No. 718,797. PATENTED JAN. 20, 1903.

J. SACHS.

SAFETY FUSE.

APPLICATION FILED SEPT. 30, 1901.

NO MODEL.

Fig. 1.

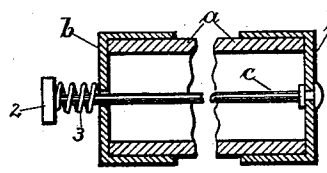



Fig. 2.

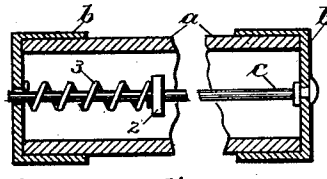



Fig. 5.

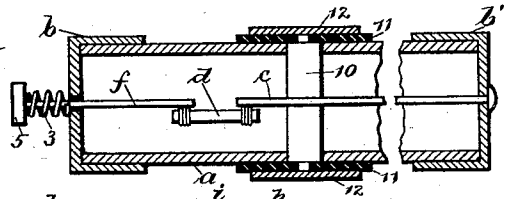



Fig. 6.

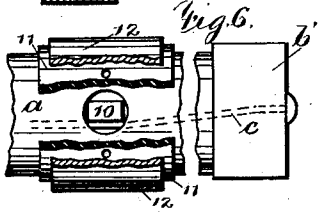



Fig. 3.

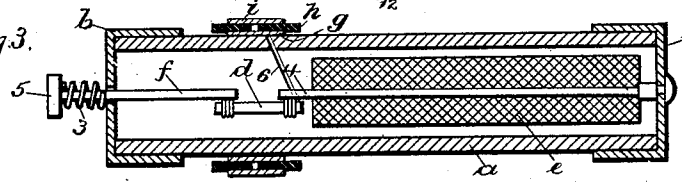



Fig. 4.

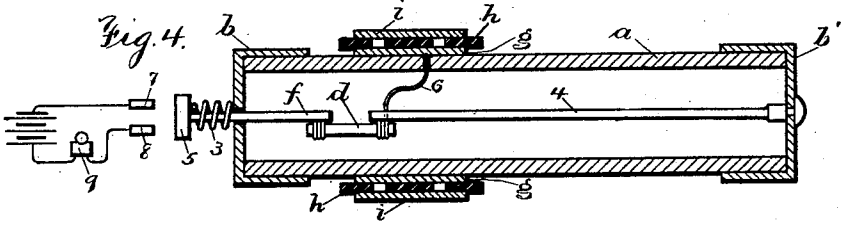



Fig. 7.

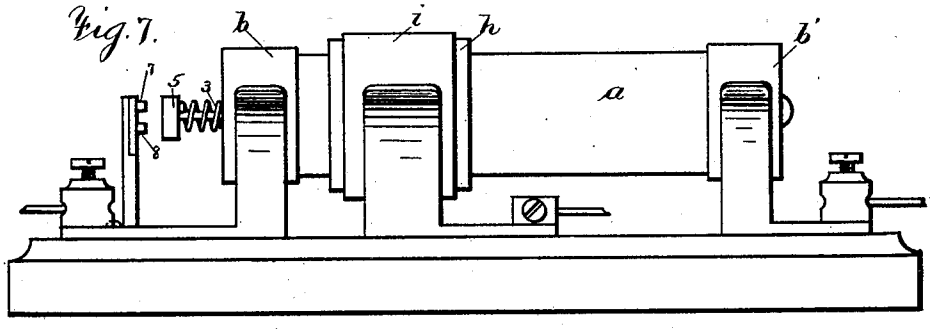
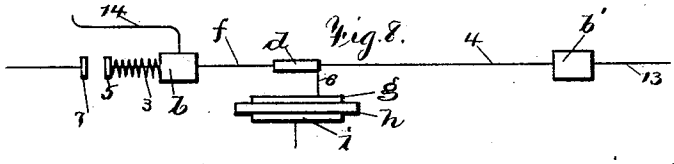



Fig. 8.




WITNESSES

C. A. Bergell

Chas. A. Smith

INVENTOR

Joseph Sachs,

PER L. N. Burrell & Son

ATTYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

JOSEPH SACHS, OF HARTFORD, CONNECTICUT.

