No. 812,184. PATENTED FEB. 13, 1906.

F. B. COOK.

THERMAL PROTECTOR AND ALARM.

APPLICATION FILED DEC. 18, 1902

2 SHEETS—SHEET 1.

Fig. 1.

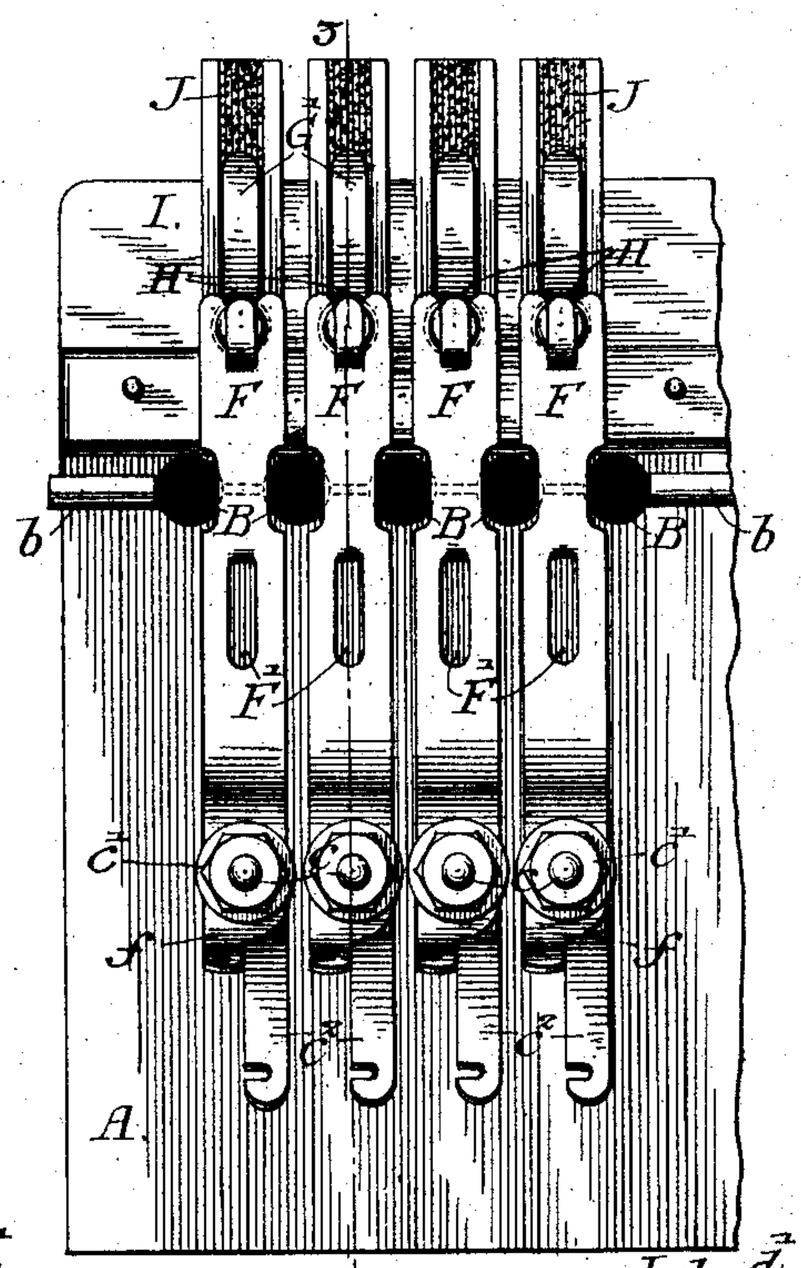


Fig. 2.

