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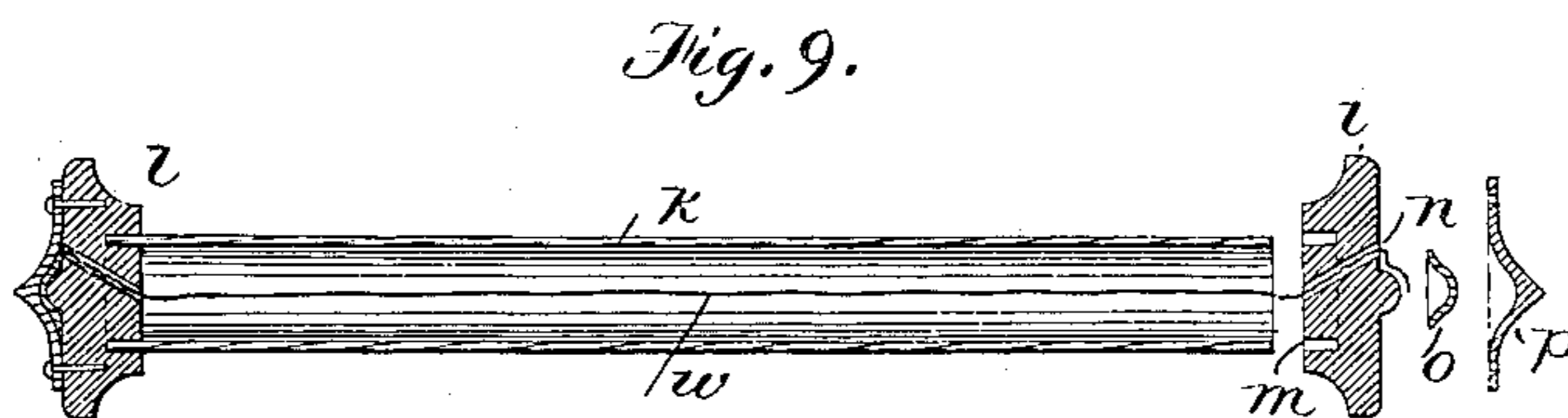
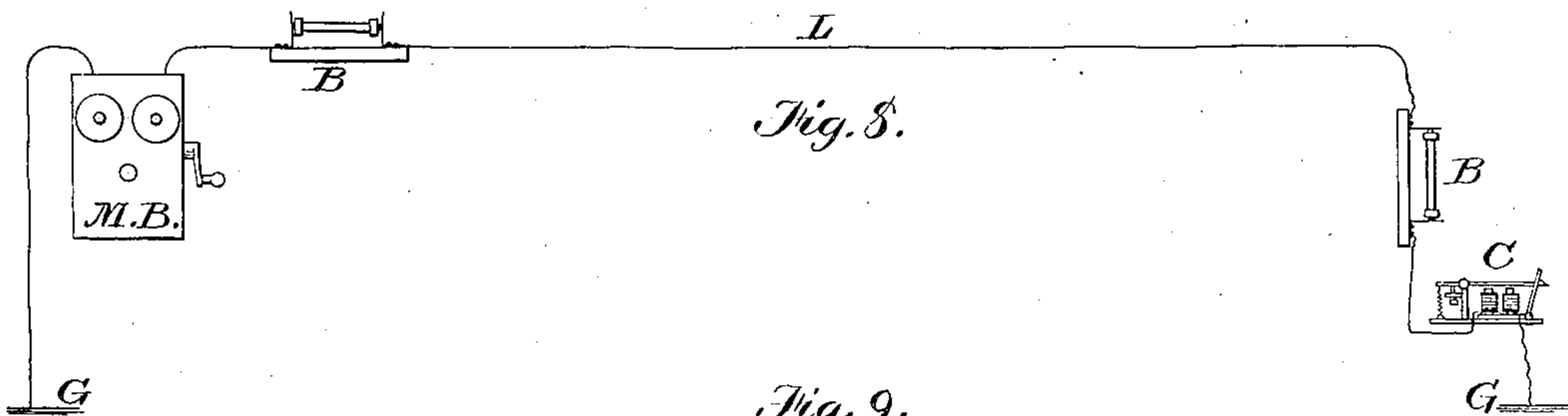
