No. 746,050. PATENTED DEC. 8, 1903.

L. W. DOWNES.

ELECTRIC FUSE OR CUT-OUT.

APPLICATION FILED MAY 7, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

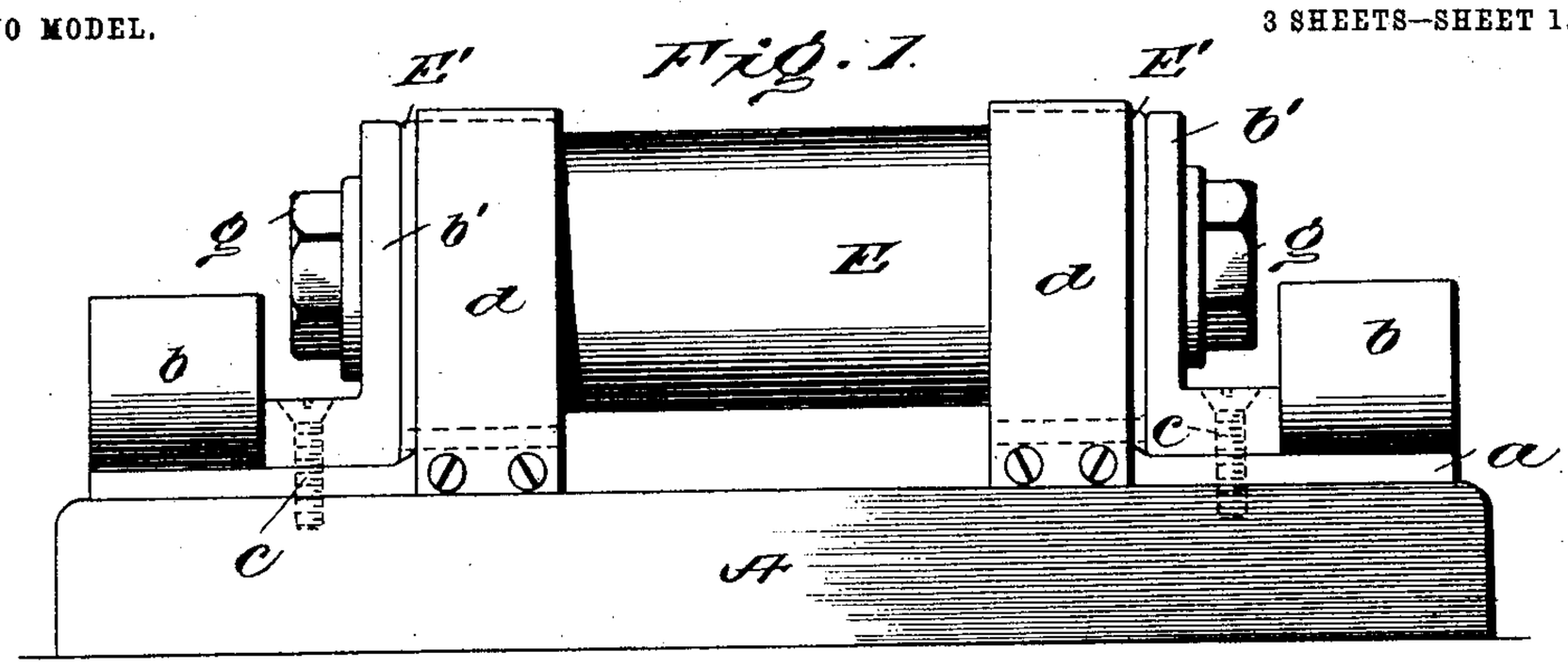


Fig. 2.

