No. 776,218. PATENTED NOV. 29, 1904.

F. B. COOK.

SELF SOLDERING HEAT COIL.

APPLICATION FILED JAN. 11, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

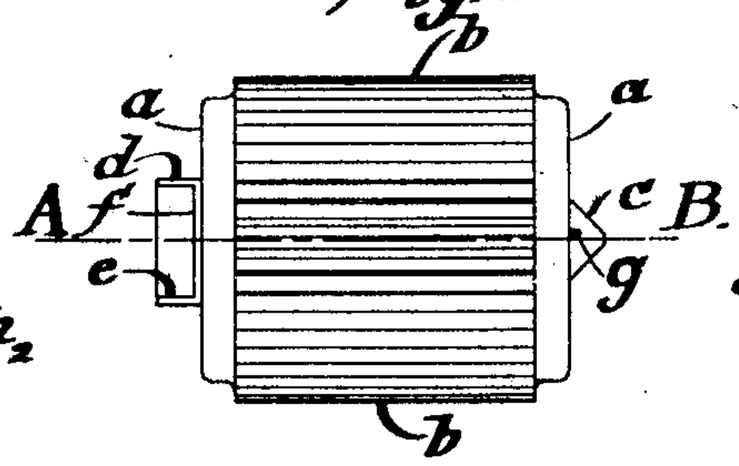


Fig. 2.

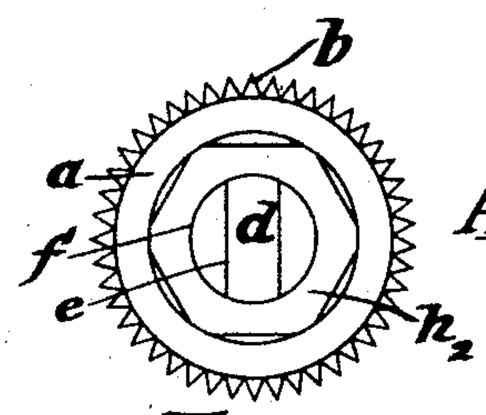


Fig. 3.

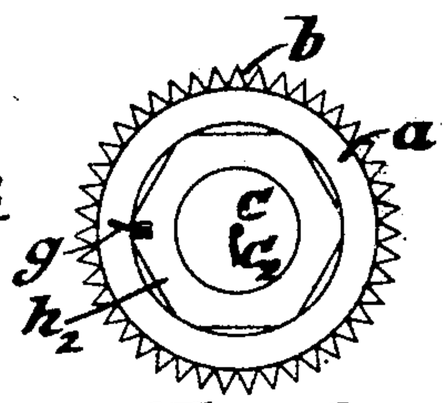


Fig. 4a.

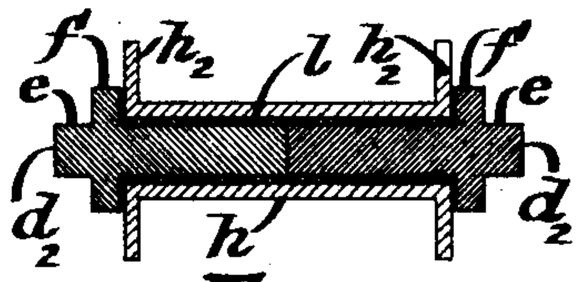


Fig. 4.

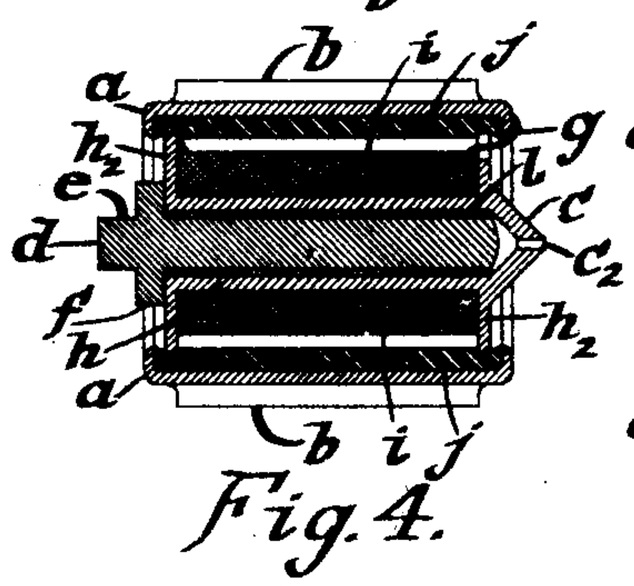


Fig. 4b.

