No. 704,439. Patented July 8, 1902.

F. B. COOK.

THERMAL PROTECTOR FOR ELECTRIC CIRCUITS.

(Application filed July 29, 1896.)

(No Model.)

Fig. 1.

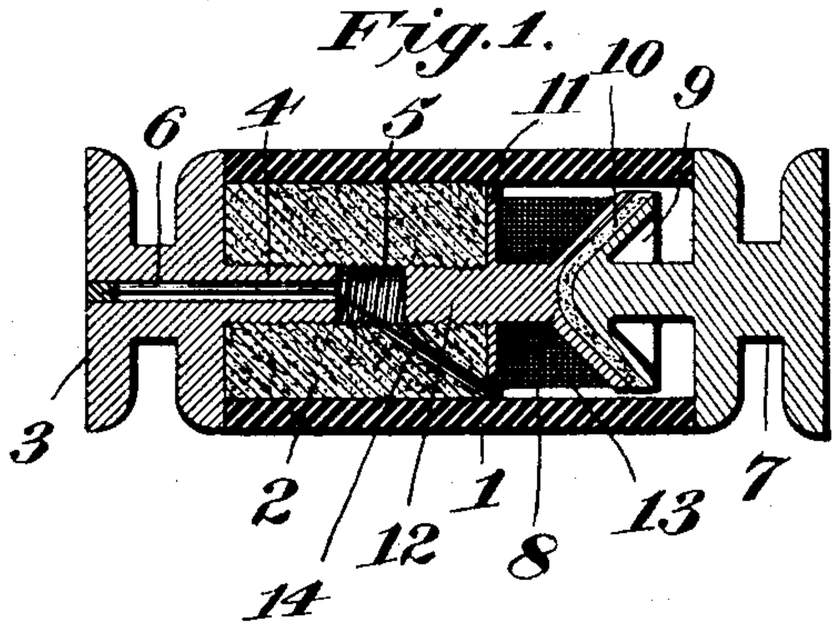
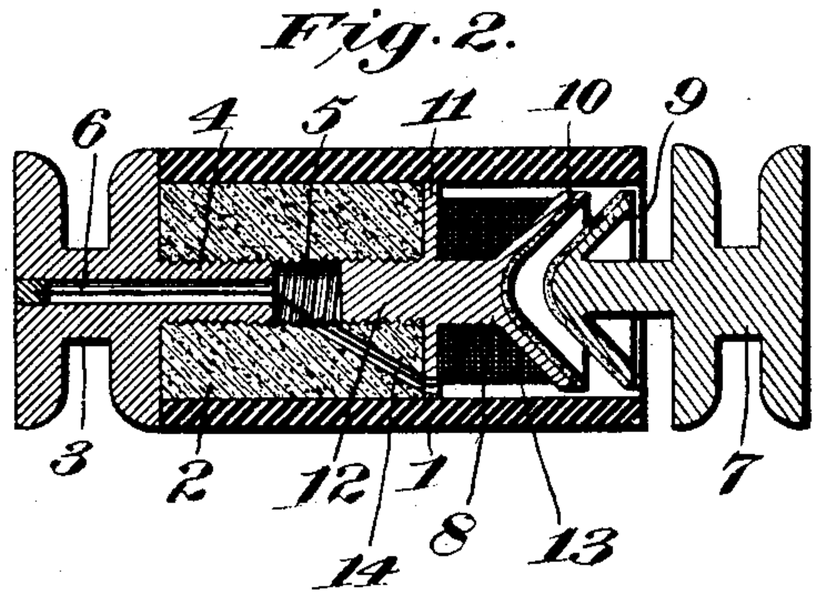


Fig. 2.



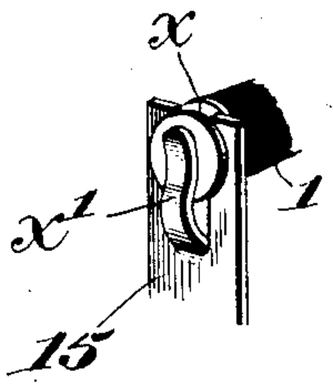


Fig. 6.

Fig. 3.

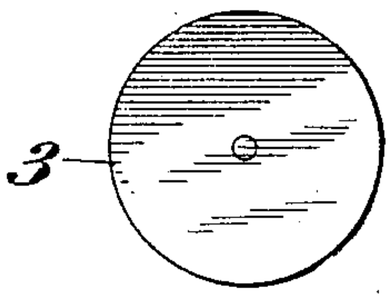


Fig. 4.