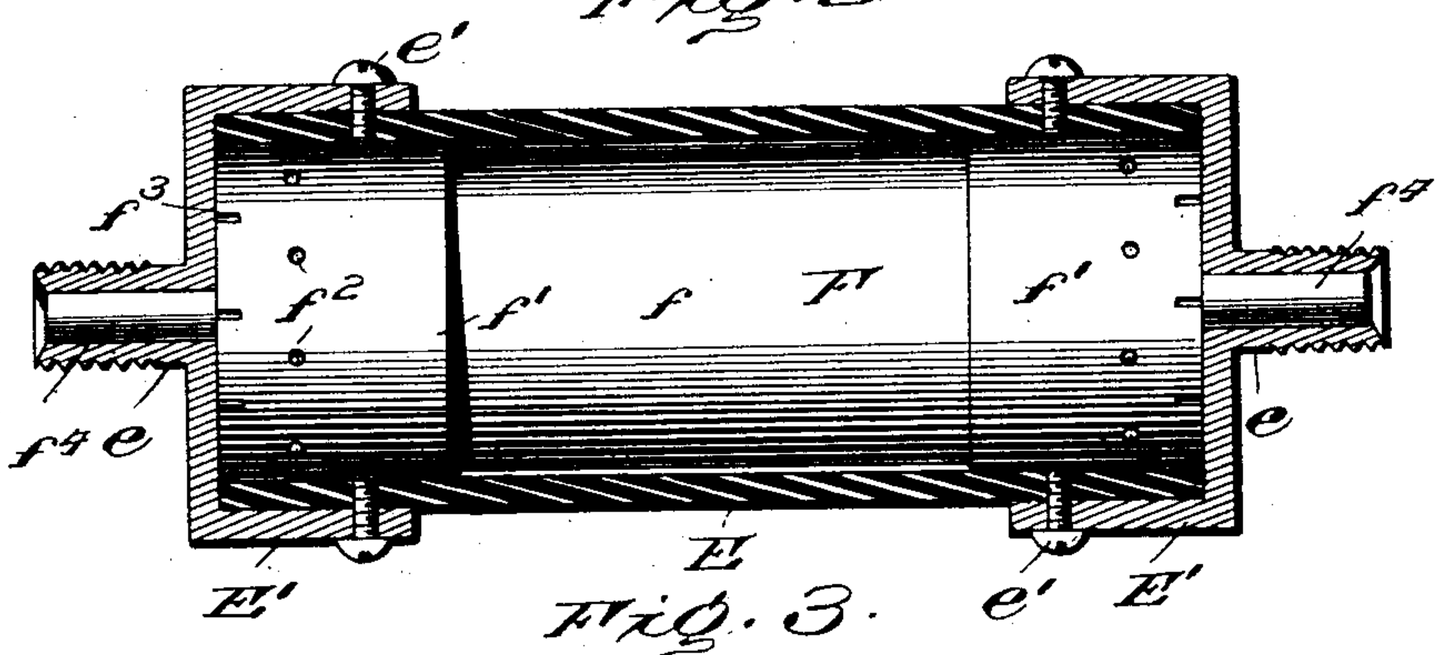


Fig. 3.

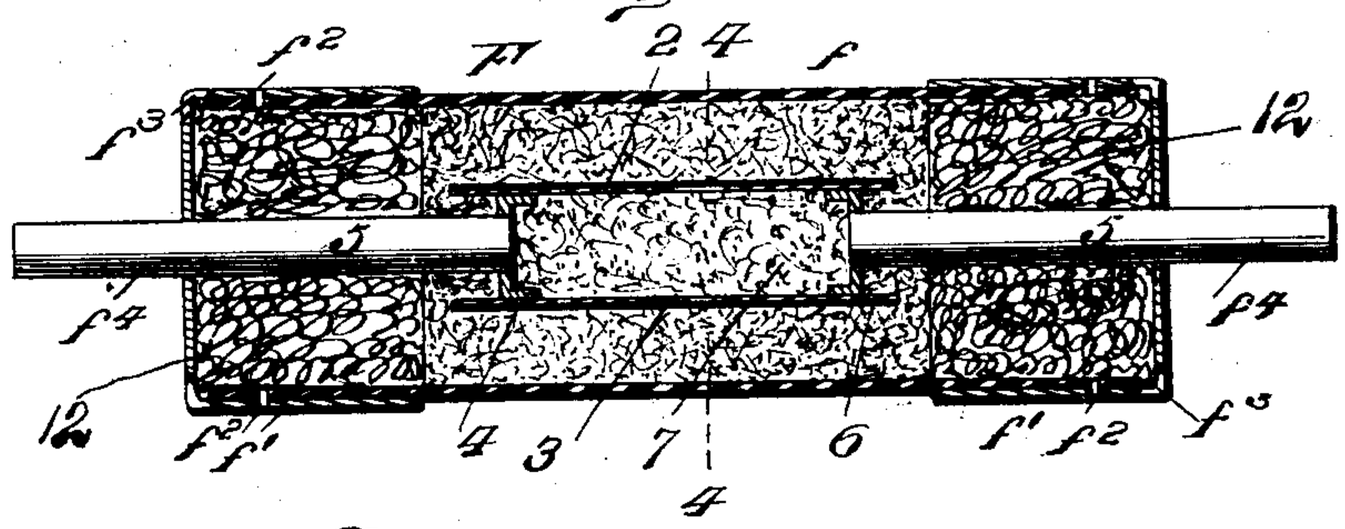


Fig. 7a

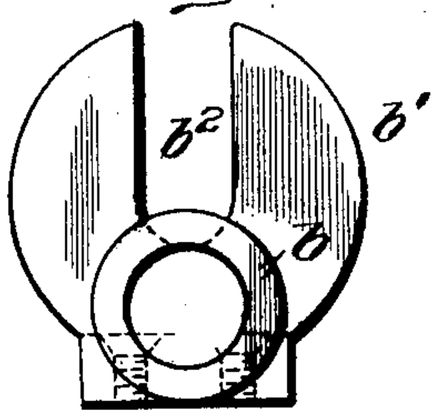


Fig. 4.

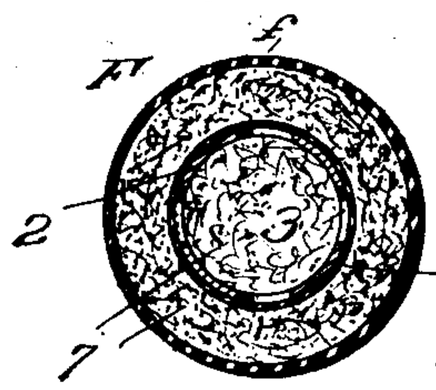
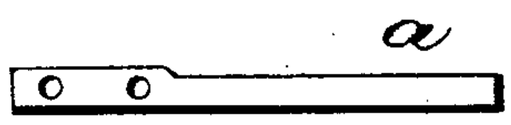


Fig. 7b.



Witnesses

Inventor

Louis W. Downes

By Philipp Bros

Attorney

No. 746,050. PATENTED DEC. 8, 1903.

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ELECTRIC FUSE OR CUT-OUT.

APPLICATION FILED MAY 7, 1902.

NO MODEL. 3 SHEETS—SHEET 2.

Fig. 5.

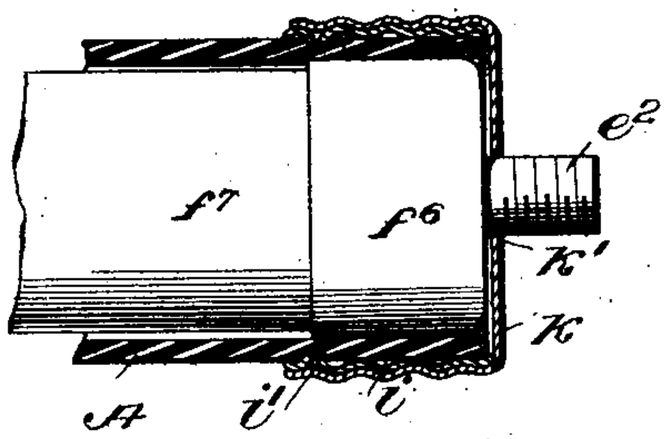

Fig. 6.

