circuit and heat-susceptible material for holding the device against operation, and means apart from the device for restoring the latter to operative condition after the operation of same permitted by the softening of the heat-susceptible material.

7. In apparatus of the class specified, a homogeneous resistance-body for inclusion in a circuit, a circuit-controlling means adapted to displace the resistance-body upon an excess of current in same, a heat-susceptible material normally holding the resistance-body against displacement, and means for restoring the latter to operative condition after operation.

8. In apparatus of the class specified, the combination of a piece of graphite for inclusion in a circuit, a circuit-controlling means adapted to open the circuit through the said graphite when an abnormal electric current traverses the latter, and means apart from the device for automatically restoring the latter to operative condition after operation.

9. In apparatus of the class specified, the combination of a piece of graphite adapted to be included in a circuit, a circuit-controlling means adapted to move the said graphite bodily and thereby open the circuit through same, when an excess of current traverses the circuit, and means for automatically restoring the device to operative condition after operation.

10. In a thermal cut-out or protector for electric circuits, the combination of a piece of resistance material adapted to be included in the circuit, a metallic plating covering one end of the resistance material, a circuit-controlling means to which the said plating is secured by a heat-susceptible material, the resistance material being moved bodily by the circuit-controlling means when the heat-susceptible material is softened, and means apart from the device whereby the latter is restored to operative condition after operation.

11. In a thermal cut-out or protector for electric circuits, the combination of a homogeneous resistance-body, means for retaining same in the circuit, a metallic plating covering one end of the resistance-body, a circuit-controlling spring, a fusible material for normally securing the metallic plating to the said spring, and a restoring means for the device, the circuit-controlling spring causing the resistance-body to be displaced and come in contact with the restoring means, upon the softening of the fusible material, and thereby re-

storing the device to operative condition, substantially as described.

12. In a thermal cut-out or protector for electric circuits, the combination of a graphite block provided with a flange on one end and adapted to be normally retained in the circuit, a metallic plating covering the said flange, a circuit-controlling spring, a heat-susceptible material normally securing the metallic plating to the said spring, and a restoring means for the device, the circuit-controlling spring being adapted to displace the graphite block and bring same against the restoring means, upon the heat-susceptible material becoming softened, and thereby restore the device to operative condition where it is secured by the heat-susceptible material becoming cool, substantially as described.

13. In apparatus of the class specified, an excess-current-operable device comprising a cylindrical, homogeneous, resistance-body provided with a flange on one end and a conical projection on the other, a metallic plating for the said flange, a circuit-controlling spring, a heat-susceptible material normally securing the said flange to the said spring, a contact member provided with a conical-shaped hole therein and adapted to engage the said conical projection, and a ground-plate, the conical projection releasing itself from the said hole when an excess current traverses the resistance-body, and thereby allowing the latter to be moved by the circuit-controlling spring and the said flange to strike the ground-plate and thereby restore the excess-operated device to operative condition, substantially as described.

14. In apparatus of the class specified, an excess-current-operable device comprising a cylindrical piece of graphite provided with a flange on one end thereof and a conical projection on the other, a copperplating covering the said flange and conical projection, a circuit-controlling spring provided with a hole therein near its free end, through which hole the cylindrical portion of the graphite is inserted, a fusible material normally securing the said flange to the said spring, a second spring provided with a conical-shaped hole therein adapted to engage the said conical projection when the device is in an operative position, a third spring adapted to be used as a ground-spring, and suitable circuit conductors conductively connected with the said first and second springs, respectively, an abnormally large current traversing the said graphite causing the fusible material to soften and thereby allow the said graphite to move within the first-mentioned hole and the conical projection thereon to release itself from the said conical hole, the circuit-controlling spring bringing the said flange in contact with the ground spring and thereby restoring the said graphite to its normal position within the first-mentioned hole where it is again secured in this operative condition by the cooling of the fusible material, substantially as described.

15. In a device of the character described, the combination of a piece of resistance material, means for normally retaining same in circuit, a restoring means, and means for moving the said resistance material, under abnormal circuit conditions, against the restoring means, after operation, and thereby restoring the device to operative condition.

16. In a device of the character described, the combination of a homogeneous resistance material for inclusion in a circuit, means for normally retaining the resistance material in circuit, means for operating the device under abnormal circuit conditions, and means apart from the device for restoring the latter to operative condition.

17. In a thermal cut-out or protector for electric circuits, the combination of a piece of resistance material, a metallic plating covering portions of the resistance material, a heat-susceptible material normally holding the device in operative condition, means for normally retaining the resistance material in circuit, and means apart from the device and adapted to restore the latter to operative condition after operation, substantially as described.

18. In a thermal cut-out or protector for electric circuits, the combination of a piece of resistance material normally held in the circuit, a restoring means apart from the device, and a circuit-controlling means adapted to abnormally move the resistance material bodily, out of the circuit and against the restoring means, and thereby restore the device to operative condition.

19. In a thermal cut-out or protector for electric circuits, the combination of a piece of graphite, means for normally retaining the same in circuit, a ground-plate, a circuit-controlling spring, and a heat-susceptible material normally securing the piece of graphite to the said spring, the latter being adapted to bodily move the said graphite, upon an abnormally large current therein, and thereby open the circuit and ground a portion thereof, substantially as described.

20. In a device of the character described, the combination of a pair of springs, a piece of homogeneous resistance material normally completing the circuit between the said springs, and a restoring means apart from the device, one of the said springs being adapted to move the resistance material bodily, against the said restoring means, under abnormal circuit conditions, to open the circuit through the resistance material and to cause the device to be restored to operative condition after operation.

21. In a device of the character described, the combination with a pair of springs, a graph-

ite block normally inserted through a hole in one spring and forming a catch with a hole in the other spring, to complete the circuit between the said springs, a fusible material normally securing the graphite block to one spring, one of the said springs being adapted to move the resistance material bodily, under abnormal circuit conditions, and thereby open the circuit, and means apart from the device for restoring the latter to operative condition after operation, substantially as described.

In witness whereof I hereunto subscribe my name this 7th day of March, A. D. 1904.

FRANK B. COOK.

Witnesses:
JNO. F. TOMPKINS,
FREDERICK R. PARKER.