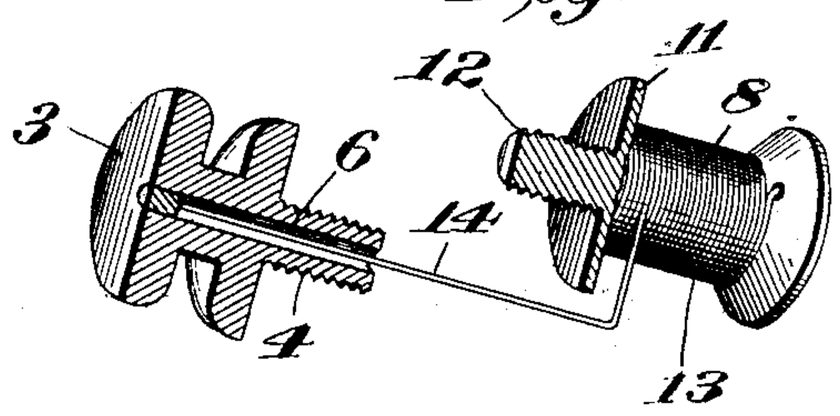
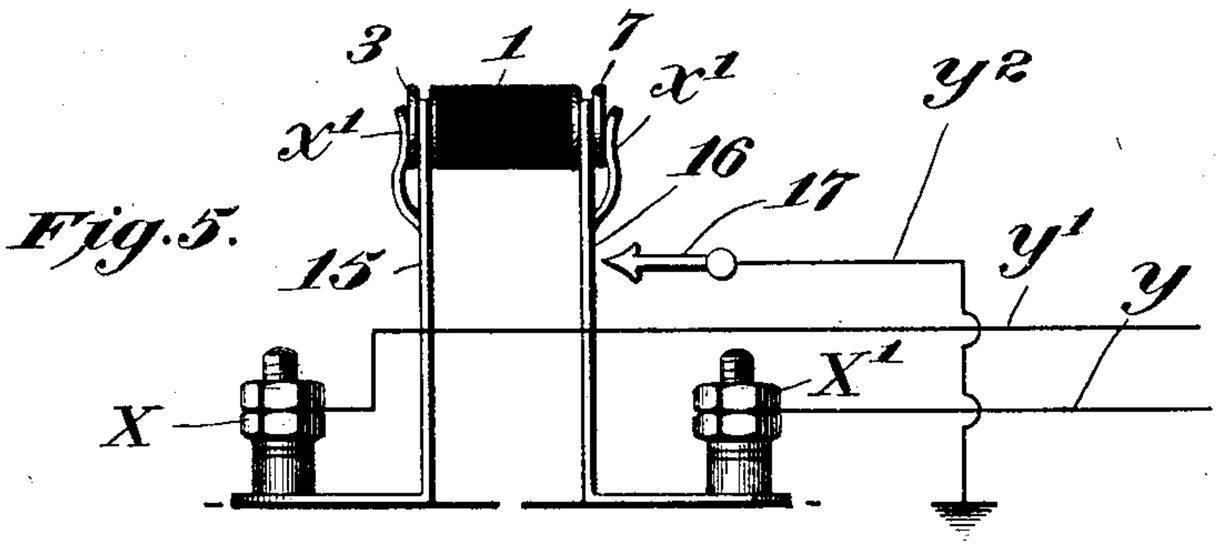


Fig. 5.



Witnesses

Elmer Seavey

Arthur F. Durand

Inventor

Frank B. Cook

By Chas. C. Bulkley

Attorney

UNITED STATES PATENT OFFICE.

FRANK B. COOK, OF CHICAGO, ILLINOIS.

THERMAL PROTECTOR FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 704,439, dated July 8, 1902.

Application filed July 29, 1896. Serial No. 600,970. (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 a certain new and useful Thermal Protector for Electric Circuits, of which the following is a specification.

My invention relates to thermal protectors for protecting various electrical devices—such, for example, as the instruments involved in a telephone or a telegraph system—against the intrusion of abnormally strong currents.