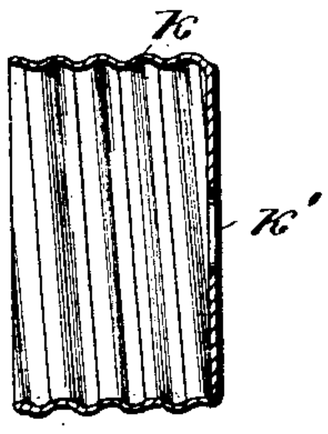

Fig. 7.

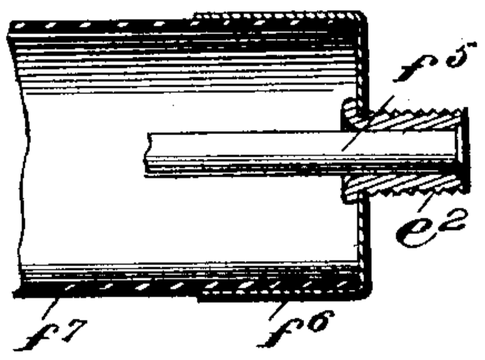

Fig. 8.

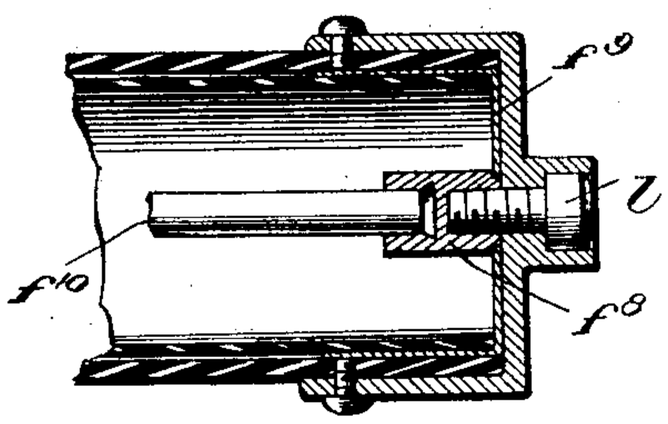

Fig. 10.

Fig. 12.

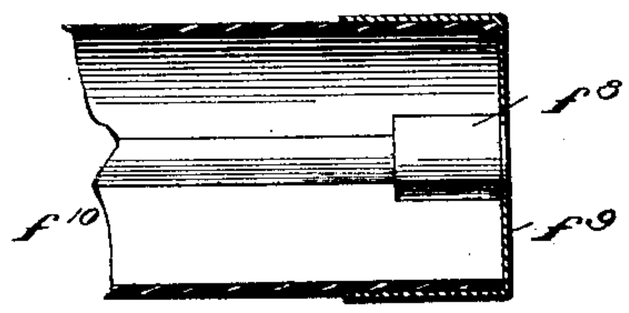

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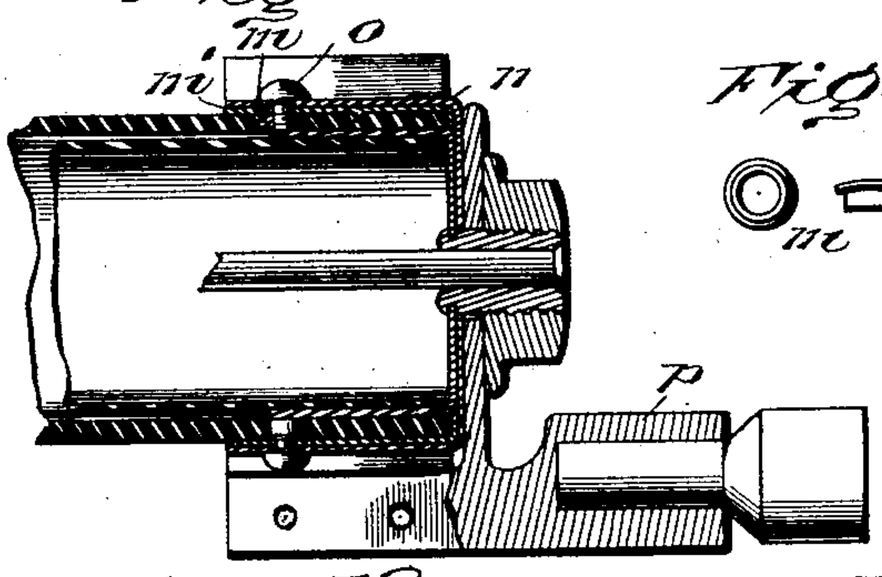
Fig. 11.