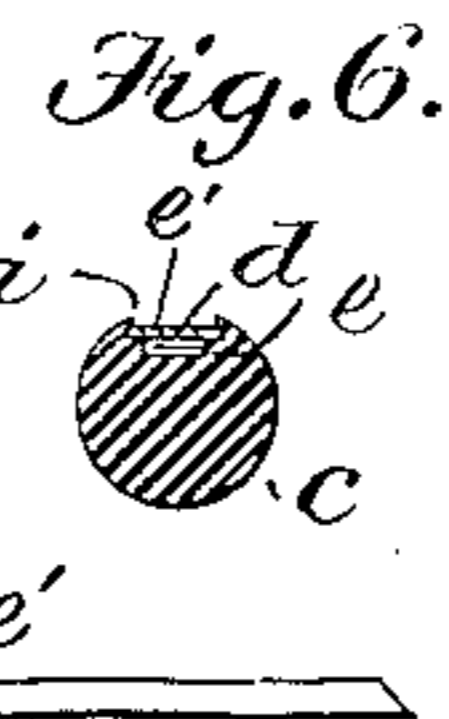
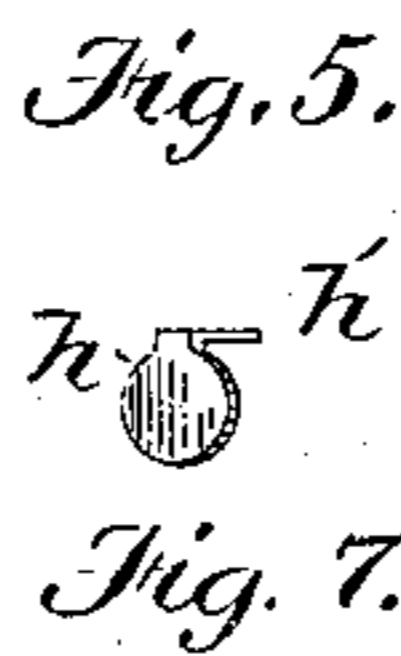
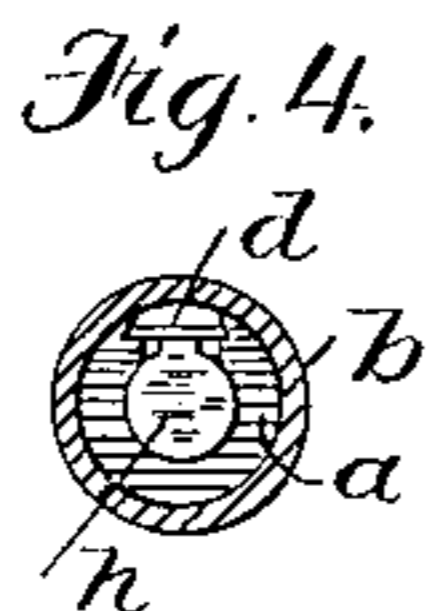