It relates more particularly to a protector of this character involving a heat-concentrating member and means operated thereby for breaking a circuit and involving also a spring-switch for automatically establishing connection between the line and ground. With this arrangement the heat-concentrating member is capable of automatically effecting a break in the circuit upon the encroachment of a current of dangerous character, and at the same time the spring-switch is operated to establish the connection to earth. Thus the telephone or other instruments are cut out from the circuit before the trespassing current can do any harm, and, in addition, the connection is closed which conducts the abnormally large current to earth.

Generally stated, the object of my invention is to provide a simple, inexpensive, and highly-efficient thermal protector of the foregoing character.

A special object is to provide a construction and arrangement whereby a coil of fine wire may be employed as the heat-concentrating member without the necessity of breaking this wire when the device is operated.

Another object is to provide a simple and effective construction whereby the heat-concentrating member and other parts can be embodied in a compact member which can be readily inserted in a suitable support.

Another object is to provide certain details and features of improvement tending to increase the general efficiency and to render a device of this character more serviceable and reliable in use.

To the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is a longitudinal section of the improved heat-coil involved in the construction of my thermal protector. Fig. 2 is a similar view, but showing the two sections of the separable conductor separated. Fig. 3 is an end view of the heat-coil shown in Figs. 1 and 2. Fig. 4 is a perspective showing certain parts of the device in section and showing the manner in which the wire constituting the heat-coil is connected between said parts. Fig. 5 is a side elevation of my improved thermal protector, the view being more or less diagrammatic in character and showing the aforesaid heat-coil mounted in place between the two posts or springs constituting the support. Fig. 6 is a perspective of the upper end of one of the posts and part of the heat-coil.

As thus illustrated, the cylindric member shown in Figs. 1 and 2 and herein termed the "heat-coil" preferably comprises a cylindric shell 1, of insulating material, adapted to inclose the various parts of which the member is composed. Within the shell of insulating material is a sleeve 2, which is also preferably composed of some suitable insulating material. A grooved head or collar-like portion 3 is preferably mounted at one end of the said shell and provided with a threaded shank 4, adapted to be screwed into the bore 5 of the insulating-sleeve 2. It will be observed that this metal head or collar portion 3 is preferably provided with a longitudinally-extending bore 6. The separable conductor involved in the construction of this cylindric member preferably comprises the two metal sections 7 and 8. The former is, it will be observed, in the nature of a head or collar-like portion and is similar in formation to the portion 3. It will be seen, however, that the inner end of this grooved head 7 is provided with a conical head 9, adapted to fit a concave portion or socketed head on the end of the section 8. Section 8 is also preferably provided with a flange 11 and with a threaded stem or shank 12, which latter is adapted to be screwed into the bore extending through the sleeve 2. A coil of fine insulated wire 13 is preferably mounted on the section 8 between the flange 11 and the socketed head. The solder 10 or other like fusible material is adapted to hold the two sections of the metal conductor nor-