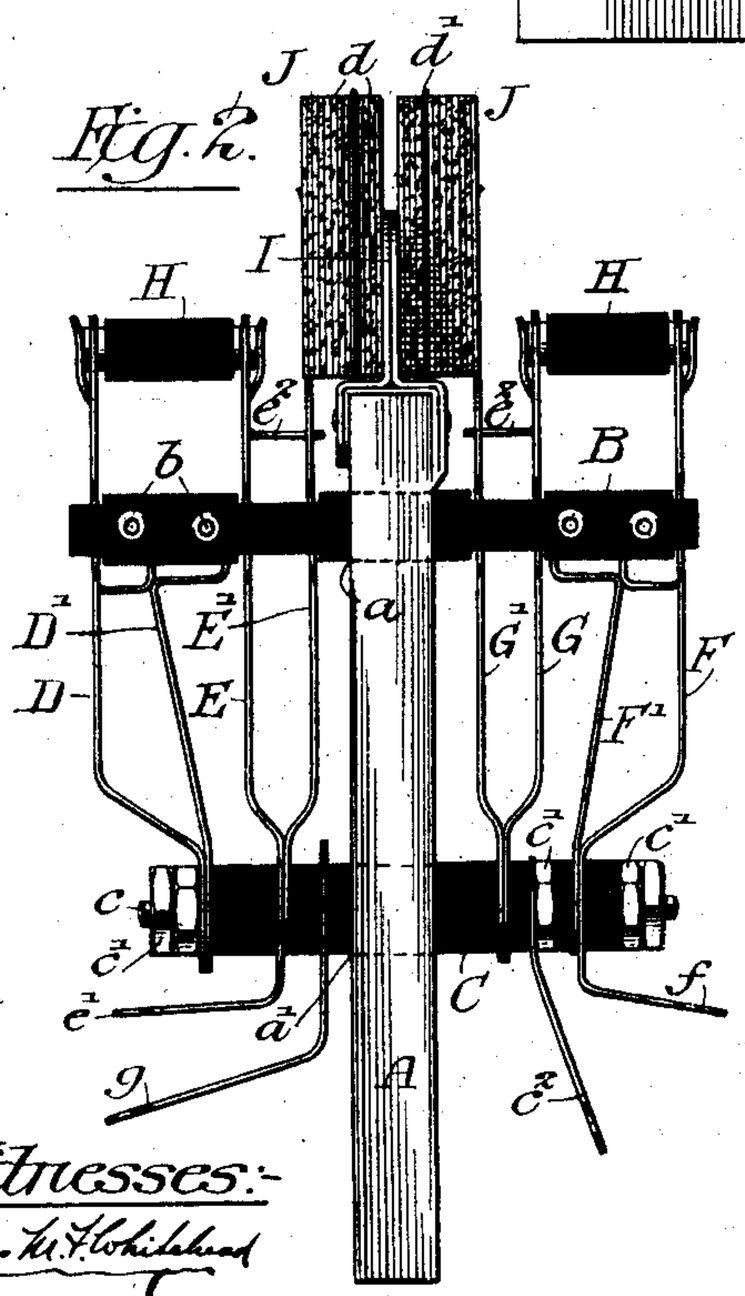