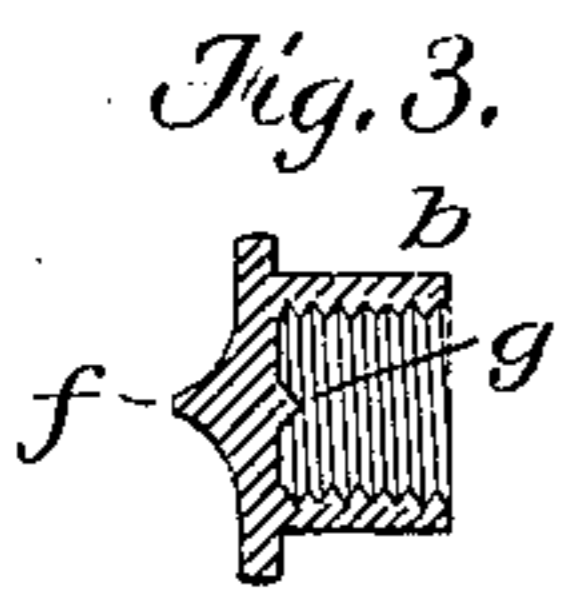
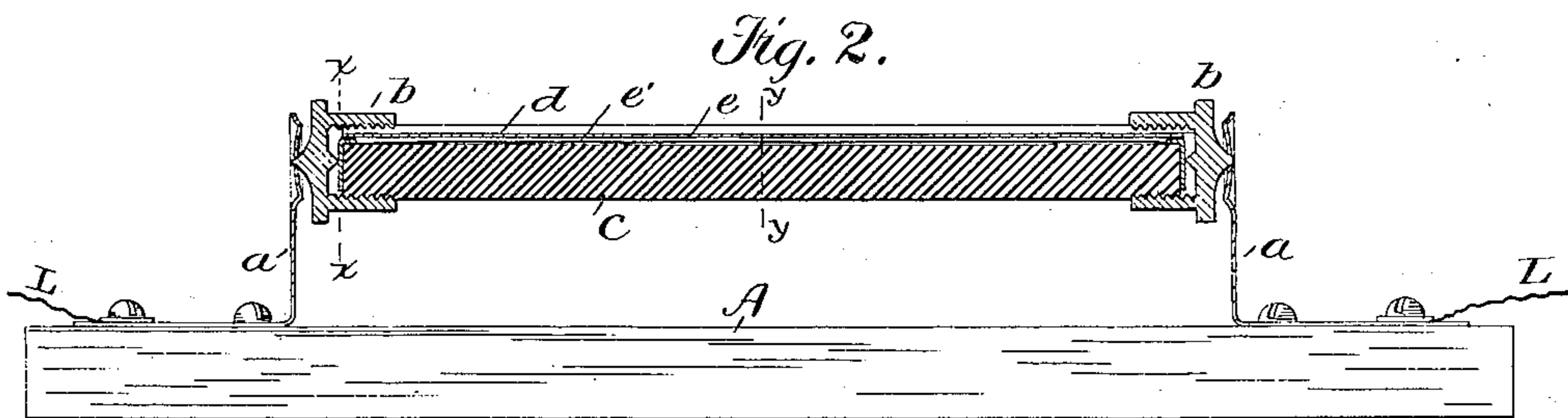
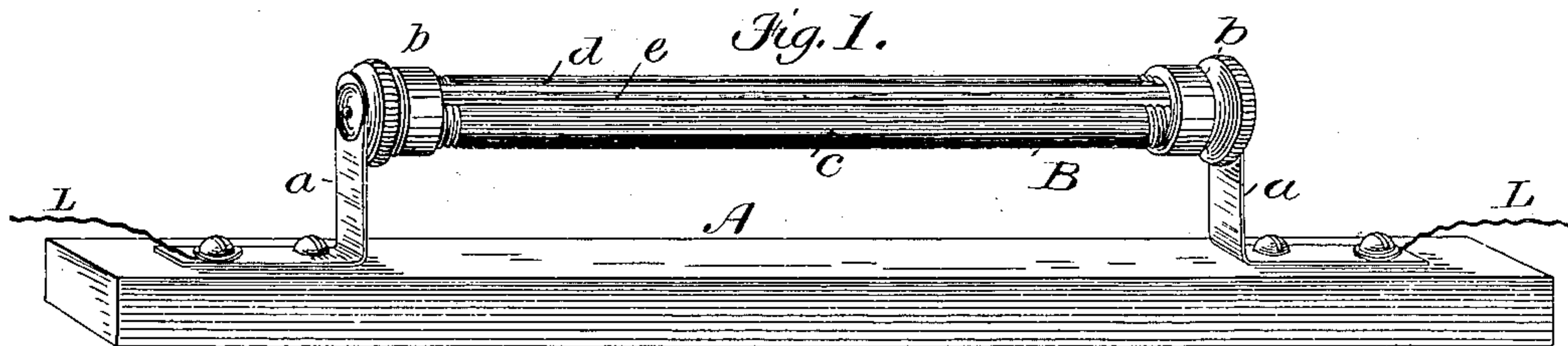
2 Sheets—Sheet I.