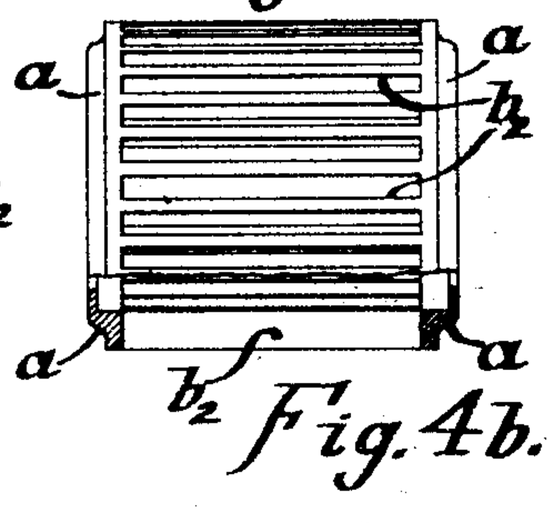


Fig. 5.

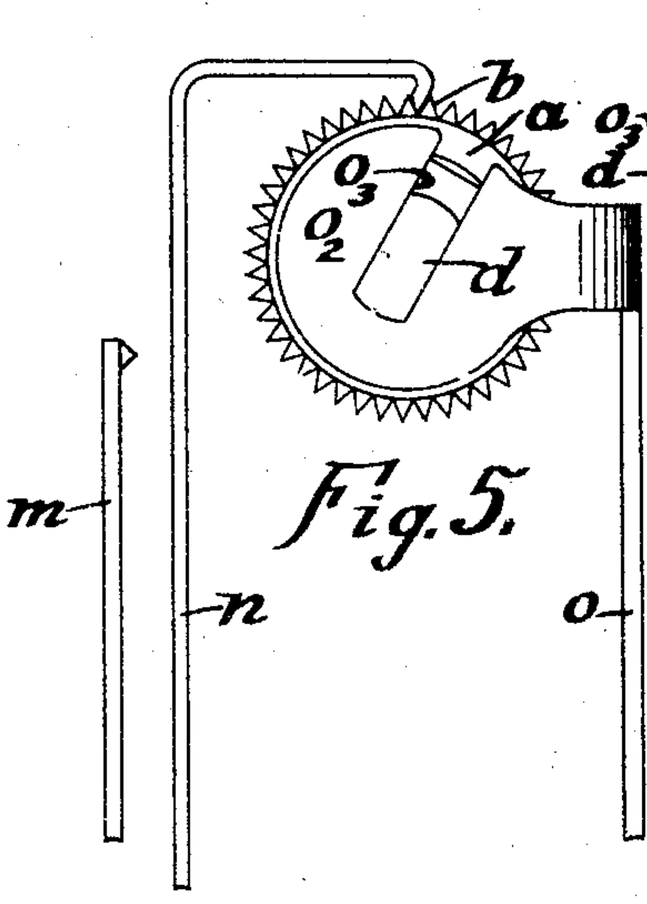


Fig. 7.

