No. 707,051. Patented Aug. 12, 1902.

F. B. COOK.

SYSTEM OF STRONG CURRENT PROTECTION.

(Application filed May 21, 1902.)

(No Model.) 2 Sheets—Sheet 1.

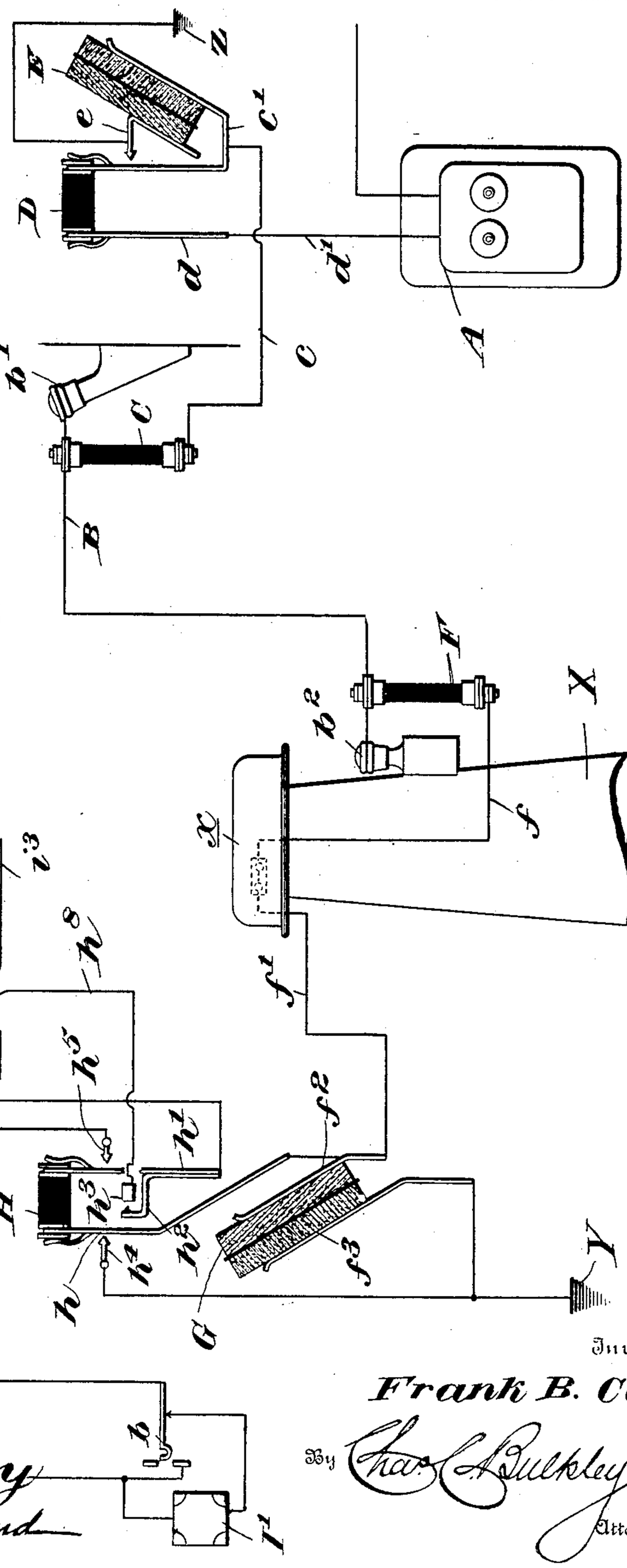


Fig. 1.

Witnesses

Elmer Seavey

Arthur F. Durand

Inventor

Frank B. Cook

By Chas. C. Bulkley

Attorney

No. 707,051. Patented Aug. 12, 1902.