T. N. VAIL.

ELECTRIC APPARATUS PROTECTOR.

No. 322,214.

Patented July 14, 1885.



Witnesses.

Geo. Willis Pierce.  
Thos D Lockwood

Inventor:  
Thos N Vail

(No Model.)

2 Sheets—Sheet 2.

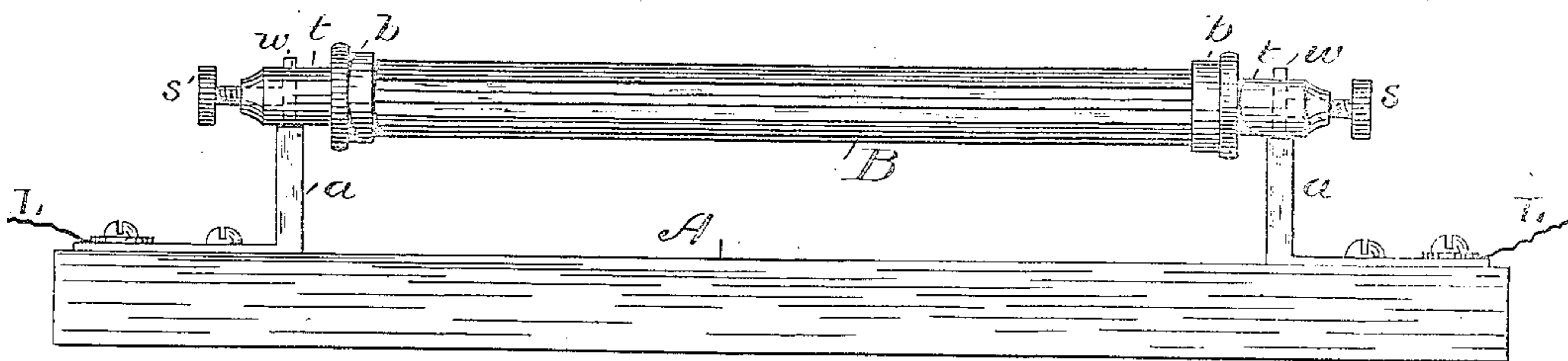
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Patented July 14, 1885.

*Fig. 10.*



Witnesses.

Geo. Willis Pierce  
Joshua Lockwood

Inventor:

T. N. Vail

# UNITED STATES PATENT OFFICE.

THEODORE N. VAIL, OF BOSTON, MASSACHUSETTS.

## ELECTRIC-APPARATUS PROTECTOR.

SPECIFICATION forming part of Letters Patent No. 322,214, dated July 14, 1885.

Application filed November 28, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, THEODORE N. VAIL, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Electric-Apparatus Protectors, of which the following is a specification.

My invention relates to the protection of telegraphic and telephonic circuits and apparatus from the disastrous consequences which have been found to result from the contact of such circuits with other circuits through which electric currents are passing of greater volume than those which traverse the circuits to be protected.

The object of my invention is to provide an efficient, economical, and easily-attached appliance for the prevention of such results, which, when destroyed or injured by the passage of the abnormal current, can be easily replaced by any person however unskilled in electrical manipulation, and, furthermore, to construct and arrange the said appliance in such a way that it may be readily inspected and its condition ascertained.

To this end my invention consists in providing, for inclusion in the circuit to be protected, at one or more suitable points, a strip of metal foil or fine wire fusible at a comparatively low temperature; in inclosing the said strip in a case formed of non-conducting material which is either wholly or partly transparent, so that the condition of the fusible conducting-link can be at all times seen, or can be readily inspected, and in providing the said inclosing-case with conducting-caps in electrical contact with the inclosing-conductor, whereby the said conductor may be readily attached to or detached from the circuit by means of spring clamps or standards, constituting a part of said circuit, and adapted to hold the protector between them, and to press upon or be screwed to the ends thereof.

