(No Model.) 3 Sheets—Sheet 1.

P. CARDEW.

THERMAL CUT-OUT.

No. 421,240. Patented Feb. 11, 1890.

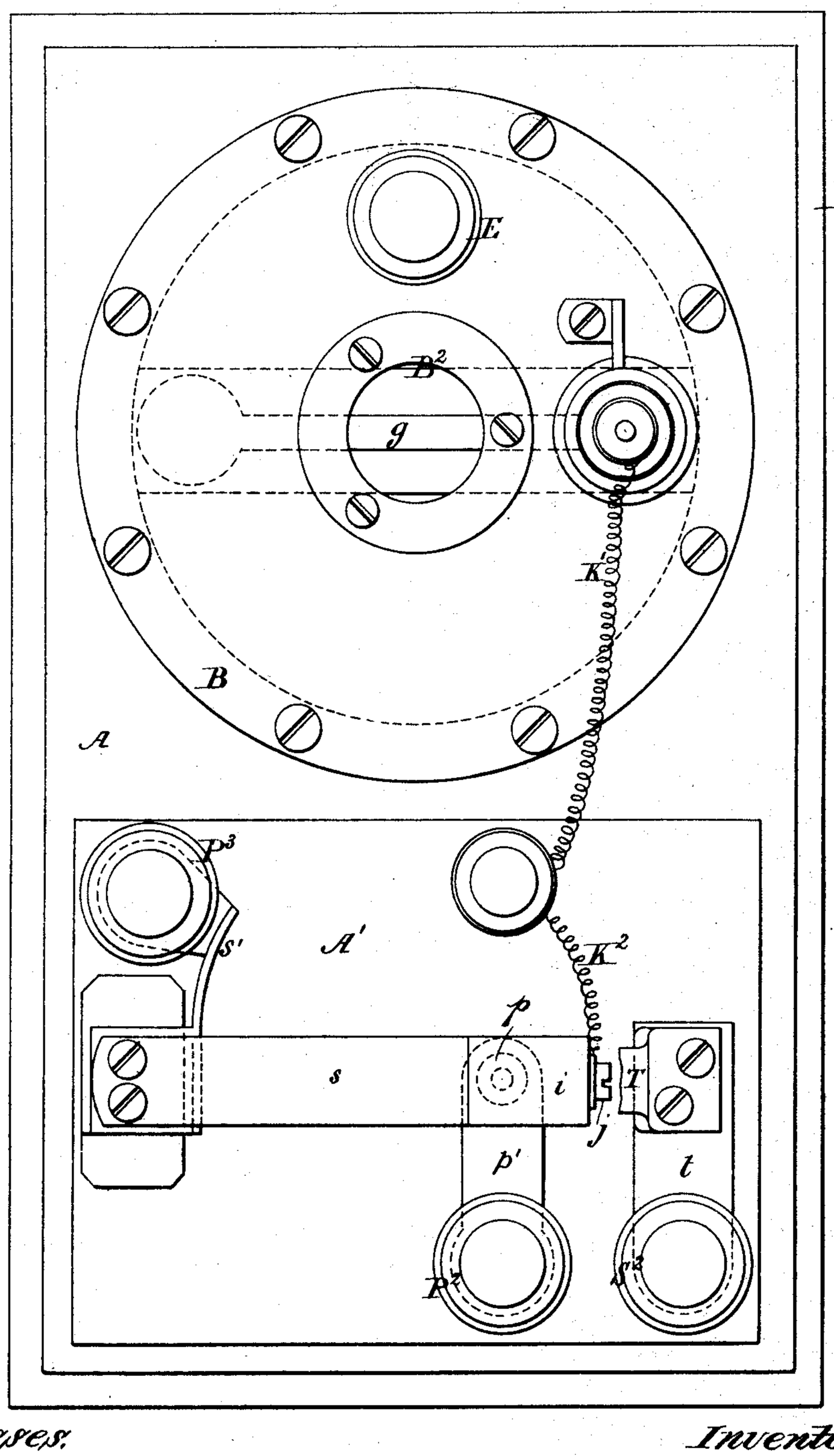


Fig. 1.

Witnesses:
J. Fran Meyers Jr.
Robert Everett

Inventor:
Philip Cardew.
By James L. Norris.
Atty.

(No Model.) 3 Sheets—Sheet 2.

P. CARDEW.

THERMAL CUT-OUT.

No. 421,240. Patented Feb. 11, 1890

Fig. 2.