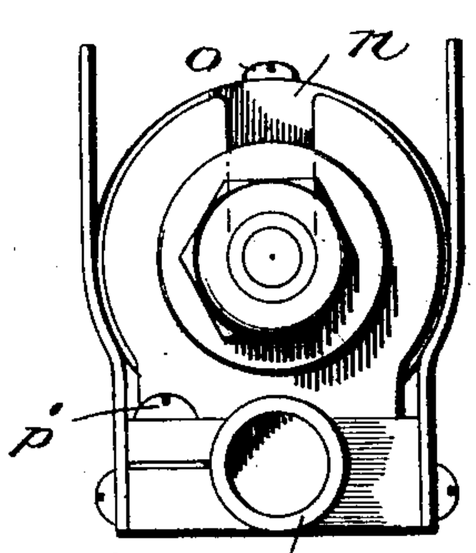
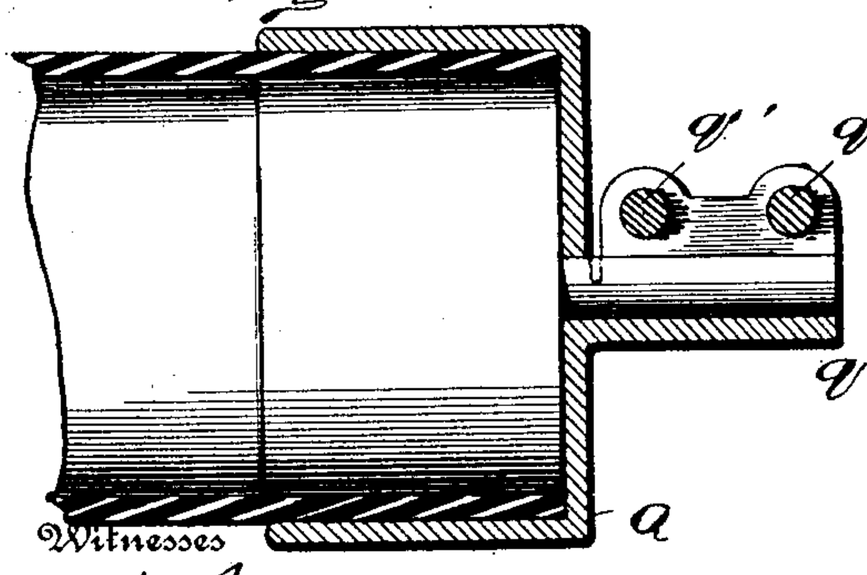
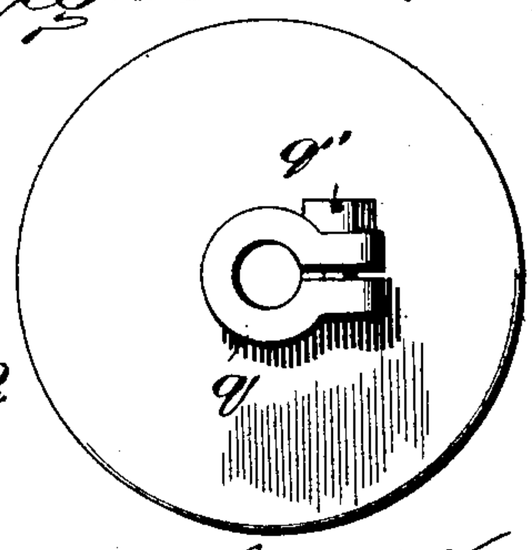


Fig. 13.

Fig. 14.





Witnesses

Jno. Innis

Inventor

Louis W. Downes

By Philip Mauro Attorney

No. 746,050. PATENTED DEC. 8, 1903.

L. W. DOWNES.

ELECTRIC FUSE OR CUT-OUT.

APPLICATION FILED MAY 7, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 15

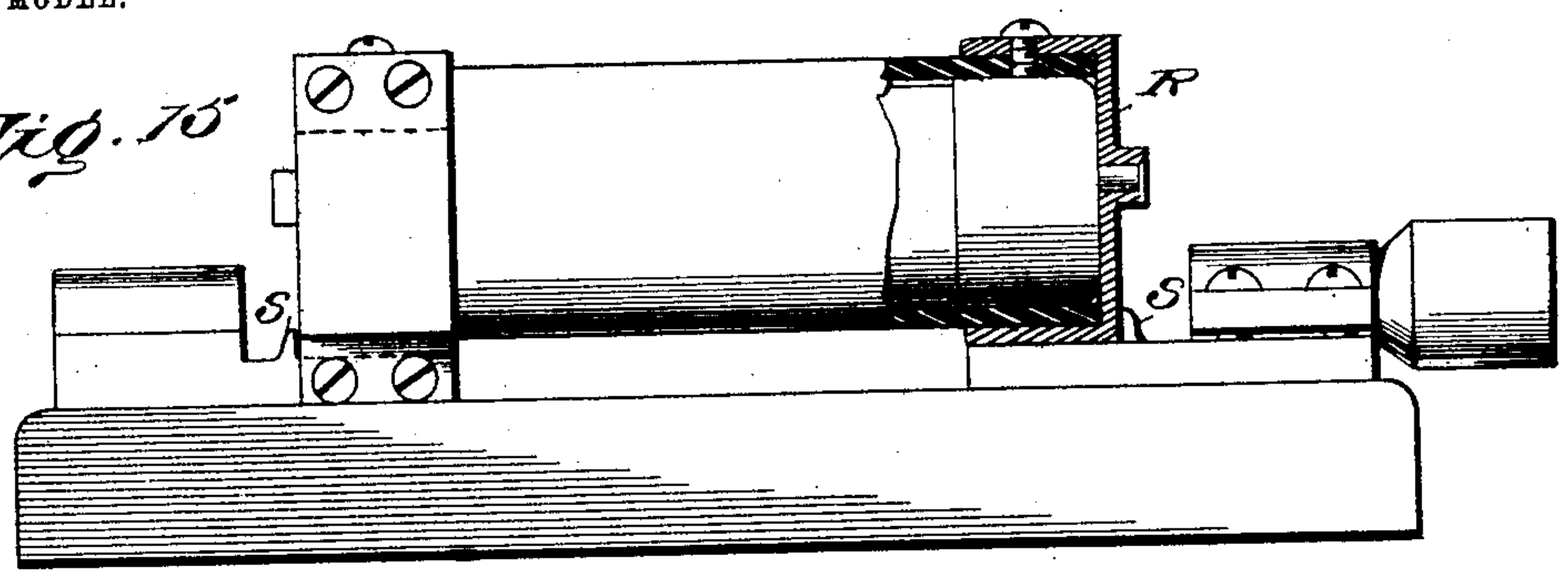


Fig. 16.