F. B. COOK.

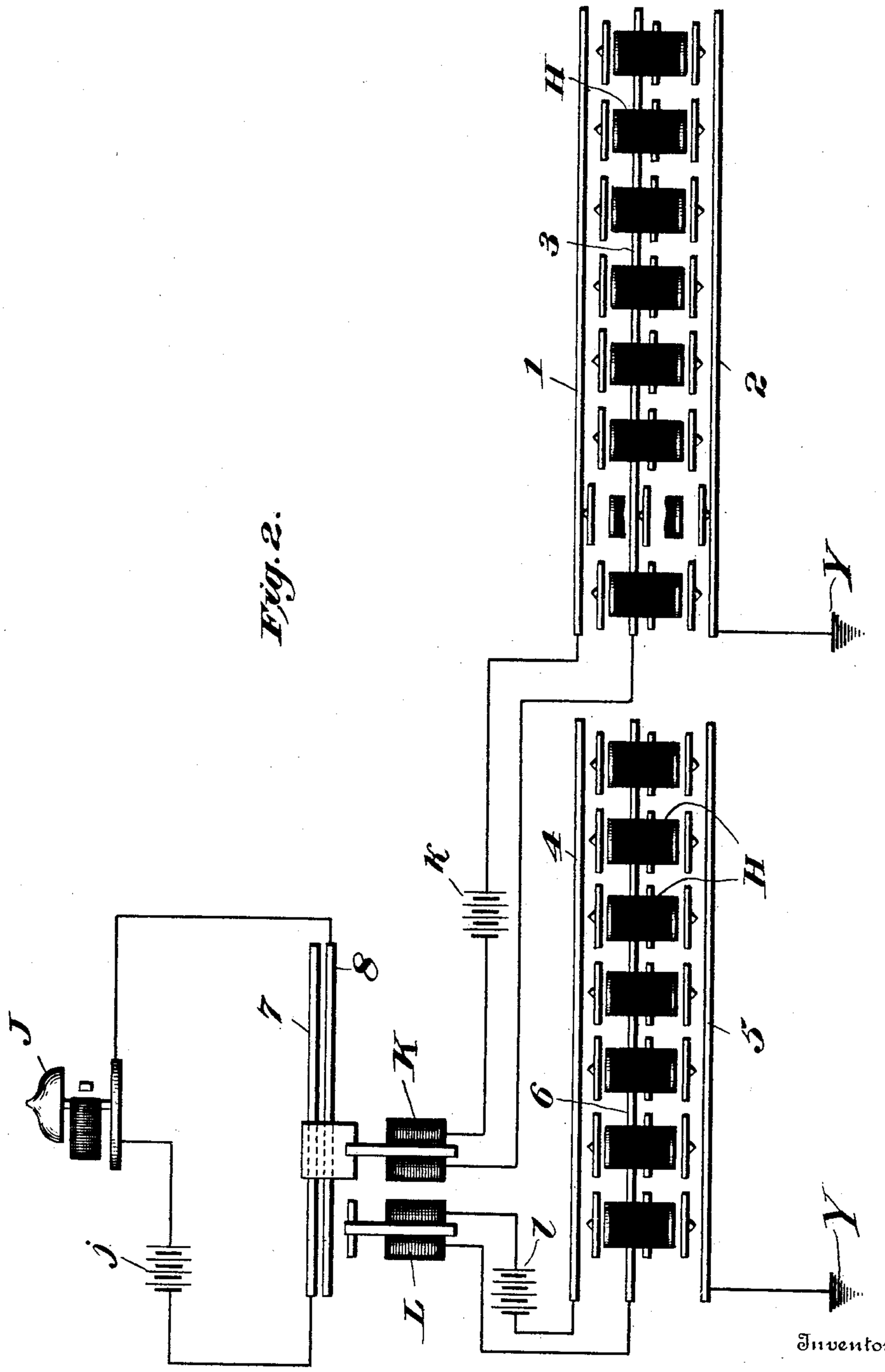
SYSTEM OF STRONG CURRENT PROTECTION.

(Application filed May 21, 1902.)

(No Model.)

2 Sheets—Sheet 2.

Fig. 2.



Witnesses

Elmer Seavey

Arthur L. Durand

Inventor

Frank B. Cook

By Chas. C. Buckley

Attorney

UNITED STATES PATENT OFFICE.

FRANK B. COOK, OF CHICAGO, ILLINOIS.

SYSTEM OF STRONG-CURRENT PROTECTION.