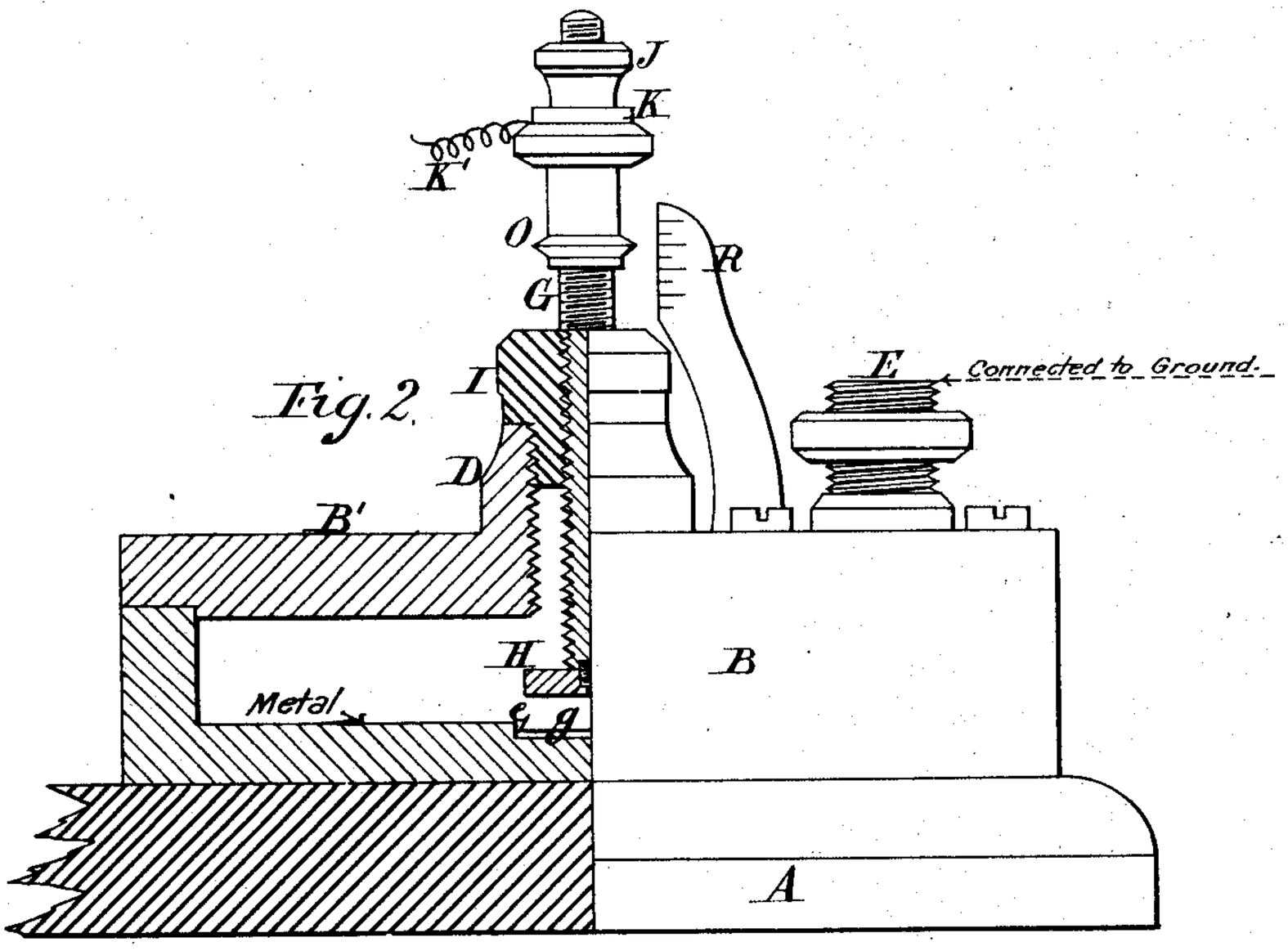