Protectors of the style and character which I am now about to describe, being extremely portable, can be carried in small quantities by inspectors and linemen, and applied whenever a new one is necessary.

Figure 1 is a perspective view of my improved protector complete and mounted. Fig. 2 is a longitudinal section thereof. Fig. 3 is

a section of the terminal cap. Fig. 4 is a section on the line  $x x$ , and Fig. 6 a section on the line  $y y$ , of Fig. 2. Figs. 5 and 7 are details; Fig. 8, a diagram showing the connections of my protector in a telephonic circuit. Fig. 9 is a modification in form and construction, and Fig. 10 shows the protecting appliance mounted and connected in circuit by means of binding-screws.

Referring to the drawings, the protector consists of a rod,  $c$ , of non-conducting material and of any suitable length and thickness, (I have found a length of four inches and a thickness of three-eighths of an inch to answer well,) having a channel,  $e$ , cut longitudinally therein for the reception of the fusible conductor  $e'$ , which I prefer to make of very light and thin tin-foil. A second and wider channel,  $i$ , is also cut in the same line as the first channel,  $e$ , so as to form a shoulder therefor. The strip of foil  $e'$  is then laid in the channel  $e$ , and is of equal length therewith, so that its ends are flush with the ends on the non-conducting rod. A small metal plate,  $h$ , having a lug or nipple,  $h'$ , is then laid on the ends of the said rod, which are made smooth and flat, and the lug  $h'$ , which is narrower than the channel  $e$ , fits therein, lapping over the end of the strip of metal foil. I then place a wider strip of transparent non-conducting material,  $d$ , such as glass or mica, (glass being preferred,) in the channel or groove  $i$ ; the said strips being supported upon the shoulder of the channel  $e$ , and a closed cavity is thus formed, in which the fusible link of foil  $e'$  is inclosed, while by the reason of the transparency of the strip  $d$  it can at all times be observed.

As a means both of securing the strips of foil and mica and the end plate in place and of forming an electrical connection with the outside circuit, I provide metal end caps,  $b$ , for the base-rod  $c$ . These caps are internally threaded to fit a corresponding thread cut on the rod  $c$  at each end, and are provided with internal stud,  $g$ , and with a similar stud,  $f$ , for the outer surface. When the caps are at each end screwed into place, as shown, as in Figs. 1 and 2, the inner stud,  $g$ , presses on the metal plate  $h$ , while the entire end of the rod

is surrounded by the substance of the cap, and the foil conductor and glass covering-plate are both thus held in place, the former being electrically united with the cap *b* through the plate *h* and projecting stud *g*. The protector B is now complete, and may be mounted by placing it between the spring-clamps *a*, which are suitably affixed to a base-board, A, and connect by wires L with the main circuit.

The outer projecting stud, *f*, fits into a corresponding recess formed on the face of each spring-plate *a*. The position of such protectors in a telephone-circuit is indicated by the diagram, Fig. 8, in which L is the main line, C an annunciator at one terminal station, and M B a signaling apparatus at the other. B B are the protectors, which are thus inserted in the circuit at a point immediately external to the instruments. In the exercise of the function of such protectors, should a current of abnormal strength be thrown on the circuit, the strip of foil or fusible metal will at once fuse, breaking the continuity of the circuits. Inasmuch, however, as the chamber *e* is completely closed, none of the particles of molten metal can escape, and damage which might thus accrue is thus prevented, while the disruption of the circuit is at once seen by means of the transparency of the cover or partition *d*.

Fig. 9 shows a modification in form. The fusible conductor *w*, which may be a fine wire of suitable metal or alloy, is placed within a glass tube, *k*, for which I provide at each end a cap, *l*, of wood, hard rubber, or similar substance, having a circular groove or recess, *m*, in which the terminal edges of the glass tube fit. The caps are also perforated, and the edges *n* of the wire are led therethrough and lap over the apex of each cap. A metal thimble or saucer-shaped plate, *o*, may now be placed over the end, while over all the contact-plate *p* is applied and screwed down. If preferred, the small plate *o* may be placed below the end *n* of the wire, in which case the wire will be compressed between the plate *o* and the external plate, *p*. The parts are, for the purpose of illustration, shown disconnected at one end. When constructed, this protector may be connected in circuit in the before-described manner.