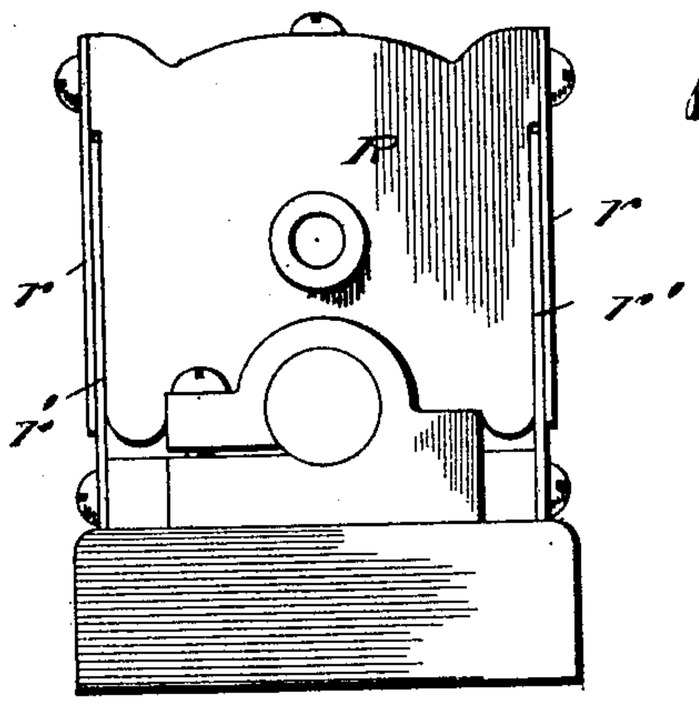


Fig. 17.

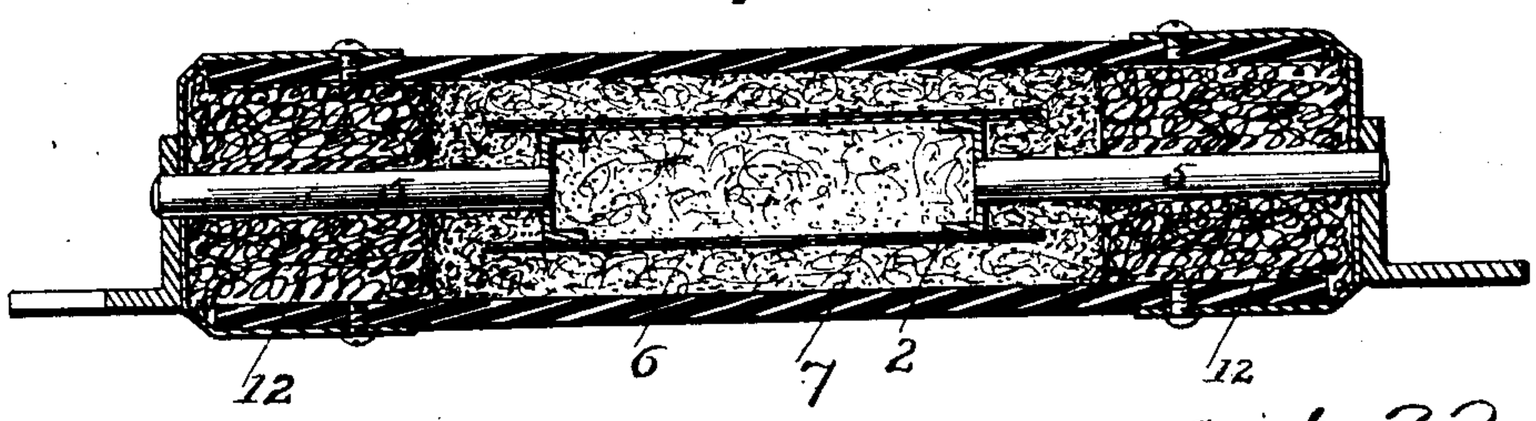


Fig. 18.

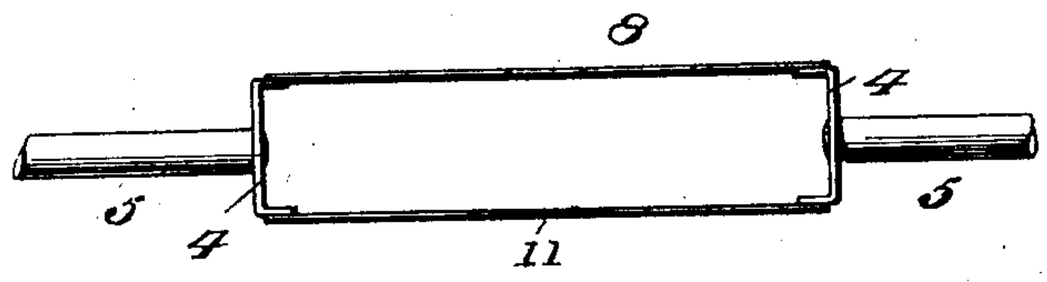


Fig. 19.

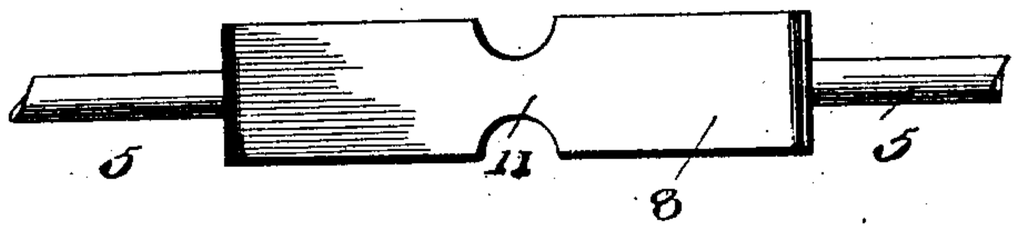


Fig. 20.