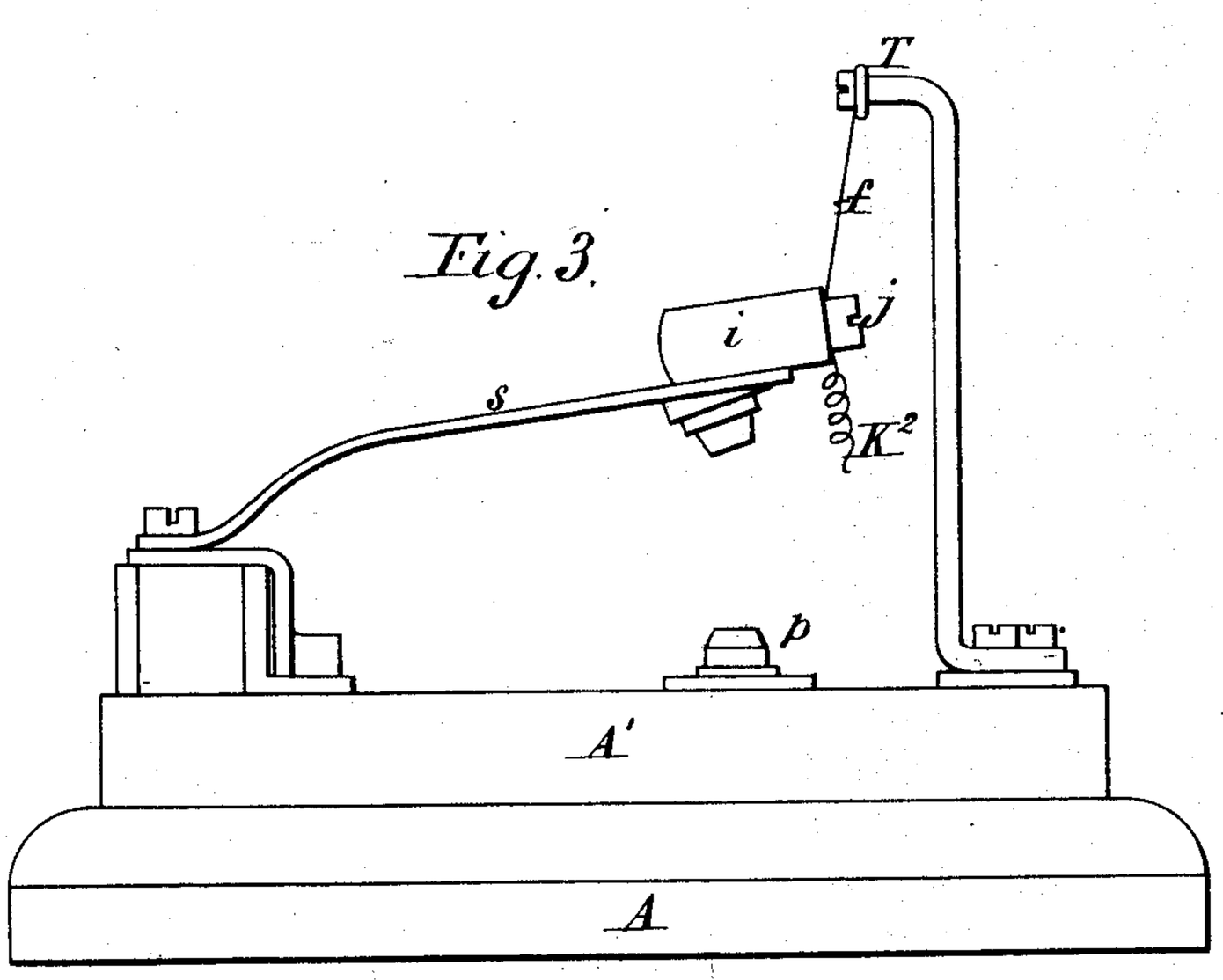