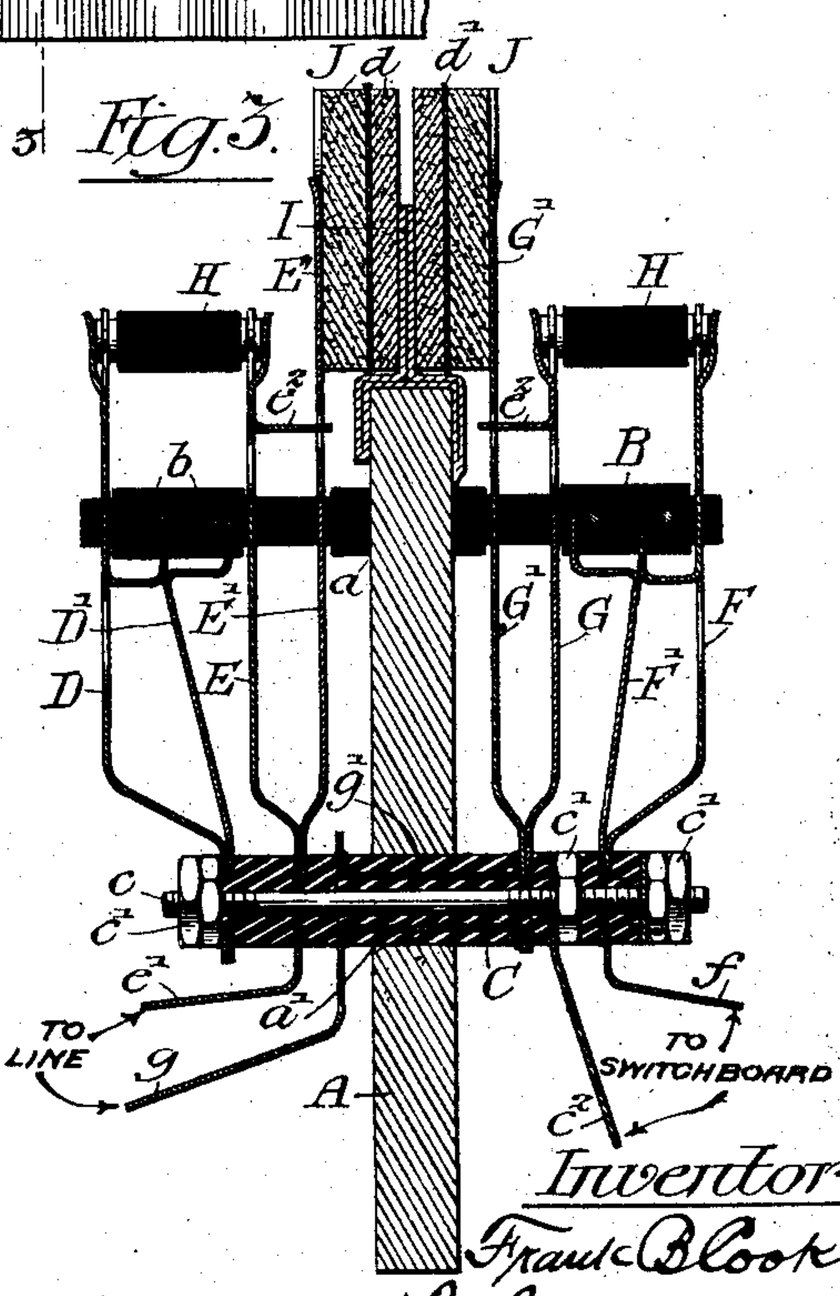