SPECIFICATION forming part of Letters Patent No. 707,051, dated August 12, 1902.

Original application filed July 29, 1896, Serial No. 600,970. Divided and this application filed May 21, 1902. Serial No. 108,331. (No model.)

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 Systems of Strong-Current Protection, of which the following is a specification.

This is a division of my application, Serial No. 600,970, filed July 29, 1896. In said application I have shown, described, and claimed a novel form of thermal protector, and I have also shown a novel form of fuse-protector. In addition said original application illustrates an arrangement for combining a carbon lightning-arrester with one of my thermal protectors, or "heat-coils," as they are commonly called. In the present application, as will hereinafter more fully appear, I have shown and claimed a circuit arrangement for employing these different kinds of protectors in a telephone system, and in connection with this system of protection I have also described and claimed a signal-circuit arrangement whereby the operation of any one of the thermal protectors or heat-coils at the central station will cause a signal to be given. As will be seen from the following, I have also herein shown a novel form of line-fuse and have herein claimed this fuse in a certain circuit arrangement and have made it an element of certain combinations. The broad claims for this particular form of fuse and also the broad claims for suspending a protector on a stretched line-wire are, however, embodied in my divisional application, Serial No. 108,330, filed May 21, 1902, the patent for which is now being withheld by the Patent Office in order to determine the question of interference.

Electrical systems—such as telephone, telegraph, and other signaling systems—are liable to suffer from the effects of excessive currents. These abnormally large or excessive currents are of different characters, some being known as "sneak-currents"—that is to say, currents which are only slightly in excess of normal—and others being greatly in excess of normal, such as result from the crossing of a telephone-wire with a trolley-line or other line conductor. It will also be seen that the instruments involved in telephone or other systems are liable to suffer from the effects of lightning-discharges. These intruding currents are all of different character, and it is obvious that a form of protector which would be effective in one case might not afford any protection in another.

Generally stated, it is therefore the object of my invention to provide a general comprehensive system which shall be capable of guarding against any or all of these different kinds of trespassing currents which are greatly in excess of normal and also of guarding against any damage which might be caused by currents only slightly in excess of normal.

A special object is to provide an arrangement and construction whereby fuse-protectors may be employed in conjunction with heat-coil protectors and also with the carbon lightning-arresters.

Another object is to provide a circuit arrangement whereby the operation of any one of the heat-coils will cause a signal to be operated.

A further object is to provide a construction and arrangement whereby the heat-coils or thermal protectors may be arranged in banks or sections, and whereby a signal may be allotted to each bank or section, and whereby not only the signal thus allotted to a bank or section will operate when one of the heat-coils is operated, but also whereby a general signal or alarm will also be given.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency and to render a protecting and signaling system of this character thoroughly reliable in use.

In carrying out my invention I provide thermal protectors, or "heat-coils," as they are sometimes called, which are adapted to sever or disrupt the circuits under the influence of quantitative currents approximately slightly in excess of the normal. In conjunction with these I also provide fuse-protectors which are adapted to sever the circuits under the influence of currents of greater quantity than those which cause heat-coils to act. In order to still further insure the instruments or electrical devices against intruding currents, I provide what may be termed "intensity-protectors," the same con-

sisting of devices which operate to establish a circuit to earth, allowing the current to jump or arc across an open space. Thus my invention may therefore be said to contemplate the combination of these various kinds of protectors together in one general system of current protection and also in their individual circuit arrangement and relative disposition therein. I also provide means, circuit arrangements, and connections whereby the indicating devices are disposed in a local circuit relative to a switchboard, and thus rendered entirely independent of the main-line circuit. These indicating devices are connected and arranged to point out or identify the circuit which has been severed by the operation of one of the thermal protectors or heat-coils. Preferably these signaling devices consist of a visual indicator for each bank or section of the heat-coils and of an audible signal connected and arranged to sound an alarm when any one of the signals allotted to the different banks or sections of the heat-coils is operated. In this way whenever a heat-coil is operated by an excessive current an alarm is sounded by the audible signaling device, and the visual signal, which has been operated by the disrupting of one of the circuits, then serves as a means for indicating the bank or section in which the disrupted heat-coil is located. The nature and advantages of my invention will, however, hereinafter more fully appear.