Fig. 3.



Witnesses.
J. Frank Meyers Jr.
Albert Garrett

Inventor.
Philip Cardew,
By James L. Norris.
Atty.

(No Model.) 3 Sheets—Sheet 3.

P. CARDEW.

THERMAL CUT-OUT.

No. 421,240. Patented Feb. 11, 1890.

Fig. 4.

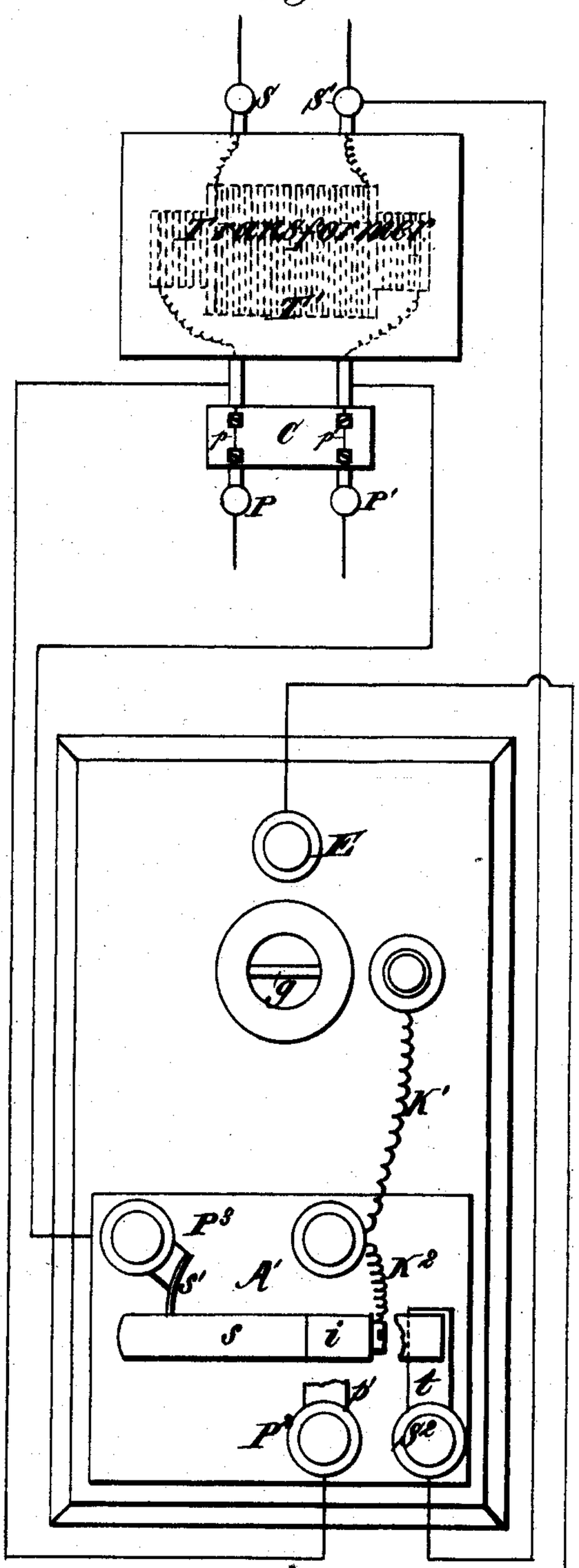
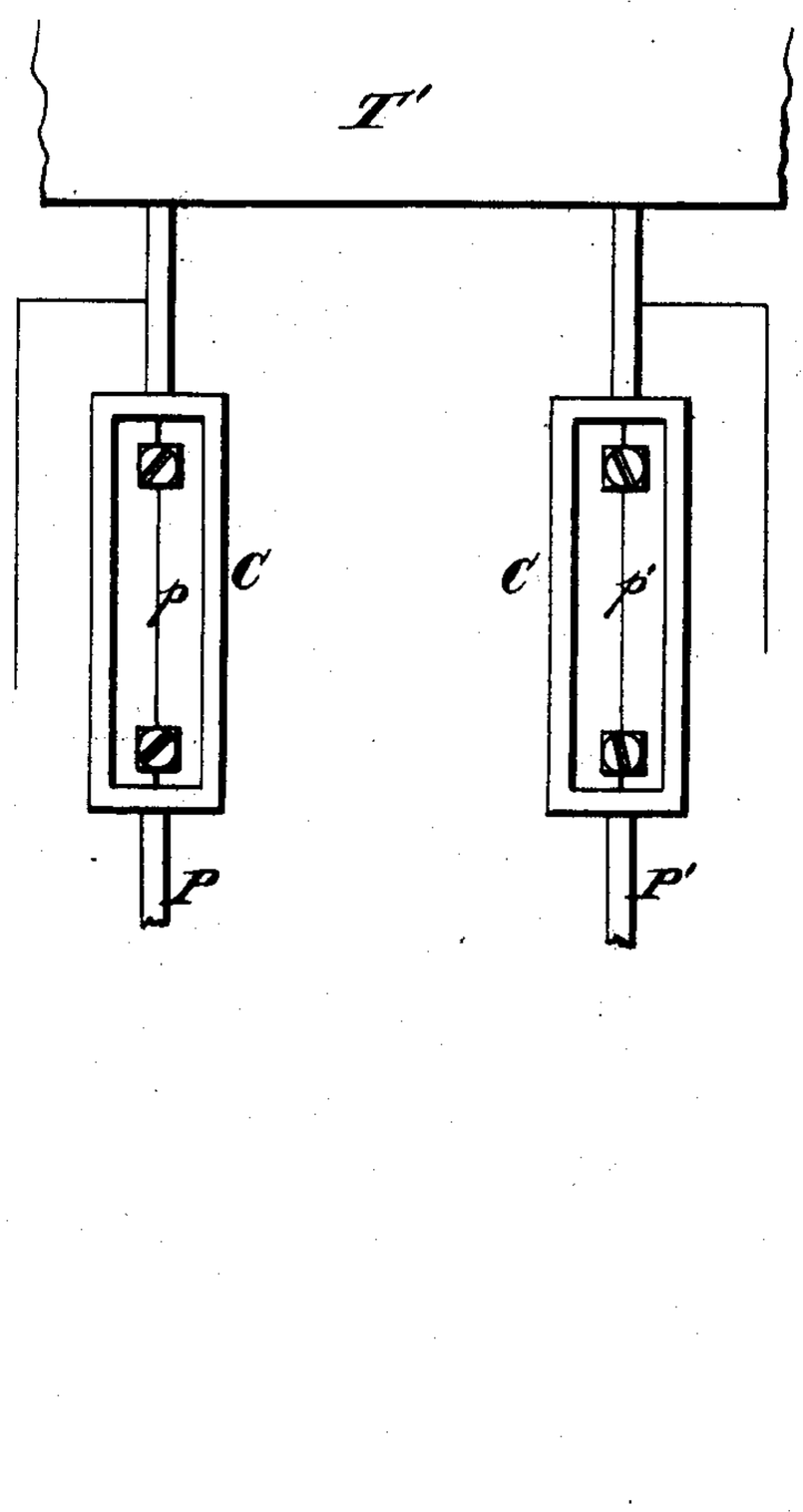