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

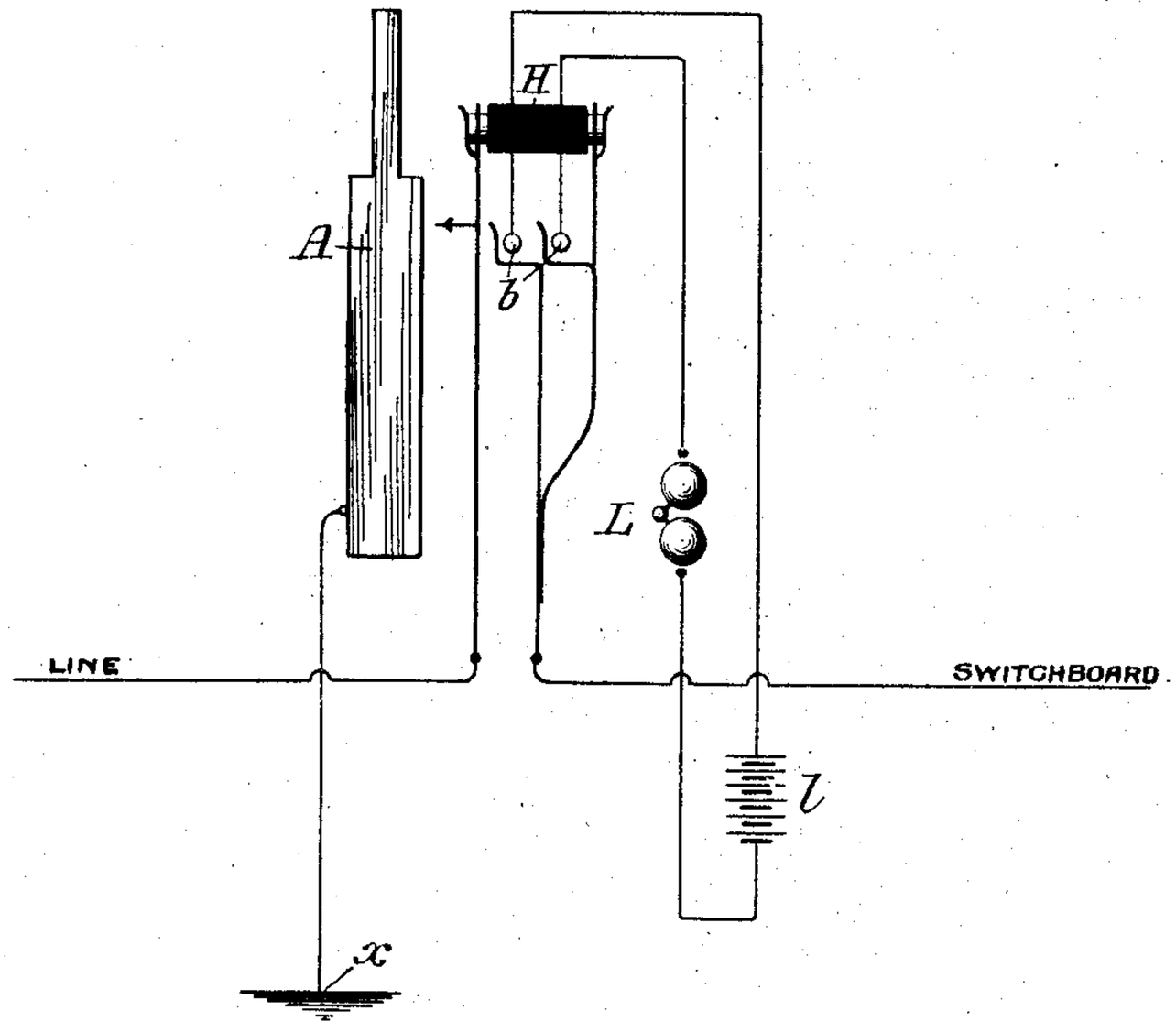
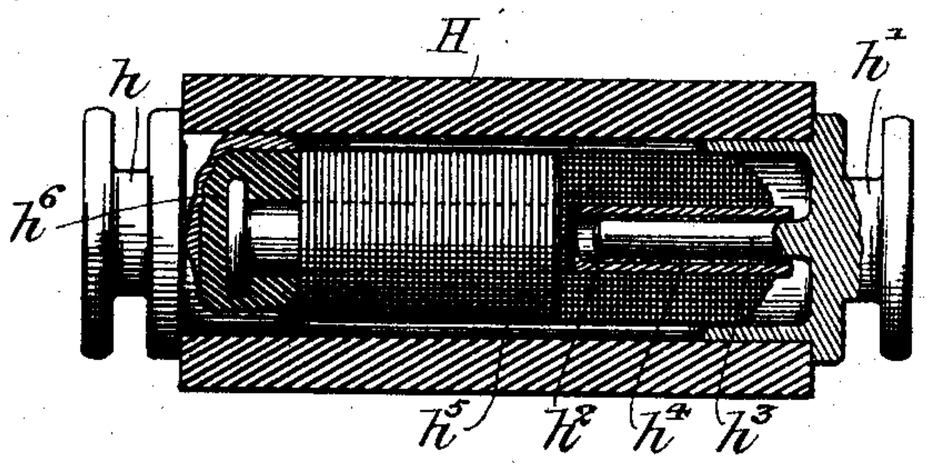


Fig. 5.



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UNITED STATES PATENT OFFICE.

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THERMAL PROTECTOR AND ALARM.

No. 812,184. Specification of Letters Patent. Patented Feb. 13, 1906.

Application filed December 18, 1902. Serial No. 135,676.

To all whom it may concern:

Be it known that I, FRANK B. COOK, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Thermal Protectors and Alarms, of which the following is a specification.