In the accompanying drawings, Figure 1 is a diagram illustrating the application of my invention to a telephone system. In this diagram a subscriber's telephone set is shown connected by the line-wire with the usual switchboard apparatus at the central station. It will be seen that a fuse and a heat-coil and a carbon lightning-arrester are associated with the subscriber's telephone set, while a like group of protectors is associated with the switchboard apparatus at the central station. Fig. 2 is a diagram illustrating the arrangement of the heat-coils in banks or sections and illustrating the circuit connections whereby the disrupting of any one of these heat-coils will cause the operation of two signals—first, a signal allotted to the bank or section in which the heat-coil is located, and, second, a general signal which sounds an alarm when any one of the different visual indicators is operated.

As thus illustrated my invention comprises a subscriber's telephone set A, which, it will be understood, can be of any suitable known or approved form. At the central exchange the line conductor B, extending from the subscriber's set, terminates in the usual spring-jack or switchboard-socket b. As shown in Fig. 1, it will be seen that the said line-wire is preferably secured to an insulator b' at the subscriber's station and a similar insulator b^2 at the central exchange. The fuse-protector C preferably has its upper end clamped upon the line-wire at a point adjacent to the insulator b'. A conductor c preferably leads from the lower end of this fuse-protector to the switch-spring c'. The connection is then completed to the subscriber's telephone through the medium of the heat-coil D and the post or spring member d and the conductor d'. The carbon blocks of the lightning-arrester E are preferably held between the spring switch member c' and the stop e. This stop is adapted to limit the movement of a portion of the spring-switch c', which supports the heat-coil—that is to say, when the spring c' is released by the disrupting of the heat-coil. At the central exchange another fuse-protector F, preferably like the fuse C, is clamped upon the line-wire at a point adjacent to the insulator b^2. This insulator can be mounted upon a pole X, having a pole-top terminal x at its upper end. With this arrangement the conductor f, leading from the lower end of the fuse F, can have its other end connected with a binding-post within the said pole-top terminal, and the connection to the switchboard can then be continued through the medium of the conductor f'. This conductor f' preferably leads to a plate or spring-jaw f^2. The carbon blocks of the lightning-arrester G are preferably arranged between this jaw f^2 and a similar spring-jaw f^3. The latter jaw is, it will be seen, preferably grounded at Y. At this juncture it will also be seen that the stop e is also preferably grounded at Z. The heat-coil H, employed in conjunction with the lightning-arrester G for protecting the switchboard apparatus, is preferably mounted between a spring-jaw h and a similar spring-jaw or post h'. The latter is, it will be seen, preferably provided with a bent portion h^2, adapted when released to make contact with the bar h^3. When the heat-coil is disrupted, the movement of the spring h is limited by a stop h^4, while the movement of the spring h' is limited in a similar way by a stop h^5. The stop h^4 is preferably grounded at Y, while the stop h^5 is connected with one pole of a signaling-battery h^6. The spring-jaw h' is connected by a conductor h^7 with the aforesaid spring-jack B. The bar h^3 is connected with the visual indicator I by means of a conductor h^8. The other pole of the battery h^6 is connected with the visual indicator by means of the conductor h^9. The said visual indicator may consist of an ordinary drop, relay, or other like signaling device. The two contact-points i and i' are preferably associated with this indicator and are connected by the conductors i^2 and i^3 with the audible or general alarm J. It will be seen that a signaling-battery j is preferably located in this normally open local circuit of the audible or general alarm.