Fig. 4a.



Witnesses.
Robt Everett.
J. G. Meyer Jr

Inventor.
Philip Cardew.
By James L. Norris
Atty.

UNITED STATES PATENT OFFICE.

PHILIP CARDEW, OF CHATHAM, COUNTY OF KENT, ASSIGNOR TO BERNARD MERVYN DRAKE AND JOHN MARSHALL GORHAM, OF WESTMINSTER, ENGLAND.

THERMAL CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 421,240, dated February 11, 1890.

Application filed February 18, 1889. Serial No. 300,302. (No model.) Patented in England November 12, 1887, No. 15,484, and in France January 24, 1889, No. 195,603.

To all whom it may concern:

Be it known that I, PHILIP CARDEW, captain in the Royal Engineers, a citizen of England, residing at Brompton Barracks, Chatham, in the county of Kent, England, have invented Improvements in Safety Devices for Use in Connection with Electrical Circuits, (for which I have obtained Letters Patent in Great Britain, No. 15,484, dated November 12, 1887, and in France, No. 195,603, dated January 24, 1889,) of which the following is a specification.

This invention relates to improvements in safety devices for use in connection with electrical circuits, more particularly those whereon induced or secondary currents are employed, whereby when the potential of the current in such circuits becomes dangerously high the breaking of the circuit is effected automatically.

It is well known that when transformers are employed for converting a high-tension primary current into a low-tension secondary current of greater quantity a fault may occur whereby contact is made between the primary and secondary conductors of the transformer, whereby the current of the secondary circuit becomes charged with the potential of the primary circuit at the point of contact, thus establishing a condition which may be injurious or even fatal to the life of persons handling conductors, lamps, &c., on the secondary circuit.

The invention consists in the features and combination of devices hereinafter described and claimed, reference being made to the accompanying drawings, in which—

Figure 1 shows a plan of the complete apparatus. Fig. 2 shows a part sectional elevation of the apparatus with the insulated plate and strip of foil. Fig. 3 shows an elevation of the apparatus with the fine wire and contact-spring. Fig. 4 is a diagrammatic plan showing the connections of the apparatus with the primary and secondary circuits of the transformer, and Fig. 4ª is a plan view showing a cut-out device.

B is a metal box mounted on a stand A of insulating material and containing within a recess *e* in its bottom the double strip of thin metal foil *g*, formed as two disks, connected by a thin strip. This foil is normally in contact throughout with the bottom of the box and with earth through the terminal E; but there is no contact with earth made on the secondary circuit of the transformers at any point.