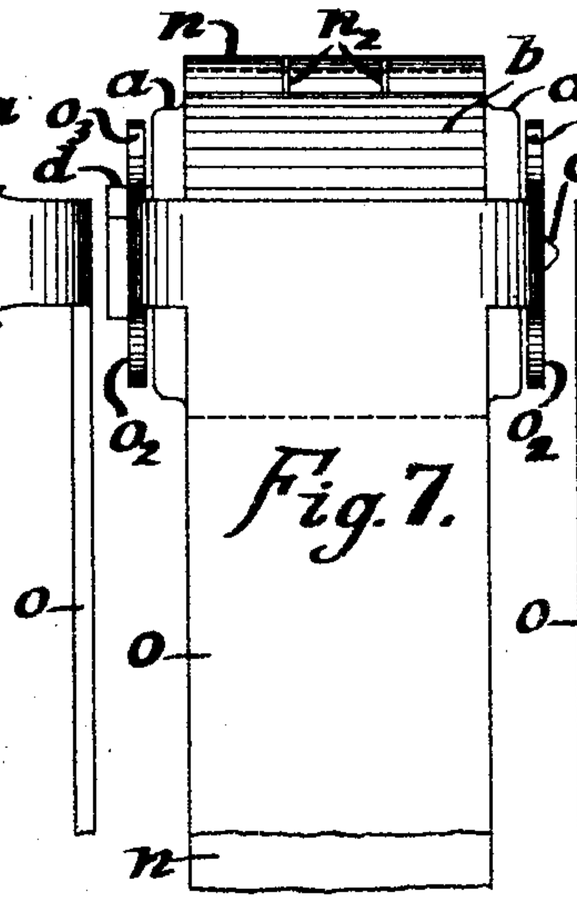
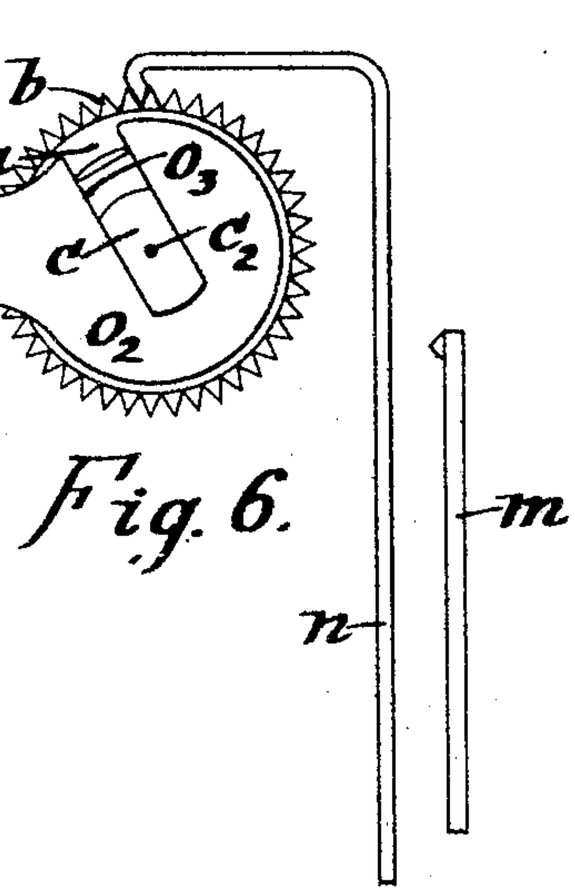


Fig. 6.



Witnesses:

Frederick R. Parker.

Harry B. Elmers

Inventor:

Frank B. Cook.

No. 776,218 PATENTED NOV. 29, 1904.

F. B. COOK.

SELF SOLDERING HEAT COIL.

APPLICATION FILED JAN. 11, 1904.

NO MODEL. 2 SHEETS—SHEET 2.