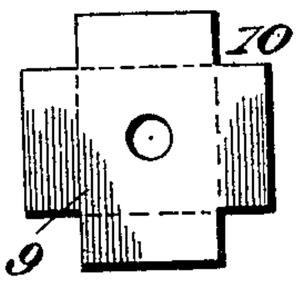


Fig. 21.

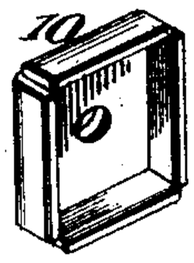
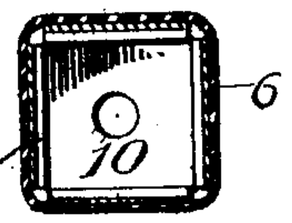


Fig. 22.



Witnesses

Inventor

Louis W. Downes

By Philip Mauro

Attorney

No. 746,050. Patented December 8, 1903.

UNITED STATES PATENT OFFICE.

LOUIS W. DOWNES, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO THE D. & W. FUSE COMPANY, OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.

ELECTRIC FUSE OR CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 746,050, dated December 8, 1903.

Application filed May 7, 1902. Serial No. 106,271. (No model.)

To all whom it may concern:

Be it known that I, LOUIS W. DOWNES, a resident of Providence, Rhode Island, have invented a new and useful Improvement in Electric Fuses or Cut-Outs, which invention is fully set forth in the following specification.

The improvements constituting my present invention are particularly advantageous as applied to high-capacity fuses, although parts of the invention may be employed to advantage in fuses of low capacity.

The invention will be most readily understood by reference to the accompanying drawings, which illustrate some of the many possible embodiments thereof.

Figure 1 is an elevation showing one of my improved fuses mounted in circuit-terminals specially adapted thereto. Figs. 1^a and 1^b are detail views of parts of the terminals. Fig. 2 is a longitudinal sectional view showing the fuse-casing in section and the cartridge-fuse within the same in elevation. Fig. 3 is a longitudinal sectional view through the cartridge-fuse of Fig. 2. Fig. 4 is a transverse sectional view on line 4 4 of Fig. 3. Fig. 5 is a sectional elevation, and Figs. 6 and 7 sectional views illustrating a cartridge-fuse and casing therefor of different construction. Figs. 8 and 9 are sectional views illustrating a modified construction of cartridge-fuse and casing. Fig. 10 is a section, Fig. 11 a detail, and Fig. 12 an end elevation, showing still another modification of the fuse-casing and a special terminal therefor. Fig. 13 is a section, and Fig. 14 an end view, of a further modification of the fuse-casing. Fig. 15 is an elevation partly in section, and Fig. 16 an enlarged end view of another modified form of casing and terminals therefor. Fig. 17 is a longitudinal sectional view showing parts of my invention embodied in a fuse having an ordinary tubular casing. Figs. 18 and 19 are detail views of an improved construction of fuse-link. Fig. 20 is a detail of a metallic blank; Fig. 21, a perspective of said blank after the wings have been bent, and Fig. 22 a transverse sectional view pertaining to a modified form of fuse-link.

Referring to Figs. 1 to 4, A is a base, of porcelain or the like, upon which the fuse-terminals are mounted. Each terminal comprises the following parts: *a*, Fig. 1^b, is a plate resting on base A. Upon one end of plate *a* rests a casting, Fig. 1^a, comprising a socket *b* for receiving the end of the circuit-conductor, and an upright plate *b'*, having a notch b^2, extending from its center upward. The casting and plate *a* are secured to base A by screws *c c*. *d d* are upright spring-blades secured to opposite edges of plate *a*, Fig. 1. E is a tubular casing, preferably made of heavy fibrous material and closed at its ends by caps E', each cap having an outwardly-projecting hollow exteriorly-screw-threaded stud *e* thereon. The caps are secured to the tubular part E by screws *e'*. F, Figs. 2 and 3, is a cartridge-fuse movably inserted in the casing. It comprises a sheath composed of tube *f*, of thin fibrous material, closed at its ends by thin stamped sheet-metal caps *f'*, which are perforated at f^2 and f^3 to permit the escape of gases evolved on the blowing of the fuse. The interior construction of the cartridge-fuse, including the construction of the fuse-link, which projects at f^4 f^4 through the caps *f' f'*, will be hereinafter explained. When the cartridge-fuse is in place in the casing, as shown in Fig. 2, the projecting ends f^4 f^4 of the fuse-link fit closely and are preferably soldered or sweated in the hollow studs *e e* of caps E' E', respectively. The cartridge-fuse is inserted in its casing by removing one of the caps E'. After the cap has been replaced and secured the studs *e e* are heated and touched with solder, which melts and runs into the small space between the projecting ends f^4 f^4 (preferably of heavy tinned copper wire) of the fuse-link and the inner walls of the studs *e e*, uniting them both mechanically and electrically. The insertion of this inclosed cartridge-fuse into the terminals of a live circuit is facilitated by the two sets of spring-blades *d d*, which make electrical contact with the caps E' E' and temporarily carry the current while the fuse-casing is being adjusted to its final position in the terminals. In this manner blistering or burning of the contact-surfaces of the upright plates *b'* and at the ends of the caps E' E' is prevented.