mally together. The character of this solder joint is, however, such that it will readily soften or yield to the heat generated by the passage of an unduly-strong current through the heat-coil. One terminal of the coil of fine insulated wire is preferably soldered to the head 3, as shown in Figs. 1, 2, and 4, while the other terminal is preferably soldered to the convex back of the socketed head on the conductor-section 8, as shown in Fig. 4. With this arrangement it will be seen that the two heads or collars at the end of the cylindric member and also the solder and heat-coil and the conductor-section 8 are all connected up in series. In other words, a current passing one way would first flow through the head or collar portion 7, thence through the solder, through the socketed head on the conductor-section 8, thence through the coil of wire or heat-concentrating member 13, through the coil-terminal 14 to its soldered connection with the head or collar portion 3, and through the latter to a circuit-conductor. The heat-coil thus embodied in a compact and cylindric form or body is preferably mounted upon a couple of upright posts or springs 15 and 16. These springs or posts can be mounted upon any suitable support adapted to insulate them from each other. Each post or spring is preferably provided with a binding-post X and X', as shown in Fig. 5. The upper ends of these springs or posts can be formed with notches x, as shown in Fig. 6, adapted to receive the grooved heads or collar portions of the heat-coil structure. As a means for securely holding the heat-coil in place in these notches each spring or post can also be provided with a tongue or bent portion x', adapted to press against the outer ends of the heads 3 and 7 when the latter are in place in said notches. In this way the solder and coil in the separable conductor involved in the construction of the heat-coil can be included in a circuit for the purpose of protecting various kinds of instruments—such, for example, as the instruments involved in an ordinary subscriber's telephone-set. In such case the line-wire Y preferably connects with the binding-post X', while the conductor Y' would connect the instruments with the binding-post X. Thus all currents traversing the circuits would be compelled to pass through the solder and coil of wire. Should the current become unduly strong or should a trespassing current show its presence in the circuit, the heat generated by the heat-coil will soften or melt the solder and allow the tension of the two springs 15 and 16 to pull the conductor-sections 7 and 8 apart. Thus the device serves to automatically break the circuit upon the encroachment of an unduly strong or dangerous current. As an additional means for protecting the instruments the spring 16, which, as stated, is preferably connected with the line-conductor, can be arranged to make contact with a grounded stop 17, which, it will be understood, can be mounted and secured in any suitable way. With this arrangement the heat-coil device in responding to an unduly-strong current not only creates a gap in the circuit, so as to cut out the instruments to be protected, but also establishes connection between the line and the ground as a result of the automatic release and operation of the spring-switch. It will be seen that in opening the circuit upon the encroachment of an abnormally strong current the springs do not break or disrupt any wire connections, inasmuch as the solder and heat-coil are, as stated, connected in series. Furthermore, the small cylindric member constituting the heat-coil proper is of such character that it can be readily inserted between the two springs. In addition the heat-coil after being operated by a strong current can be readily removed and replaced by a new one. It will be readily understood that the springs 15 and 16, or at least the latter, are of such character that they are held under tension when connected by the cylindric member constituting the heat-coil. In this way both the solder and the post 15 are normally subject to the spring tension of the spring or post 16. The contact piece or stop 17 acts as a stop to limit the movement of the spring 16 when released by the melting of the solder. Thus it will be seen that I provide a simple and comparatively inexpensive thermal protector for guarding electrical circuits against excessive current. With the heat-coil and solder thus intimately associated together within the shell the device is rendered extremely sensitive and capable of opening the circuit upon the intrusion of a current only slightly in excess of the normal, sometimes called "sneak" currents. In this way the device affords protection against both excessive currents and currents only slightly in excess of normal. The conductor Y^2 preferably leads to ground only.

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

1. A heat-coil protector consisting of an inclosing shell, interior insulating material, a heat-coil, a concave socket, a convex head fitted therein, fusible material between the face of the socket and the face of the head, and means for holding a spring contact-strip or contact-strips.

2. In a heat-coil-protective apparatus an inclosing shell of insulating material, a body of interior insulating material, a collar of conducting material secured to one end of the body of interior insulating material, a spring-contact connected to and held by said collar, another collar held at the other end to the inclosing shell, a spring-contact connected to and held by said latter collar, a concave socket and concave head fitted therein and fusible material between the face of the socket and the face of the head.

3. The combination with a heating-coil, of a small quantity of conducting material

adapted to be fused by the heat of the coil, a switch-spring held under tension by said fusible conducting material, and an electric circuit including said heating-coil, fusible material and spring-switch in series, whereby the fusing of said fusible material permits the movement of said spring-switch to open the circuit; substantially as described.

4. The combination with a small resistance-coil, of a spool of good heat-conducting material upon which the coil is wound, a stem secured to said spool by easily-fusible solder, a spring adapted to move said stem out of contact with the spool when the solder is fused, and an electric circuit including said coil, spool, solder and stem in series; whereby the detachment of said stem from the spool effects the opening of the circuit.

5. The combination with a heat-coil, of a small quantity of conducting material adapted to be fused by the heat of the coil, a spring-switch held under tension by said fusible conducting material, and an electric circuit including said heat-coil, fusible material and spring-switch in series, together with an earth connection and a normally open circuit thereto whereby the spring-switch when released closes said normally open circuit.

6. A normally closed circuit comprising an instrument to be protected, a line, a heat-coil and a spring-switch, together with a normally open circuit to earth only, and means operated by the heat-coil whereby the spring-switch closes the normally open circuit and opens the normally closed circuit.

7. A normally closed circuit comprising an instrument to be protected, a line, a heat-coil, a spring-switch in series with the heat-coil, a normally open branch to earth, and means operated by the heat-coil to cause the spring-switch to open the normally closed circuit and close the normally open earth branch.

8. A spring or springs, a separable conductor, fusible material interposed between and holding the parts or sections of said conductor together, and a heat-concentrating member which, fusing the material, permits the springs to separate the conductor and open the circuit, said heat-concentrating member and springs being serially included in the circuit.