## SAFETY-FUSE.

SPECIFICATION forming part of Letters Patent No. 718,797, dated January 20, 1903.

Application filed September 30, 1901. Serial No. 77,019. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH SACHS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented an Improvement in Safety-Fuses, of which the following is a specification.

My present invention relates to an inclosed indicating-fuse, with which is combined a sneak-current, high potential, and lightning protector, the same being an improvement upon the devices shown and described in United States Letters Patent granted to me November 2, 1900, and numbered 662,466 and 662,501, respectively.

In carrying out my invention I employ with a tubular casing of insulating material having end caps that are preferably of metal a fuse electrically in contact with both end caps, one end of the fuse-strip being securely fastened to one of the end caps and the other end passed through the other end cap. This last-named end of the fuse-strip is preferably provided with a head or disk and means whereby upon the blowing of the fuse this end of the fuse-strip is caused to move longitudinally and further protrude beyond the end cap to visually indicate the condition of the fuse. This movement may be arranged to audibly indicate such blowing of the fuse by closing an alarm-circuit. A spring-coil between the end cap through which the fuse-strip passes and the head or disk upon said fuse-strip serve as suitable means for effecting this movement and indication of a blown fuse. In the length of the fuse-strip proper I may introduce a section of high-resistance heating material—for example, carbon or graphite—to the ends of which the parts of the fuse-strip or suitable wires are secured by a joint fusible by the heating of the graphite section due to excess currents. The respective ends of the fuse strips or wires are constructed and connected as hereinbefore stated. I may also provide the fuse with a lightning-arrester by providing the casing with one or more circumferentially-disposed parts of metal or electrodes insulated from one another and preferably concentric. Where two such parts are employed, one is electrically connected to the fuse-strip and the other connected to ground. The casing may be filled with some good non-conducting material; but I prefer to simply surround the fuse-wire connected to the graphite section with asbestos. The instrument is particularly adapted for use on telephone, telegraph, signal, and other service systems.

In the drawings, Figure 1 is a broken longitudinal section at the ends of the tubular casing, representing my improved fuse. Fig. 2 is a similar view showing a modification of the structure. Fig. 3 is a longitudinal section illustrating my invention and embodying the sneak-current protector. Fig. 4 is a longitudinal section illustrating my invention and embracing the lightning-arrester attachment and showing an alarm-circuit. Fig. 5 is a modification of Fig. 4, and Fig. 6 is a partial plan and section of Fig. 5. Fig. 7 is an elevation, including a base, of the device shown in Fig. 4. Fig. 8 is a diagrammatic view of the electrical connections.

Referring to Figs. 1 and 2, *a* represents the tubular casing, of insulating material; *b b'*, the end caps or metallic terminals secured thereto. The fuse-strip *c* is made of some fusible metal of comparatively low melting-point—such as lead, zinc, or tin—as is common. One end of this fuse-strip *c* is securely attached to the end cap *b'*. The other end passes through the end cap *b* and may terminate, as shown in Fig. 1, in the head or disk 2, which is preferably not of the same material as the fuse-strip. A coiled-wire spring 3 is between the head 2 and the end cap *b* either externally under compression or, as shown in Fig. 2, the disk 2 may be within the casing, as is also the spring 3, which in this instance is under tension.

As shown in Fig. 3, I may divide the fuse-wire to form a fuse device which I call a "sneak-current protector and fuse" and in which is a section or piece *d* of high-resistance heating material, preferably having annular recessed portions near its ends. One end of the section *d* is electrically connected to the end-cap terminal *b'* by a wire 4. The high-resistance graphite or carbon rod is wound at its ends with a fine wire soldered together and thereto, so as to form terminal collars. An end of the fuse-wire 4 is connected to the section *d* by being soldered to the end contact-collar around the graphite

section. The fuse-wire 4 is preferably surrounded with a non-conducting material *e*, such as asbestos. The rod or bar *f* is secured to the other end of the section *d* in a manner similar to that used in uniting the fuse-wire thereto. This bar *f* passes through the end-cap terminal *b* and terminates in an integral head 5, the spring-coil 3 being placed between the head and the end cap *b*, as hereinbefore described. The joints connecting the section *d* of high-resistance heating material with either the fuse-wire 4 or conductor-rod *f* are either or both of them fusible by the heat produced in the graphite resistance-section by excess currents, which in time would injure the instruments in line, but which before injuring the instruments will sufficiently heat the resistance-section to thereby disrupt the joint and open the circuit.