This is important, because should such blistering or burning occur the contact area would be so much reduced by the unevenness resulting as to be inadequate for carrying the current for which the construction was designed. A slight burning on the spring-blades or at the side of the caps is of no material consequence, and these parts can be replaced at slight expense should they become seriously damaged by continued use. As it is not always desirable or reliable to depend upon the spring-blades alone to carry very heavy currents, owing to the difficulty of getting sufficient positive contact area, I provide nuts *g g*, adapted by engagement with the screw-threads on studs *e e* to clamp the end surfaces of the caps E′ E′ into tight and positive contact with the inner faces of upright plates *b′ b′*, respectively, thus relieving the spring-blades of the necessity of carrying any great volume of current. Upon blowing of the fuse the nuts are loosened and the casing withdrawn from the terminals, one or both caps E′ E′ removed, which is readily accomplished, as the fuse-link has been melted in two at its middle. Sufficient heat is then applied to studs *e e* to melt the solder and permit the ends of the fuse-link to be pushed out, leaving the openings clean and ready for the insertion of another fuse-link. This simple operation may be readily carried out by any mechanic or the engineer of an electrical equipment, and enables large-capacity fuses to be replaced or recharged at the small expense of the cartridge-fuse, the more expensive casing and fittings being repeatedly reused.

In the construction shown in Figs. 5, 6, and 7 an exteriorly-screw-threaded hollow stud e^2 is secured in an opening in the center of each of the thin sheet-metal caps f^6, Fig. 7, which close the ends of the thin fibrous tube f^7 of the cartridge-fuse, the metal of the cap being forced into a groove around said stud. The terminals f^5 of the fuse-link are soldered in the stud, as before. In conjunction with this construction of cartridge-fuse I prefer to close the ends of the casing A in the manner indicated in Fig. 5. About each end of the tube part of the casing is a thin sheet-metal exteriorly-screw-threaded sleeve *i*, which may be secured by indenting it into the outer surface of the tube, as at *i′*, by a punch. This sleeve is engaged by a thin sheet-metal screw-threaded cap *k*, Fig. 6, having a central opening *k′*, through which stud e^2 projects. As will be apparent, the construction of cartridge-fuse and casing shown in Figs. 5, 6, and 7 may be mounted in terminals such as shown in Fig. 1 or such as hereinafter described with reference to Figs. 10 and 12.

In another construction shown in Figs. 8 and 9 the stud f^8 is secured in a central opening in each cap f^9 of the cartridge-fuse. In this instance said studs project inwardly and the terminals f^{10} of the fuse-link are soldered in the inner end thereof. A screw *l*, passing through an opening in the cap of the casing, takes into a screw-threaded socket in the stud.

In the modified construction shown in Figs. 10, 11, and 12 the cartridge-fuse is the same as that of Figs. 5 and 7; but the construction of the casing is in some respects different. Interiorly-screw-threaded eyelets *m*, Fig. 11, are forced into countersunk openings in the tubular part of the casing. A drawn sleeve *m′* of thin metal is then slipped over the end of the casing, so that openings therethrough register with the openings of the eyelets. The sleeve is then secured to the eyelets by solder applied through said openings. A cap *n* for closing the end of the casing is then slipped over the sleeve *m′* and secured by screws *o* passing through the caps into the eyelets. The presence of the eyelets and of sleeve *m′* prevents wear on the fibrous tubular part of the casing due to repeated removal of the cap *n*. The terminal for receiving the fuse, as shown in Figs. 10 and 12, is the same as that of Figs. 1 and 1ª, except that the socket *p* for receiving the end of the circuit conductor or cable is split, so that the socket may be contracted to clamp said conductor or cable by tightening a screw *p′*.

In the modified form of cap Q for the casing, as shown in Figs. 13 and 14, the stud *q* is split and adapted to be tightly clamped against the terminals of the fuse-link by tightening screws *q′*, thus avoiding the necessity of soldering.

In the modified construction of Figs. 15 and 16 the caps R of the fuse-casing have depending spring-blades *r r*, Fig. 16, at opposite sides. Similar blades *r′ r′*, projecting upwardly from the terminals, engage tightly between the inner surfaces of blades *r r* and the adjacent surfaces of caps R, thus affording a large area of electrical contact-surface between the fuse-casing and the terminals. The terminals shown in these figures have no upright contact-plates. A small lug or projection *s* on each terminal determines the proper position of the fuse with reference to the spring-blades.

Referring to the interior construction of the cartridge-fuse, as shown in Figs. 3 and 4, 2 is the fuse-link proper, consisting of a tube of suitable metal, preferably of a character capable of being readily volatilized with little or minimum disruptive action. Among the preferred metals I may mention lead, tin, zinc, and alloys thereof. The tube may be formed by molding or by bending a piece of sheet metal into proper form. The wall or walls of the tube are thereby made solid as contradistinguished from a woven-wire or similarly-formed tube or fuse-link. Openings 3 in tube 2 about its middle reduce the sectional area of metal and upon heating of the same cause melting of the fuse-link at this point. 4 4 are flanged plates or disks fitting within and closing the tubes 2 a short distance in from the ends thereof, respectively. These plates are soldered to the in-

ner wall of the tube. 5 5 are fuse-terminals soldered at one end in openings in plates 4 4, respectively, and projecting at f^4 f^4 through the caps f' f' of the cartridge, as already explained. 6 is an envelop of asbestos paper, fitting closely about the fuse-link 2. The space at the middle of the cartridge or sheath and within and about the fuse-link about the asbestos envelop is completely filled with a granular or finely-divided material 7, such as slaked lime, providing a multitude of interstices for the dissipation and escape of the gas evolved by the volatilization of the metal of the fuse-link 2 upon blowing of the fuse. The spaces in the opposite ends of the cartridge (beyond the filling 7) are tightly filled with a packing of asbestos wool 12, which holds the filling 7 in place and prevents it from jarring and sifting out through vent-openings f^2 f^3, at the same time affording such porosity as to permit the gas to readily pass therethrough to said vents.