Fig. 10 shows an improved form of mounting my inclosed protector by means of binding-screws. By adopting this plan, which is in some respects preferable, I am enabled to dispense with spring-contacts, which have heretofore been employed.

A is the base-board, to which standards *a*, connected electrically with the line-wire L, are attached. These standards terminate in stout wires or cylindrical rods *w*.

The protecting appliance B is made as hereinbefore specified, with the exception that the metal cap *b* has a screw-terminal, *t*, affixed thereto and homogeneous therewith. The said terminal has a hole drilled therethrough for

the reception of the wire or rod *w*, and a screw, *s*, binds the wire in a manner well understood.

What I claim is—

1. A protector for electrical circuits, comprising a fusible safety-strip of metal foil or wire, a non-conducting case inclosing said strip and supporting it for its entire length, the whole or a portion of said case being transparent, and metal end pieces or caps for the said case, mechanically attached thereto and in electrical contact with the fusible conductor, whereby the said fusible conductor may be connected with an electric circuit, substantially as specified.

2. The combination, in a circuit-protector substantially of the character specified, of an easily-fusible conductor—such as a thin strip of metal foil or fine wires—and case therefor, of hard rubber or like material, inclosing and supporting said conductor, a plate or strip of glass or mica constituting one side of said case, and metal end pieces or caps adapted to secure the said conductor and the transparent medium to the case, and also constituting the terminals of said conductor.

3. The combination, in a circuit-protector, of a rod of hard rubber or like non-conducting material, longitudinally grooved or channeled on one side thereof, the said groove being shouldered, as specified, a strip of tin-foil resting in the said groove, a strip or plate of mica or glass placed over the said tin-foil, on the shoulder of the said groove, and forming with the sides of the grooves an inclosing-chamber for the said tin-foil, and terminal pieces or caps adapted to screw on the ends of the hard-rubber rod, whereby the said plate of glass or mica is fastened thereto for the purpose of constituting an electric connection for the tin-foil strip, substantially as described.

4. In a circuit-protector, the combination of a rod of hard rubber or similar non-conductor, longitudinally grooved, as specified, so as to form a shoulder-cavity throughout its length, a fusible strip of metal foil of equal length resting in the said cavity, a metal plate at each end provided with a lug or nipple, the said lug being adapted to overlap the end of the tin-foil strip in electrical contact therewith, a strip of transparent non-conducting material—such as glass or mica—adapted to rest upon the shoulder of the longitudinal cavity, and constituting one of the sides of the said cavity, and terminal pieces or caps internally threaded and adapted to be screwed upon the ends of the non-conducting rod, and to form an electrical connection by means of the metal plate with the fusible conductor, and also to hold in place the several elements of the protector, as specified.

5. The combination, in a circuit-protector, substantially as hereinbefore described, of a fusible safety-strip of metal foil or wire, an inclosing-case of hard rubber or similar non-conducting material, a plate or strip of glass or mica constituting one side of said case, and

metal end pieces or caps adapted to be screwed to the end of the inclosing case, thereby connecting with the fusible conductor and securing the same, together with its transparent cover, the said caps also being provided externally with binding-screw terminals for attachment to the main line, for the purposes specified.

5 6. The combination, with a circuit-protector or constructed, as described, of a grooved non-conducting rod, a fusible metal strip or wire placed in said groove, and conducting terminal caps for the said rod connecting with the fusible strip and having binding-screws attached thereto, of an electric circuit and stand-

ards carrying projecting wires or rods mounted on a suitable base and permanently connected with the said circuit, the said projecting wires being adapted for connection with the protector binding-screws, whereby the said protector is included in the circuit, substantially as and for the purposes set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 24th day of November, 1884.

THEO. N. VAIL.

Witnesses:

GEO. WILLIS PIERCE,  
THOS. D. LOCKWOOD.