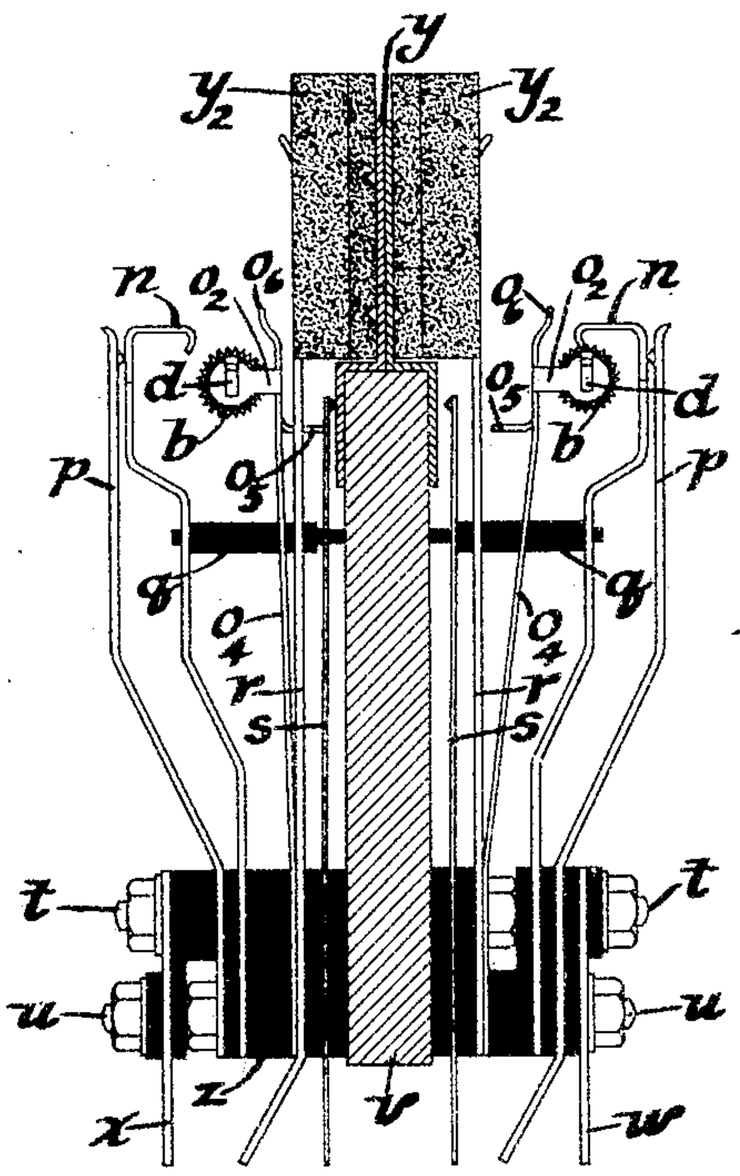


Fig. 8.

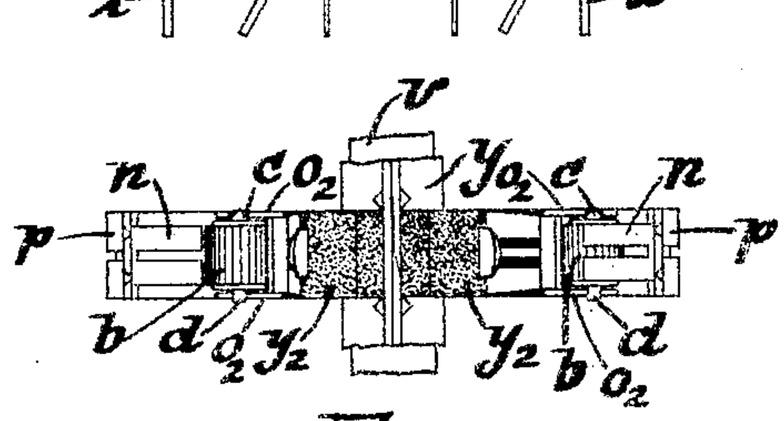


Fig. 9.

Witnesses:
Frederick R. Parker.
Harry B. Elmore

Inventor:
Frank B. Cook.

No. 776,218. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

FRANK B. COOK, OF CHICAGO, ILLINOIS.

SELF-SOLDERING HEAT-COIL.

SPECIFICATION forming part of Letters Patent No. 776,218, dated November 29, 1904.

Application filed January 11, 1904. Serial No. 188,586. (No model.)

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-Coils, 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 thermal protectors for electrical circuits, my object being, first, to provide a self-soldering protector of this type—that is, a thermal protector—which automatically adapts itself for use after it has operated, and, second, to provide an efficient, compact, and durable arrangement of the parts of such a protector, which may be cheaply manufactured and economically used.

In this present invention I employ a hollow spool containing the heat-producing winding and a pin inserted into the hollow spool and secured thereto by a fusible material, much the same as in my application for patent, Serial No. 181,211, filed November 14, 1903, for heat-coil. Instead of a toothed wheel secured to the pin, as in this said application, Serial No. 181,211, I employ a toothed drum inclosing the said spool and winding, but insulated from the said spool. This drum is adapted to engage a spring in the teeth thereof and to turn with the spool and winding on the said pin when the fusible material is softened, the said pin being fixed. This turning of the drum releases the spring therefrom, and thereby breaks the circuit through the heat-coil. When the fusible material again cools, the pin is resoldered within the hollow spool and the heat-coil is then in condition for the said spring to be again engaged with the teeth of the drum. It will be seen, as hereinafter described, that the only operation necessary to restore the heat-coil in the electrical circuit, of which it is a protector, is pressing the spring back to engagement with the teeth of the drum, the heat-coil device not requiring any adjustment. The apparatus may be operated over again and again, each time restoring itself to its normal serviceable condition.

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 heat-coil. Fig. 2 is a left end elevation of Fig. 1. Fig. 3 is a right end elevation of Fig. 1. Fig. 4 is a cross sectional view of the heat-coil, taken on line A B of Fig. 1. Fig. 4^a is a cross-sectional view of a modified form of pin, taken the same as Fig. 4. Fig. 4^b shows a modified form of drum, the drum being provided with a series of slots instead of a series of teeth. Fig. 5 shows the end view, Fig. 2, in connection with the connecting-springs for the heat-coil. Fig. 6 shows the end view, Fig. 3, in connection with the said springs. Fig. 7 shows a side elevation of the heat-coil and said springs. Fig. 8 is an elevation showing the heat-coil in connection with a protector-strip and protective apparatus, there being a pair of protectors mounted on opposite sides of the strip, one in a "set" position and the other in an "operated" position; and Fig. 9 is an end view of the protective apparatus shown in Fig. 8.