In Fig. 4 I have shown a fuse of the same construction as shown in Fig. 3, but embracing a lightning-arrester attachment. Around the casing *a* a metal electrode *g* is provided. One or more layers of perforated mica *h* are arranged around this electrode *g*, and a surrounding or engaging metal electrode *i* is arranged outside of the said mica. The inner electrode *g* is electrically connected to the fuse end of the section *d* by the conductor 6. The outer electrode *i* is connected to ground in any desired or well-known manner. Lightning or excessively high potential discharges passing from the line over the fuse-wire 4 will be diverted through the conductor 6 to the electrode *g*, and from thence jump the air-gap to the outer electrode *i* to ground. This insures the protection of the instruments in line from lightning or other high-potential discharges which may occur in the circuit. In Fig. 4 I have also shown two contacts 7 and 8 adjacent to the head or end of the rod *f*. These contacts are the terminals of an alarm-circuit in which is a bell or other sounding or indicating device 9. These are arranged so that when the head of the rod *f* is protruded by the blowing of the fuse the same is caused to bear upon the said contacts to close the alarm-circuit, ringing the bell and giving an audible signal indicating that the fuse is blown.

As shown in Figs. 5 and 6, I may modify the construction illustrated in Fig. 4 by employing a piece of carbon 10 or similar material, which is passed transversely of the fuse-case and through openings therein, the ends thereof being preferably flush with the outside surface of the fuse-case. The carbon fits snugly in the hole in the tube. Adjacent to the part where the carbon 10 passes through the case the case is wound with a wrapper 11, of paper or other insulating material, which is perforated where it passes over the ends of the carbon 10. Outside the paper wrapper a metal electrode 12 is provided, which is electrically connected to ground. The fuse *c* passes directly to one side of the carbon 10 and makes contact therewith. The other parts are similarly constructed to those hereinbefore described. It will be readily understood that the carbon 10 serves in the same capacity as the conductor 6 and electrode *g* in Fig. 4 and that the construction shown in Fig. 5 requires but one electrode on the exterior of the case. Fig. 6 is a partial plan of Fig. 5, showing to better advantage the manner in which the carbon 10 is passed through the case.

Fig. 7 is an elevation of the fuse devices, Fig. 4, mounted on a suitable base.

Referring to Fig. 8, which is a diagrammatic view of the connections, it is essential that the end cap *b'* be connected to the line conductor 13, the conductor 14, leading from the end cap *b*, going to the instruments in the circuit, whatever they may be. It will be readily understood from these connections that any excessively high potential, whether it be a lightning discharge or due to a cross with a high-potential electric light or power wire, will pass to the electrode *g* by conductor 6 and pass through the perforations of the insulation to the outer electrode *i* and be conveyed to ground. A so-called "sneak" excess current, which is apt to cause injury if it be maintained for any length of time, will heat the graphite section and cause a rupture at the joint, allowing the spring 3 to visually project the rod *f*, bring the head 5 against the contacts 7 and 8, and thereby close the alarm-circuit. Should the main fuse-wire 4 be disrupted, due to a fusing together of the lightning-arrester electrodes, and thus permitting an abnormal current to pass through it from the crossed circuit, the indicating-spring will be affected in the same manner as above described.

In this device I have provided in one and the same instrument an ample protector for the instruments in a circuit against high-potential discharges and excessive currents and at the same time have provided a means whereby the blowing of a fuse is indicated visually or audibly or in both said ways.

I claim as my invention—

1. In a safety-fuse, the combination with a tubular case of insulating material, end caps or terminals therefor, and a non-conducting filling therein, of a fuse, an interposed section of high-resistance material, the said fuse extending through the case with one end of said strip connected to one of said end-cap terminals and with the other end of the fuse passing through the other end-cap terminal and terminating in an enlarged head, a spring-coil between said head and the end-cap terminal through which the said fuse passes, an electric circuit and contact devices against which the said head of the fuse is brought to bear to close the said circuit when the fuse is blown, substantially as specified.