My invention relates to devices for protecting electrical circuits against the encroachment of dangerous or abnormally large currents.

It relates more particularly to a form of protector involving the use of both heat-coils and carbon lightning-arresters. As is well known, the said heat-coils are adapted to automatically open the circuit upon the encroachment of currents only slightly in excess of normal, sometimes called "sneak-currents." The carbon lightning-arresters, as is also well understood, protect the instruments in the circuit against lightning discharges and provide a path to ground for a high-potential current.

Generally stated, the object of my invention is to provide an improved construction and arrangement whereby both heat-coils and carbon lightning-arresters may be conveniently and effectively employed in conjunction with each other and organized into a self-contained and improved piece of apparatus for protecting electrical circuits and instruments against the encroachment of dangerous or abnormally strong currents.

A special object is to provide an improved construction and arrangement whereby a number of heat-coil devices may be arranged in a couple of parallel rows at each side of a grounded plate or support and whereby the carbon lightning-arresters may be conveniently and effectively mounted in a row along the edge of said plate.

Another object is to provide an improved, simple, and effective arrangement whereby each heat-coil when operated will be capable of closing the circuit of a local alarm. It is also an object to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a combined heat-coil and carbon lightning-arrester protector of this particular character.

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

The thermal protector herein shown forms a portion of the subject-matter of my copending application for Letters Patent on thermal protector and alarm, Serial No. 135,677, filed with this present application.

In the accompanying drawings, Figure 1 shows a portion of one of the metal strips or iron plates, together with a number of heat-coils and lightning-arresters which are mounted upon this plate. Fig. 2 is an end view of the devices shown in Fig. 1. Fig. 3 is a section on line 3 3 in Fig. 1. Fig. 4 is a diagram of the circuits involved in my improved protector and alarm device. Fig. 5 is an enlarged longitudinal section of one of the heat-coil devices involved in my improved protecting apparatus.

Referring to Figs. 1, 2, and 3, A represents a portion of a metal strip or iron plate upon which the heat-coils and carbon lightning-arresters are mounted. It will be readily understood that this strip or plate can be of any suitable length consistent with the use and purposes of the device as a whole and according to the number of coils and lightning-arresters which it may be desired to mount thereon. Near the upper edge of this plate a number of separating or spacing rods or strips of insulation B are inserted through openings *a*, and farther down on the plate a number of somewhat similar rods or strips of insulation C are inserted through similar openings *a'*. The insulating rods or strips B project at each end of the plate and are preferably connected by metal rods *b*, which latter form part of the alarm-circuit, as will hereinafter more fully appear. The rods of rubber or other like insulating material C are each preferably provided with a rod or metal core *c*, which, as will be observed, projects at each end and which is provided with a number of small nuts *c'*. Upon each rod *c* a number of springs D, D', E, E', F, F', G, and G' are mounted and distributed, as illustrated in Figs. 2 and 3. The line-terminal *e'* may be a part of the spring E, while the other line-terminal *g* is preferably formed of a separate piece and electrically connected by the metal sleeve *g'* with the springs G and G'. The switchboard-terminal *f* can be formed integral with the spring F, while the other switchboard-terminal c^2 is preferably formed of a separate piece and electrically connected with the metal rod *c*. It will also be observed that the springs D and D' are electrically connected with the rod *c*. The springs E and E', the springs G and G', and