Like characters refer to like parts in the several figures.

The core *h* is provided with annular projections h^2 h^2, one at each end thereof, thus forming a spool for the heat-producing winding *i*, which is wound thereon. The core *h* is centrally bored and a pin *d* inserted therein and secured thereto by a fusible material *l*. One end of the pin *d* is enlarged, as at *f*, and this enlarged portion is cut away, as at *e*, thus forming a shoulder *f*, which rests against the core *h*, and a flattened projection *e*, adapted to be engaged in a slotted support, and thus prevent the turning of the pin *d*. One end of core *h* is provided with a conical projection *c* thereon, also adapted to engage a support for the heat-coil. The projection *c* is provided with a small hole c^2 therein as an air-passage from the hollow portion of the core to the outside. An insulating-sleeve *j* is placed over the annular projections h^2 h^2, thereby inclosing the said spool and the heat-producing winding *i*. An outer sleeve or drum *a*, of conducting material, is placed over the insulating-sleeve *j* and is turned over at its ends so as to secure itself, the sleeve *j*, and the spool

h^2 hh^2 together. The drum a is provided with a series of teeth b on its outer surface, the said teeth extending nearly from one end of the drum to the other and running parallel with the longitudinal axis of the heat-coil. One end of the winding i is secured to the drum a, as at g, the other end of i being secured to the said spool. The annular projections h^2 h^2 are preferably hexagonal in shape, as shown in Figs. 2 and 3, so that the corners thereon will slightly embed themselves in the insulating-sleeve j, and thus secure the sleeve j to the said spool.

In Fig. 4[a] I employ two pins d^2 d^2, inserted into the hollow core h, one at each end of core h, and secure both pins d^2 d^2 within the said core by the fusible material l. The pins d^2 d^2 meet at the center of core h and are of a sufficient length to allow the core h to have a slight amount of end play thereon when the fusible material is softened. This arrangement allows the core h to turn freely upon the pins d^2 d^2, there being no friction between the shoulders f f of the said pins and the annular projections h^2 h^2.

In Fig. 4[b] I show a modified form of drum a. This drum is provided with a series of slots or holes b^2 b^2 therein, adapted to engage the spring n and serve the same purpose as the teeth b b.

Figs. 5, 6, and 7 show the connecting-springs for the heat-coil. The spring o is provided with ears o^2 o^2, bent as shown, each ear being slotted at o^3. The heat-coil is placed between the ears o^2 o^2, the flattened end e of the pin d and the conical projection c of the said spool engaging the respective slots o^3 o^3 of the ears o^2 o^2. The flattened end e of pin d normally prevents the heat-coil from turning relatively to the spring o. The ears o^2 o^2 tend to spring together, thus tightly holding the heat-coil to same. With the modified form of pin shown in Fig. 4[a] the flattened ends e e of pins d^2 d^2 would engage the respective slots o^3 o^3 of the ears o^2 o^2, and thereby prevent the heat-coil from turning relatively to the spring o. Spring n is adapted to engage a tooth b of the drum a, it being split at n^2, so as to give several separate contacts with tooth b. The tendency of spring n is to turn the heat-coil upon its supports and also to hold it down in the slots o^3 o^3, the said slots being in position for this purpose. Spring n is adapted to engage a ground-plate m when released from the tooth b.

The circuit through the heat-coil is through spring o, ears o^2 o^2, in multiple, pin d and projection c, in multiple, spool h^2 hh^2, winding i, drum a, tooth b, and spring n. Springs o and n are adapted to be connected to respective circuit-conductors.

When an abnormally large current flows through the winding of the heat-coil, it produces heat therein. This heat is conducted by the heat-conducting core h to the fusible material l, which secures the pin d within the hollow core h. When this heat is sufficient, the fusible material l is softened, thus allowing the core h to turn on the pin d. The spring n being under tension now turns the body of the heat-coil upon the pin d, which is held stationary, thus disengaging itself from the teeth of the drum a. When spring n is thus disengaged from the teeth b, the circuit through the winding of the heat-coil is broken. When the fusible material l cools and hardens, it again solders the pin d within the hollow core h, after which the spring n may be engaged with the teeth b, as before. The heat-coil may be operated over again and again in a manner similar to that just described, each time resoldering itself for use.