2. In a safety-fuse, the combination with a case of insulating material, end-cap terminals therefor and a non-conducting filling therein, of a fuse, one end of which is electrically con-

nected to one of said terminals, a rod electrically connected to and extending through the other terminal, a piece of high-resistance material electrically connected to the non-terminal ends of said fuse and rod by joints adapted to be disrupted by the heat produced in the said high-resistance material by small sneak-currents, electrodes mounted on the said case, perforated insulating material interposed between said electrodes, an electrical connection from one of said electrodes to the joint between the fuse and the said high-resistance material and next to the line-terminal, means for connecting the said other electrode to ground, and means for externally indicating the condition of the fuse, substantially as specified.

3. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, means interposed in said fuse to be heated by excess currents to disrupt the joint connecting the said means and the said fuse, means secured to the said casing and electrically connected to the said fuse for conveying high-potential discharges to ground, and means for externally indicating the disruption of the said fuse, substantially as specified.

4. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, means interposed in said fuse to be heated by excess currents to disrupt the joint connecting the said means and the said fuse, and means secured to the said casing and electrically connected to the said fuse for conveying high-potential discharges to ground, substantially as specified.

5. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, a piece of high-resistance material interposed in said fuse and connected thereto by fusible joints which are disrupted by excess currents heating the said high-resistance material, and means connected to the said casing and in electrical connection with the said fuse and with ground whereby high-potential discharges are grounded, substantially as specified.

6. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, a piece of high-resistance material interposed in said fuse and connected thereto by fusible joints which are disrupted by excess currents heating the said high-resistance material, means connected to the said casing and in electrical connection with the said fuse and with ground whereby high-potential discharges are grounded, and means for externally indicating the blowing of the fuse, substantially as specified.

7. In a safety-fuse, the combination with a case of insulating material, and terminals therefor, of a fuse electrically connected to the said terminals, a conductor within said case in contact with said fuse and extending to the exterior of said case, an adjacent metal electrode leading to ground, and means for forming an insulating-gap between the said conductor and electrode, substantially as specified.

8. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, a piece of high-resistance material interposed in said fuse and connected thereto by fusible joints which are disrupted by excess currents heating the said material, a conductor within said case in contact with said fuse and extending to the exterior of said case, an adjacent metal electrode leading to ground, and means for forming an insulating-gap between the said conductor and electrode, substantially as specified.

9. In a safety-fuse the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, a piece of high-resistance material interposed in said fuse and connected thereto by fusible joints which are disrupted by excess currents heating the said material, insulating-covering surrounding the fuse and partially filling the said case, a conductor within the said case in contact with said fuse and extending to the exterior of said case, an adjacent metal electrode leading to ground, and means for forming an insulating-gap between said conductor and electrode, substantially as specified.

10. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, a piece of high-resistance material interposed in said fuse and connected thereto by fusible joints which are disrupted by excess currents heating the said material, a conductor within said case in contact with said fuse and extending to the exterior of the case, an adjacent metal electrode leading to ground, means for forming an insulating-gap between said conductor and electrode, and means for externally indicating the blowing of the fuse, substantially as specified.

11. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, a piece of high-resistance material interposed in said fuse and connected thereto by fusible joints which are disrupted by excess currents heating the said high-resistance material, a piece of conducting material extending transversely through said casing and in electrical contact with said fuse, a strip of insulating material on the said casing adjacent to where the said material passes through the same, the said insulating material having perforations therein, and an electrode of metal surrounding the said in-

sulating material and connected to ground whereby excess potentials are grounded, substantially as set forth.

12. In a safety-fuse, the combination with a case of insulating material and terminals therefor, of a fuse electrically connected to the said terminals, a piece of high-resistance material interposed in said fuse and connected thereto by fusible joints which are disrupted by excess currents heating the said high-resistance material, a piece of carbon extending transversely through said casing and in electrical contact with said fuse, a strip of insulating material surrounding the said casing adjacent to where the said carbon passes through the same, the said insulating material having perforations therein, a band of metal surrounding the said insulating material and connected to ground, whereby excess currents are grounded, and means for externally indicating the blowing of the fuse, substantially as specified.

Signed by me this 23d day of September, 1901.

JOSEPH SACHS.

Witnesses:
GEO. T. PINCKNEY,
BERTHA M. ALLEN.