also the springs F and F′ are preferably insulated from the core or rod *c*. The upper ends of the springs D, E, F, and G are preferably notched and adapted to receive the grooved heads of the cylindric heat-coil devices H. These heat-coil devices can be of any suitable or approved construction, but are preferably of the character shown in Fig. 5. In this figure it will be seen that the head *h* is connected with the opposite or similar head *h′* through the medium of the two stem portions h^2 and h^3 and the interposed solder h^4. A coil of wire h^5 is wrapped around the two stems thus held together by the solder. The stem portion h^2 is insulated from the head *h* by a mass of insulation h^6. One terminal of the heating-coil h^5 is secured to the head *h*, while the other terminal is secured to the stem h^2. With this arrangement it is obvious that the two heads *h* and *h′*, the hollow stem h^2, and the heating-coil and solder are all connected in series. It follows, therefore, that the passage of an undue or abnormally strong current through these elements will cause the heating-coil h^5 to develop sufficient heat to melt the solder, thereby allowing the two heads to be pulled apart by the springs upon which they are supported, and at this juncture it will be understood, of course, that the springs D, E, F, and G are normally under tension when the cylindric heat-coils H are inserted in place, as shown in the drawings. Thus, as will be seen, the switchboard and line springs, with the cylindric heat-coils mounted upon their ends, are arranged in banks or groups at each side of the flat metal plate or support A. A device of this character is capable of use in various connections. For example, it may be installed in a telephone-exchange, and in such case the line conductors will be secured to the line-terminals *e′* and *g*, while the switchboard-conductors will be united with the terminals *f* and c^2 Thus connected the heating-coil of each heat-coil device will constitute part of a line-circuit, and consequently all currents traversing this circuit will pass through the springs and heat-coils. Now should an unduly strong or abnormally large current show its presence in one of the line-circuits the heat developed by the heating-coils h^5 in this circuit will cause a melting of the solder h^4 and a consequent opening of the circuit, due to the separation of the sectional conductors involved in each heat-coil by the action of the released springs, and in addition to the opening of the line-circuit in this manner each line-spring is capable of establishing a connection to ground through the medium of the contact e^2, one of which is mounted on each line-spring and which are adapted when the line-springs are released to make contact with the brass mounting-strip I, which is secured to the upper edge of the metal strip A, the latter being preferably of cold-drawn steel. As shown in Fig. 4, this strip or plate A is preferably grounded at X.

In order to protect the circuits against lightning discharges, a plurality of carbon lightning-arresters J are mounted in a couple of parallel rows along the brass mounting-strip I. The arrangement is such that a carbon lightning-arrester is associated with each heat-coil device. Each lightning-arrester may comprise a couple of carbon blocks *d*, with a mica or other like dielectric interposed between them. At one side these blocks are held in place by the auxiliary line-springs E′, while at the other side the blocks are held in place by the auxiliary line-springs G′. Thus each line-terminal *e′* and *g* is adapted to connect a line conductor with both a carbon lightning-arrester and a heat-coil, the latter serving as the medium of connection between the line conductor and the instruments to be protected. With this arrangement all lightning discharges will be conducted from line to ground through the medium of the carbon blocks, the discharge or high-potential current arcing across from one carbon block to another in the well-known manner.

As a matter of further and special improvement the switchboard-springs D, D′, F, and F′ are adapted to close the circuit of a local alarm L when either one of the heat-coils is operated or disrupted by the passage of a current above the normal. This is accomplished by connecting the rods *b* in a normally opened circuit, including the said alarm and the battery 1. With this arrangement the two rods when electrically connected by the springs F and F′, for example, complete the circuit and cause the alarm device to give a signal. This is clearly shown in Fig. 4, wherein it will be seen that the heat-coils operate to normally maintain the springs F and F′ out of contact with the two rods *b;* but when these springs are released by the giving way of the connection in the heat-coil the circuit is closed and the signal operated. In this way an attendant can replace the burned-out or operated heat-coil as soon as the alarm is sounded.

Thus it will be seen that I provide a compact and self-contained piece of protective apparatus which is adapted for use in connection with all kinds of electrical apparatus and instruments, but which is more particularly adapted for installation in a telephone-exchange for the purpose of protecting the switchboard apparatus against the encroachment of either abnormally strong currents or currents only slightly in excess of normal. Furthermore, it will be seen that the construction permits of the ready repair and substitution of all parts and permits the heat-coils and lightning-arresters to be conveniently mounted in banks or groups. Again, with the heat-coils and lightning-arresters

mounted upon a flat metal plate it is possible to easily install and remove the protective apparatus and to arrange them in a position to be easily and carefully inspected. Other advantages will be obvious to those skilled in the art.