When two pins d^2 d^2 are used, as in Fig. 4[a], the spool h^2 hh^2 turns upon both said pins, when the fusible material l is softened. When the fusible material l again cools, both pins d^2 d^2 are resoldered to the hollow core h. In the explanation of operating the heat-coil, as just described, I have considered the spring o to be rigid and the spring n to be flexible; but I wish it to be understood that spring n may be rigid and spring o flexible or that both springs may be flexible.

The combination of springs shown in Figs. 8 and 9 are essentially the same as shown and claimed in my application for patent, Serial No. 183,733, filed December 4, 1903, for protective apparatus. Spring o^4 is provided with ears o^2 o^2, between which the heat-coil is held. It is also provided with a contact-piece o^5, adapted to pass through a hole in spring r and make contact with spring s, spring s making contact with ground-plate v when the heat-coil operates and with a projection o^6, by which the heat-coil and spring o^4 are reset after operation. Spring n is held rigid by the insulating-post q and is adapted to engage a tooth of the heat-coil. Spring p is a test-spring and is held in contact with spring n. Lightning-arrester y^2 is held between spring r and ground-strip y. Springs o^4 and r are held in contact with each other. All of the springs are mounted to the ground-plate v by bolts t and u, with suitable insulation between the springs, the bolts t and u, and the ground-plate v. The set position of the heat-coil is shown upon the right of Fig. 8, while the operated position is shown upon the left of the same figure.

I do not wish to limit this invention to the minor details of construction as herein shown.

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

1. In a heat-coil, the combination of a fixed member, a heat-producing member, a drum inclosing the heat-producing member, and means for turning the said drum upon the fixed member, under abnormal conditions.

2. In a heat-coil, the combination of a hollow spool, a winding wound upon the spool,

a pin inserted into the hollow spool and secured thereto by a fusible material, a toothed drum inclosing the said spool and insulated therefrom, means for holding the said pin fixed, and means for turning the drum and spool upon the said pin when the fusible material is softened.

3. In a heat-coil, the combination of a hollow spool, a winding for the spool, a pin inserted into the hollow spool, and secured there by a fusible material, a flattened end on the pin, an insulating-sleeve inclosing the spool and winding, a toothed drum inclosing the said sleeve and securing itself, the said sleeve and the spool together, a support provided with a slot therein adapted to engage the flattened end of the pin and thereby hold the said pin stationary, and a spring adapted to engage a tooth of the toothed drum and thereby turn the said drum and spool upon the said pin when the fusible material is softened, substantially as described.

4. In a heat-coil, the combination of fixed members, a heat-producing means, a toothed drum inclosing the heat-producing means, and means for turning the said drum upon the fixed members and thereby controlling a circuit.

5. In a heat-coil, the combination of a hollow spool, a winding wound upon the spool, pins inserted into the hollow spool and secured thereto by a fusible material, a toothed drum inclosing the said spool and insulated therefrom, means for holding the said pins fixed, and means for turning the drum and spool upon the said pins when the fusible material is softened.

6. In a heat-coil, the combination of a hollow spool, a winding for the said spool, pins inserted into the hollow spool, one from either end, and secured thereto by a fusible material, a shoulder on each pin, the said pins coming together within the hollow spool and thereby allowing a small amount of play between the said shoulders and the said spool, a flattened end on each pin, a toothed drum inclosing the said spool and insulated therefrom, a spring-support for the heat-coil, provided with slots therein, the said slots being adapted to engage the flattened ends of the respective pins and thereby hold the latter stationary, means to coöperate with the toothed drum and thereby turn same relatively to the said pins when the fusible material is softened, substantially as described.

7. The combination with a heat-coil comprising an axis, a heat-conducting member secured upon the axis by a fusible material, a heat-producing member inclosing the heat-conducting member, an insulating-sleeve secured to the heat-conducting member, a drum inclosing the insulating-sleeve and secured thereto, and a series of parallel teeth on the said drum, extending parallel with the said axis, of a spring-support for holding the said axis fixed, and a spring member adapted to engage a tooth of the said drum and by such engagement turn the said drum and heat-conducting member upon the said axis, when the fusible material is softened, the heat-conducting member being again secured to the said axis when the fusible material cools and hardens, substantially as described.