Now should an excessively large trespassing current show its presence on the line near the subscriber's station the fuse C will be burned out and will in this way disrupt the connection between the line and the subscriber's telephone set. Again, should the

trespassing current be only slightly in excess of the normal or, as it is sometimes called, a "sneak-current," then the coil D, comprised in the thermal protector device, will be disrupted, allowing the spring *c'* to make contact with the stop *e*. Thus in addition to disrupting the circuit the operation of the heat-coil will also establish connection between the line and the ground. In case of lightning the high-potential current can descend to earth at Z through the carbon blocks of the lightning-arrester E, the current arcing from one block to the other. Should the high-potential current be of sufficient duration, the arcing will burn out the dielectric between the two carbon blocks, and thus establish a positive connection between the line and earth. In a similar manner the fuse F at the central exchange is adapted to burn out under excessive current and in this way sever the connection between the main-line conductor and the switchboard apparatus. Also, as in the previous case, the heat-coil H is adapted to respond to trespassing currents only slightly in excess of normal and to disrupt the circuit and at the same time establish connection between the line and the earth at Y. Lightning-discharges will arc across from one block of carbon to the other in the lightning-arrester G, or, as previously explained, will burn out the dielectric between the two blocks and descend to earth through a positive connection. When released by the disrupting of the heat-coil H, the spring *h'* and the arm or bent portion h^2 close the local circuit including the visual indicator I. This indicator when operated closes the normally open circuit including the audible alarm J. In large exchanges it is preferable to arrange the heat-coils H in banks or sections, substantially as shown in Fig. 2. With this arrangement a visual indicator can be allotted to each bank or section, and the arrangement can be such that the operation of any heat-coil in said section will cause the said signal to be displayed. For example, as shown in Fig. 2, the visual indicator K, which is similar to the indicator I, previously described, is allotted to the bank or section of heat-coils shown at the right. In this section or bank of heat-coils shown at the right the bar 1 corresponds to the stop h^5, (shown in Fig. 1,) the bar 2 corresponds to the stop *h*, (shown in Fig. 1,) and the bar 3 corresponds to the stop or member h^3. (Shown in said Fig. 1.) In said Fig. 2 the visual indicator L, arranged alongside of the indicator K, is allotted to the bank or section of heat-coils shown at the left. In this second bank or section of heat-coils the bars 4, 5, and 6 are similar in function to the previously-described bars 1, 2, and 3. The bars 7 and 8 correspond to the contact-points *i* and *i'* in Fig. 1 and are in the normally open circuit including the aforedescribed battery *j* and the audible signal or alarm J. The local circuits of the two visual indicators K and L are provided with batteries *k* and *l*, which correspond to the battery *h*. (Shown in Fig. 1.) Thus it will be seen that should any of the heat-coils in the bank or section to the right be operated the local circuit including the visual indicator K will be closed, causing it to in turn close the local circuit including the general alarm J. In a similar manner the disrupting of any heat-coil in the bank or section to the left will cause the operation of the visual indicator L, which latter will in turn cause the operation of the said general alarm J. Thus the sounding of the general alarm indicates that a heat-coil in one of the sections has been burned out or disrupted. The attendant then observing the display of one of the visual indicators understands that the disrupted heat-coil is located in the bank or section allotted to such visual signal. In this way it is comparatively easy to locate the burned-out or disrupted heat-coil, even though a visual indicator is not provided for each separate heat-coil.

It will be readily understood that the various protectors herein shown may be of any suitable form or character. Preferably, however, the heat-coils are of the form and construction described in my said original application; but as fuses, heat-coils, and lightning-arresters are well known in the art I have not illustrated any particular form or construction in either case. It will also be understood that the various signaling devices can be of any suitable or approved form.

I claim as my invention—

1. In a system of protection for electrical circuits, the combination of a line-wire, a fuse hung on said wire, a pair of posts, a cylindric heat-coil removably mounted upon said posts, means for connecting the said fuse, heat-coil and posts in series between said line-wire and the instruments to be protected, an earth branch and carbon lightning-arrester connected at a point between the fuse and the heat-coil, and a grounded conductor connected with said lightning-arrester.

2. In a system of protection for electrical circuits, the combination of a line conductor, a fuse connected at one end with said line conductor, a pair of metal posts, a cylindric heat-coil device removably mounted upon the ends of said posts, one of said posts being flexible and held under tension by said heat-coil, means for connecting the said fuse, heat-coil and posts in series between the line conductor and the instruments to be protected, a grounded stop for limiting the movement of the said post which is held under tension, and a carbon lightning-arrester connecting said stop with the post under tension.