The wiring or method of applying connections is obviously facilitated and rendered more satisfactory by reason of the line-terminals all being grouped at one side of the support A and the switchboard-terminals all grouped at the other side thereof.

What I claim as my invention is—

1. A protector, comprising a plate of metal, rods inserted transversely through said plate of metal, line and switchboard springs mounted upon said rods, the line-springs between the switchboard-springs and plate, heat-coil devices removably mounted upon the ends of said springs, a brass mounting-strip secured to the edge of said plate, the switchboard-springs normally pulling upon the heat-coil devices, and away from said plate, and a pair of parallel rows of carbon lightning-arresters mounted upon said brass strip, each carbon lightning-arrester being electrically connected with an adjacent line-spring together with a normally open alarm-circuit, each of said outer switchboard-springs being adapted, when released, to constitute part of the alarm-circuit.

2. A protector, comprising a flat plate of metal, rods of insulation inserted transversely through said plate, line and switchboard springs mounted on certain of said rods, the other rods of insulation serving to separate the different pairs of line and switchboard springs, and heat-coil devices mounted upon said springs, the switchboard-springs normally pulling upon the heat-coil devices, and away from said plate together with a normally open alarm-circuit, each of said outer switchboard-springs being adapted, when released, to constitute part of the alarm-circuit.

3. A protector, comprising a flat plate of metal, line and switchboard springs arranged in pairs and mounted in two rows, one at each side of said plate of metal, said springs all being insulated from said plate of metal, and heat-coil devices removably mounted upon the ends of said springs, the switchboard-springs normally pulling upon the heat-coil devices, and away from said plate together with a normally open alarm-circuit, each of said outer switchboard-springs being adapted, when released, to constitute part of the alarm-circuit.

4. In a self-contained piece of protective apparatus, the combination of a flat metal plate, line and switchboard springs mounted in pairs at one side of said plate, other line and switchboard springs mounted in similar pairs at the other side of said plate, all of said springs being insulated from said plate, heat-coil devices removably mounted upon the ends of said springs, the switchboard-springs normally pulling upon the heat-coil devices, and away from said plate, and a number of carbon lightning-arresters mounted along the edge of said plate, and arranged in two parallel rows extending between the two parallel rows of heat-coil devices, each carbon lightning-arrester being electrically connected with an adjacent line-spring, and also with the said flat metal plate together with a normally open alarm-circuit, each of said outer switchboard-springs being adapted, when released, to constitute part of the alarm-circuit.

5. The combination of a flat metal plate, a row of rods or strips of insulating material inserted transversely through the plate, another row of rods or strips of insulating material inserted through the plate, each of said last-mentioned rods being provided with a metal core, line-springs mounted on said last-mentioned rods and arranged at each side of the said plate, said line-springs being insulated from the said metal cores, switchboard-springs also mounted upon the said last-mentioned rods, the switchboard-springs at one side of the plate being electrically connected with the cores, the other switchboard-springs being insulated from the said cores, and heat-coil devices removably mounted upon the ends of said springs, the first-mentioned rods of insulation serving to maintain the proper distance between the pairs of line and switchboard springs.

6. The combination, in a self-contained piece of protective apparatus, of a flat metal plate, rods or strips of insulation inserted through the upper portion of said plate, said rods being connected at each side by metal rods, switchboard-springs suitably mounted and insulated from said plate, said switchboard-springs being normally out of contact with said metal rods, but adapted to make contact with said metal rods, line-springs, each line-spring being associated with a switchboard-spring, and heat-coil devices removably mounted upon said springs, the switchboard-springs normally pulling upon the heat-coil devices, and away from said plate together with a normally open alarm-circuit, each of said outer switchboard-springs being adapted, when released, to constitute part of the alarm-circuit.