9. A normally closed circuit comprising an instrument to be protected, a line, a heat-concentrating member, and a spring-switch, together with a normally open circuit to earth only, and means operated by the heat-coil whereby the spring-switch closes the normally open circuit and opens the normally closed circuit.

10. The combination with a heat-concentrating device, of a small quantity of conducting material adapted to be fused by the said heat-concentrating device, a spring-switch held under tension by said fusible conducting material, and an electric circuit including said heat-concentrating device, fusible material, and spring-switch in series, with an earth connection and the normally open circuit thereto, whereby the spring-switch when released closes said normally open circuit.

11. In a heat-coil apparatus, a pair of springs, a removable member held by the said springs, the heads of said member engaged by said springs, an inclosing shell, an insulating-block within said inclosing shell, a heat-coil, a stem held within the insulating-block, a connector-face held on the stem, said insulating-block, stem and connector-face being held by one spring-head and another stem projected from the other head carrying a connector-face, said faces being normally held together by fusible material.

12. A device for automatically opening a circuit and establishing connection with the ground, comprising a suitable spring, a post insulated from and subject to the tension of said spring, a heat-concentrating member and fusible material arranged between said spring and said post, the fusible material being adapted and arranged to be fused by the said heat-concentrating member and to hold the said spring under tension, a circuit including said spring, post and heat-concentrating member in series, an insulated stop limiting the movement of said spring when released by the fusing of said material, and a grounded conductor connected with said stop, whereby the said spring when released opens said circuit and establishes connection with the ground.

13. A conductor made in sections and formed with a headed end portion, a flat spring having a notched end adapted to removably engage said headed end portion, a member removably engaging the other end of said conductor and subject to the tension of said spring, said member and spring being insulated from each other, a connection holding the sections of the conductor together, and a heat-concentrating member arranged to cause said connection to weaken and break, so as to allow said spring to pull the conductor-sections apart.

14. A conductor made in sections and having its opposite ends formed with reduced headed portions, a connection holding the sections together, flat supports insulated from each other and having their ends notched to receive said reduced headed portions, one of said supports being flexed or sprung so as to pull on the said connection, and a heat-concentrating member arranged to cause said connection to weaken and break, so as to allow the flexed support to pull the conductor-sections apart.

15. The combination of two conductor parts extending one within the other, a connection holding the two parts together, a heat-coil on one of said parts, said heat-coil being adapted to cause said connection to weaken and break, a support removably engaging the outer end of one of said parts, and a spring removably engaging the outer end of the

other part, the said support, heat-coil and spring being serially included in a circuit, and the said support and connection being normally subject to the tension of said spring, whereby the two parts extending one within the other are moved apart or separated upon the weakening or breaking of said connection.

16. The combination of a separable conductor, a connection holding the sections of the conductor together, a heat-concentrating member arranged to cause the said connection to weaken and break, a tubular shell inclosing the heat-concentrating member, a support removably engaging one end of the separable conductor, and a spring removably engaging the other end of the same and exerting spring tension upon said connection, the said spring and support being insulated from each other, and the said support being also subject to the tension of said spring.

17. A thermal cut-off comprising a stem and core, connected by solder, in a coil of wire, between two posts, one of which is a spring pulling upon the solder, away from the other, all in the circuit.

18. The combination of a suitable support, a flat spring insulated from said support, a conductor made in sections and adapted to be inserted between said support and spring, solder uniting the sections of said conductor, a heat-coil associated with said solder, an electric circuit including said support, solder, heat-coil and spring in series, and a stop adapted to limit the movement of said spring and to be connected with a grounded conductor, the said solder and support being normally subject to the tension of said spring, and the said spring when released by the fusing of the solder operating to establish connection between the circuit and the grounded conductor.

19. The combination of two metal parts extending one within the other, solder uniting said parts, a heat-coil wrapped around one part adjacent to the solder, a support and a spring insulated from each other, the said support and solder being normally subject to the tension of said spring, an electric circuit including said spring, heat-coil, solder and support in series, the said spring causing the two metal parts to move relatively when the solder is melted by the heat-coil, a grounded conductor, and means whereby the said spring when released operates to establish connection between the said circuit and the said grounded conductor.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK B. COOK.

Witnesses:
CHAS. C. BULKLEY,
L. M. BULKLEY.