The interior construction of fuse above described, and especially the tubular or hollow fuse-link, is most important in high-capacity fuses. As is well understood, and for the reasons set forth in my Patent No. 640,371, dated January 2, 1900, it is desirable as far as possible to reduce the area of cross-section of the metal of the fuse-link to the minimum amount, while at the same time providing a maximum surface area for conducting the electric current and radiating the heat produced by the same. Important results follow. The actual bulk or volume of metal (composing the fuse-link) necessary to carry a given current may be reduced. The metal may be so distributed that when it is suddenly volatilized by the action of the current the gases can be readily disposed of or dissipated through the porous filling which surrounds the fuse-link, with consequent reduction of the pressure developed inside of the fuse-casing. By the tubular form of fuse-link above described I attain these results to the maximum degree. With a minimum bulk or volume of metal I obtain a maximum surface of fuse-link exposed to the porous filling, since the filling on the outside as well as the filling within the cylinder provide paths for the escape of volatilized metal upon blowing of the fuse. In this connection it should be explained that the abestos envelop 6 acts simply to direct the gases toward the ends of the casing at the instant of volatilization of the metal, and yet does not entirely prevent the gases from expanding in a transverse direction, since the envelop is usually broken open upon disruption of the fuse.

While the tubular form of fuse-link of cirlar cross-section is preferred and the most efficient for my purposes, the modified forms shown in Figs. 18, 19, 20, 21, and 22 have been found to yield good results. In Figs. 18 and 19 the plates 4 4, to which the fuse-terminals 5 5 are respectively secured, are connected to two flat metal strips 8 8, reduced at their middle 11 to cause them to melt at that point. In the tubular construction shown in Figs. 20, 21, and 22 four flat metal strips 8 are used. In this case the plates to which the fuse-terminals are secured are formed from metal blanks 9, Fig. 20, the wings 10 of said blank being bent over, as shown in Fig. 21, and the end of strips of fuse metal soldered thereto. Fig. 22 shows the envelop of asbestos-paper wrapper about the four-sided fuse-link. A similar envelop is placed about the fuse-link of Figs. 18 and 19. These modified forms of the fuse-links are filled and surrounded with the granular material in the same manner as shown in Fig. 3.

As will be apparent, the herein-described fuse-link and interior construction can be used in conjunction with any suitable form of inclosing casing. For example, in Fig. 17 I have shown it used in conjunction with the ordinary tubular casing.

What I claim is—

1. In an electric fuse or cut-out, a cartridge-fuse comprising an inclosing sheath, a fuse-link within said sheath, and a filling of suitable material within the sheath about the fuse-link; a casing in which the cartridge-fuse is removably inserted comprising a tubular part, removable caps closing the opposite ends of the tubular part and electrically connected to the terminals of the fuse-link of the cartridge-fuse; and circuit-terminals in which the fuse is mounted making direct electrical contact with the caps of the casing.

2. In an electric fuse or cut-out, a cartridge-fuse comprising an inclosing sheath, a fuse-link within said sheath, and a filling of suitable material within the sheath about the fuse-link; a casing in which the cartridge-fuse is removably inserted comprising a tubular part, removable caps closing the opposite ends of the tubular part, and electrically connected to the terminals of the fuse-link of the cartridge-fuse; and circuit-terminals in which the fuse is inserted each having spring-blades making electrical contact with the sides of one of the caps of the casing and an upright plate bearing with electrical contact against the exterior surface of the end of said cap.

3. In an electrical fuse or cut-out, a casing comprising a tubular part and caps closing the ends of said tubular part, a fuse-link within the casing electrically connected between the caps, an exteriorly-screw-threaded stud projecting from each end of the casing, circuit-terminals in which the fuse is mounted each having an upright plate through which one of the studs passes, and a nut on the projecting end of each stud for clamping the end surface of each cap into tight electrical contact with the adjacent surface of the upright plate of the corresponding terminal.

4. In an electric fuse or cut-out, a casing comprising a tubular part, caps closing the ends of said tubular part, and a hollow stud

projecting from each cap; a cartridge-fuse removably inserted in the casing comprising a sheath, a fuse-link within said sheath having terminals projecting from the ends of the sheath into the hollow stud and making electrical contact therewith, and a filling of suitable material within the sheath and about the fuse-link.

5. In an electric fuse or cut-out, a casing comprising a tubular part, caps closing the ends of said tubular part, and a hollow stud projecting from and integral with each cap; a cartridge-fuse removably inserted in the casing comprising a sheath, a fuse-link within said sheath having terminals projecting from the ends of the sheath into the hollow studs and making electrical contact therewith, and a filling of suitable material within the sheath and about the fuse-link.

6. In an electric fuse or cut-out, a casing comprising a tubular part, caps closing the ends of said tubular part, and a hollow stud projecting from and integral with each cap; a cartridge-fuse removably inserted in the casing comprising a sheath, a fuse-link within said sheath having terminals projecting from the ends of the sheath into the hollow studs and soldered therein, and a filling of suitable material within the sheath and about the fuse-link.

7. In an electric fuse, a tubular metallic fuse-link having a solid wall.

8. In an electric fuse, a tubular metallic fuse-link having a solid wall perforated to cause fusing of the same at a predetermined point.

9. In an electric fuse, a tubular metallic fuse-link having a solid wall and a filling of suitable material within and about said link.

10. In an electric fuse, a fuse-link having opposing inner walls, an envelop of asbestos about the fuse-link, a filling of suitable material within the envelop and between said opposing inner walls and about the fuse-link and its envelop.

11. In an electric fuse, an inclosing casing or sheath having vent-openings at its ends, a fuse-link within the casing or sheath, a filling of suitable finely-divided material about the fuse-link, and a suitable porous filling in each end of the casing preventing the finely-divided material from sifting through the vent-openings.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LOUIS W. DOWNES.

Witnesses:
JAMES H. THURSTON,
EDWIN P. ALLEN.