8. The combination with a heat-coil comprising an axis and a toothed drum inclosing the inner members of the heat-coil, of a spring-support provided with slotted ears for holding the said axis fixed, and a spring member split at its free end and adapted to engage a tooth of the said drum, thus making several independent contacts with the said tooth, the said spring member causing the drum to turn, relatively to the said axis, when an abnormally large current traverses the heat-coil, substantially as described.

9. In a heat-coil, the combination of an axis, secured within a hollow heat-conducting member by a fusible material, a toothed drum inclosing the heat-coil and secured to the heat-conducting member but insulated therefrom, means for holding the axis fixed, and means for turning the toothed drum and heat-conducting member upon the said axis when the fusible material is softened, the heat-conducting member being again secured to the said axis by the cooling action of the fusible material, substantially as described.

10. In apparatus of the class specified, a heat-producing means, means for normally holding same against rotation, and means for abnormally turning the heat-producing means and thereby controlling a circuit.

11. In a heat-coil, the combination of a fixed axis, a hollow core within which the said axis is secured by a fusible material, a heat-producing member inclosing the said core, a drum inclosing the said parts of the heat-coil and insulated from the said core, and means for turning the drum and core upon the said axis when the fusible material is softened.

12. In a cut-out or protector for electrical circuits, a heat-concentrating means, means for holding same against rotation under normal circuit conditions, and means for turning the heat-concentrating means under abnormal circuit conditions and thereby controlling a switch.

13. In a cut-out or protector for electrical circuits, a heat-concentrating means, means for holding same against rotation under normal circuit conditions, a rotary detent secured to the heat-concentrating means, and circuit-controlling means adapted to engage the said detent and tending to rotate same, the circuit-controlling means turning the said detent and heat-concentrating means under abnormal circuit conditions, the said detent being turned to a new engaging position, substantially as described.

14. In a cut-out or protector for electrical

circuits, a rotary detent provided with a plurality of engaging devices, circuit-controlling means adapted to engage one of the said devices and tending to turn the said detent, a heat-concentrating means adapted to turn with the said detent, and means to which the heat-concentrating means and detent are held against rotation by a heat-susceptible material, the circuit-controlling means turning the said engaging devices into successive engaging positions when the heat-susceptible material is softened.

15. In a cut-out or protector for electrical circuits, a resistance body for inclusion in the circuit, a stationary portion adapted to hold the resistance body against rotation under normal circuit conditions, and means for turning the resistance body upon the stationary portion under abnormal circuit conditions and thereby controlling the circuit.

16. In apparatus of the class specified, the combination with a fixed axis, of a rotary portion comprising a conducting member, a heat-concentrating member and a plurality of engaging devices, and secured to the said axis by a heat-susceptible material, and means adapted to engage a said device and turn the said rotary portion upon the said axis when the heat-susceptible material is softened, thereby bringing another said device into engaging position for the engaging means.

17. In a device of the character described, a fixed axis, a rotary detent, a heat-producing means, a heat-susceptible material normally securing the rotary detent and heat-producing means against rotation, and means for turning the rotary detent and heat-producing means upon the axis when the heat-susceptible material gives way.

18. In a device of the character described, an axis, a heat-concentrating means normally secured to the axis by a heat-susceptible material, a rotary detent electrically connected with the heat-concentrating means, and means for turning the rotary detent and heat-concentrating means upon the said axis to control a circuit.

19. In a device of the character described, an axis, a resistance body for inclusion in the circuit, a plurality of engaging devices electrically connected with the resistance body, a heat-susceptible material normally holding the resistance body against rotation, and means for engaging an engaging device and thereby turning the resistance body and bringing the said engaging devices successively into engaging position for their engaging means, the operation of the device breaking the circuit through the resistance body, substantially as described.

20. In a device of the character described, a fixed axis, a heat-conducting member, a heat-susceptible material normally securing the heat-conducting member to the said axis, and a heat-producing member secured to the said heat-conducting member and adapted to turn with the latter upon the said axis when the fusible material is softened, the said conducting member being again secured to the said axis by the heat-susceptible material becoming cool, substantially as described.

In witness whereof I hereunto subscribe my name this 8th day of January, A. D. 1904.

FRANK B. COOK.

Witnesses:

JNO. F. TOMPKINS,

FREDERICK R. PARKER.