3. The combination of a line conductor, an insulator for supporting said line conductor, a fuse having its upper end clamped upon said line conductor, a line-spring connected with the lower end of said fuse, a post connected with the instruments to be protected, a heat-

coil device connecting said post and spring and holding the latter under tension, a grounded stop for limiting the movement of said spring, and a carbon arrester connecting said stop with said spring.

4. In a protecting system, the combination of a line conductor, a fuse supported upon said line, a pair of metal strips, a heat-coil mounted upon the ends of said strips, one of said metal strips being bent to provide one jaw for holding a pair of carbon blocks, another jaw for holding said carbon blocks, said second jaw serving as a stop for limiting the movement of the portion of the strip supporting the heat-coil, a grounded conductor connected with said stop, suitable connection between the lower end of said fuse and the metal strip which partially supports both the heat-coil and the carbon blocks, and a conductor leading from the other metal strip to the instruments to be protected.

5. In a protecting system, the combination of a line conductor, insulators supporting said conductor, fuse-protectors clamped upon the line conductor adjacent the said insulators, a thermal protector connected up in series between one fuse and the instruments or electrical devices to be protected at one station, a heat-coil connected up in series between the other fuse and the instruments or electrical devices to be protected at the other station, and a signal at said last-named station adapted to be displayed upon the operation of said last-mentioned heat-coil.

6. In a protecting system, the combination of a plurality of line-circuits, a plurality of thermal protectors connected in said line-circuits and arranged in banks or sections, a visual indicator allotted to each bank or section, each indicator being adapted to display a signal when a thermal protector is operated, and a general signal connected and arranged to be operated by any one of the said visual signals.

7. A current-protective system for telephone, telegraph and other like stations, consisting of a plurality of circuit-disrupting devices arranged in sections or banks, an indicating device for each section, the circuit of which is adapted to be established by any one of the disrupting devices when operated by excessive currents to point out the section in which the circuit is disrupted, and an alarm or indicator common to the whole station, the circuit of which is adapted to be established by any one of the indicators of the sections.

8. A current-protective system for telephone, telegraph and other like stations, consisting of a plurality of circuit-disrupting devices arranged in sections or banks, an indicating device for each section included in a local circuit, means for establishing the local circuit of a section when any line-circuit of that section is disrupted to operate the indicating device aforesaid, another local circuit including an indicator common to the whole station, and means for automatically establishing said latter local circuit.

9. A current-protective system for telephone, telegraph and other like stations, consisting of a plurality of circuit-disrupting devices arranged in sections or banks, an indicating device for each section included in a local circuit for each indicating device, means for establishing the local circuit of a section when any line-circuit of that section is disrupted to operate the indicating device aforesaid, and another local circuit including the indicator common to the whole station, which latter circuit is established in the act of establishing any one of the former local circuits of the sections or banks.

10. A current-protective system for telephone, telegraph and other like stations consisting of a plurality of circuit-disrupting devices arranged in sections or banks, an indicating device for each section included in local circuits, means for establishing the local circuit of a section when any line-circuit of that section is disrupted to operate the indicating device aforesaid, and another local circuit including an indicator common to the whole station adapted to be established by any one of the indicating devices of the sections.

11. In a telephone or telegraph circuit protective system, a plurality of current-protectors arranged in sections, sets or banks, an indicating device for each of the said sets, sections or banks, and a local circuit including the said indicating device together with means for closing the local circuit upon the disruption of any circuit of a set, section or bank of protectors, whereby the indicating device is operated to point to that section, set or bank of protectors in which the circuit is severed, and another indicator in an independent circuit common to the exchange as a whole by which attention is directed to the fact that a circuit of some set, section or bank of protectors is disrupted.

12. A plurality of thermal protectors arranged in banks or sections, a plurality of visual indicators arranged in a bank, one for each bank or section of thermal protectors, and circuit connections whereby each indicator may be operated by any protector in its allotted bank or section.

Signed by me at Chicago, Cook county, Illinois, this 14th day of May, 1902.

FRANK B. COOK.

Witnesses:

ARTHUR F. DURAND,

HARRY P. BAUMGARTNER.