7. The combination, in a protector, of a flat metal plate, suitable pieces of insulation inserted transversely through said plate, alarm-circuit contacts mounted on certain of said pieces of insulation, line and switchboard springs mounted on the other pieces of insulation, said switchboard-springs being adapted to engage the said contacts, but adapted to be normally out of contact with the same, suitable heat-coil devices removably applied to the ends of said line and switchboard springs, the switchboard-springs normally pulling upon the heat-coil devices,

and away from said plate, and carbon lightning-arresters arranged in two parallel rows along the edge of said metal plate, one block of each carbon lightning-arrester being electrically connected with an adjacent line-spring, and the other block of each lightning-arrester being electrically connected with said plate together with a normally open alarm-circuit, each of said outer switchboard-springs being adapted, when released, to constitute part of the alarm-circuit.

8. A self-contained piece of protective apparatus, comprising a flat strip adapted to serve as a mounting or support, line and switchboard springs mounted in pairs at each side of said strip, heat-coil devices removably applied to the ends of said springs, the switchboard-springs normally pulling upon the heat-coil devices, and away from said plate, and carbon lightning-arresters mounted in two parallel rows along the edge of said plate, one block of each lightning-arrester being electrically connected with an adjacent line-spring, and the other block of each lightning-arrester being electrically connected with a member which is adapted to be connected to ground together with a normally open alarm-circuit, each of said outer switchboard-springs being adapted, when released, to constitute part of the alarm-circuit.

9. In a device of the character described, the combination of a suitable support, outer switchboard-springs and inner line-springs suitably mounted at one side of said support, heat-coil devices removably applied to the ends of said springs, a normally open ground-circuit including said support, each line-spring when released being adapted to constitute part of said ground-circuit, and a normally open alarm-circuit, each of said outer switchboard-springs being adapted when released to constitute part of said alarm-circuit, and the line-springs being mounted intermediate of the said support and switchboard-springs.

10. In a device of the character described, the combination of a metal support, an inner line-spring and an outer switchboard-spring suitably mounted at one side of said support, a heat-coil device removably applied to the ends of said springs, a normally open ground-circuit including said support and line-spring in series, and an alarm-circuit normally open at two points and including said switchboard-spring, the line-spring being mounted intermediate of the support and switchboard-spring.

11. A thermal protector and alarm apparatus, comprising a metal support, a row of heat-coil devices mounted at each side of said support, a normally open ground-circuit including said support, line-terminals connected with the said heat-coil devices and all mounted at one side of said support, and switchboard-terminals also suitably connected with said heat-coil devices and all mounted at the other side of said support, said heat-coil devices having line and switchboard springs, the line-springs being mounted intermediate of the support and switchboard-springs, together with a normally open alarm-circuit, each switchboard-spring when released being adapted to constitute part of said alarm-circuit.

12. A thermal protector and alarm apparatus, comprising a metal support, line and switchboard springs mounted in pairs at each side of said support, heat-coil devices removably applied to each of said pairs of springs, line-terminals connected with said line-springs and all mounted at one side of said support, switchboard-terminals suitably connected with said switchboard-springs and all mounted at the other side of said support, a normally open ground-circuit including said support, each line-spring when released being adapted to constitute part of said ground-circuit, together with a normally open alarm-circuit, each switchboard-spring when released being adapted to constitute part of the alarm-circuit.

13. In a device of the character described, the combination of a suitable support, line and switchboard springs mounted on said support, an auxiliary spring between the said line and switchboard springs, a heat-coil device applied to the ends of the line and switchboard springs and holding the same normally under tension, a pair of metal rods both mounted between the line and switchboard springs, one rod being normally out of contact with the auxiliary spring and the other rod being normally out of contact with the switchboard-spring, whereby both rods are engaged by their respective springs when the switchboard-spring is released and moves away from the rods, together with a normally open alarm-circuit including said rods and including also said auxiliary and switchboard springs.

14. The improved thermal protector and alarm apparatus comprising a support with a row of thermal cut-outs at each side thereof, together with line-terminals and switchboard-terminals, the line-terminals all being arranged at one side of said support, and the switchboard-terminals all at the other side of said support, substantially as shown and described.

Signed by me at Chicago, Cook county, Illinois, this 11th day of December, 1902.

FRANK B. COOK.

Witnesses:
HARRY P. BAUMGARTNER,
WM. A. HARDERS.