G is a metal rod screwed through an insulating-bush I, screwed into the hole D of the box, which rod carries at its lower end a plate H of conducting material, while at its upper end it has a terminal J, to which is connected by a washer K a wire K′, leading to a contact-screw on a plate A′, carrying the short-circuiting apparatus, from which screw another wire K^2 leads to a pinching-screw *j* on an insulating-block *i*, fixed on a spring-arm *s*, the wire K^2 being also connected to a fine wire *f*, by which the spring-arm *s* is suspended from a conducting-post T. This post is connected by a conductor *t* to a terminal S^2, from which a conductor passes to the one terminal S′ of the secondary coil of the transformer T′. The spring-arm *s* is connected to the terminal P^3, from which a wire passes to the terminal P′ of the primary coil of the transformer. The spring *s* tends to descend and make contact with a stud *p*, connected by a conductor *p*′, terminal P^3, and conducting-wire with the second terminal P of the primary coil of the transformer.

The action of the apparatus thus arranged will be as follows: Whenever by a fault in the transformer the potential of either side of the secondary circuit rises sufficiently high to become dangerous to persons handling the conductors thereon, such potential will be transmitted to the insulated plate H in the box B through S^2, T, *f*, K^2, K′, and G. On account of the great difference of potential between H and earth, and as practically the insulation of the circuits is never so perfect as to prevent a connection with earth at some point thereof, the portion of metal foil *g* under the plate H will be attracted by the latter and will rise into momentary contact with it, the other portion remaining in contact with earth through the box B and terminal E. A momentary current will thus be produced which will start an arc; but this will be im-

mediately suppressed by the fusing of the fine wire *f*, whereby the arm *s* will be made to descend, and in making contact with *p* and P^2 will short-circuit the primary coil of the transformer. Upon the latter is arranged an automatic cut-out or circuit-breaking device C, as shown in Fig. 4ª, which is brought into action by the decrease of resistance between P and P′, produced by the short-circuiting, and which thus effects the interruption of the primary circuit.

In Fig. 4ª I show a cut-out device comprising simply two insulated fine wires *p p′*, interpolated in the leads P P′ of the primary circuit, which wires melt simultaneously when the resistance is decreased by the short-circuiting. The position of the foil *g* in the box is visible through a glass window B^2 in the cover B′ of the box B. The spindle G carries an ivory disk O, acting as a pointer to a scale R, by means of which the distance of the plate H from the foil *g* can be accurately adjusted.

Having thus described the nature of my said invention and in what manner the same is to be performed, I claim—

1. In a safety apparatus for preventing the occurrence of a dangerously-high potential on electric circuits, a device interposed between the circuit to be protected and earth, consisting of an insulated plate in connection with said circuit, and a strip of metal foil connected at one end with earth and having its other end situated in close proximity to the said plate, in combination with a fine wire introduced in the connection of said metal foil with earth, a short-circuiting lever supported by the fine wire, which, when released by the fusing of the wire, short-circuits the current in the said circuit, and a circuit-breaking device included in the said circuit, which is brought into action by the short-circuiting, substantially as described.

2. In a safety apparatus for preventing the occurrence of a dangerously-high potential on electrical circuits, a medium interposed between the circuit to be protected and earth, consisting of an insulated plate which is connected to and charged with the potential of such circuit, and a thin strip of foil having its one end situated at a short distance from the said insulated plate, so as to be attracted thereby when the plate is charged with high-potential electricity, while its other end remains in contact with earth, substantially as herein described.

3. In safety apparatus for preventing the occurrence of a dangerously-high potential on an electrical circuit, the combination of an insulated plate H, which is in conducting-connection with the circuit, a strip of metal foil *g*, which is in connection at one end with earth and at the other end is situated a short distance from the said plate, a piece of fine wire *f*, introduced in the conductor connecting the circuit with the plate, and a short-circuiting spring-contact *s*, which is held out of contact by the fine wire *f*, but which closes the short-circuiting contact when the wire *f* is fused, substantially as described.

4. In a safety apparatus for preventing the occurrence of a dangerously-high potential on an electrical circuit, the combination of metal box B, with earth-connection at E, a screwed stem G, screwing through an insulated bush I in the box and having at its lower end a conducting-plate H and at its upper end a terminal J, connecting with the circuit, a strip of metal foil G, situated in a recess *e* of the box B, a fine wire *f*, connected at one end with the post T, communicating with the circuit, and at the other end with an insulated contact-spring S and by wires K′ K^2 with the terminal J, a terminal P^2, with which spring *s* makes contact and which is connected to the one side of the circuit, and a terminal P^3, connected to the spring *s* and with the other side of the circuit, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 1st day of February, A. D. 1889.

PHILIP CARDEW.

Witnesses:

CHAS. D. ABEL,
Patent Agent, 28 *Southampton Buildings*, *London, W. C.*

JNO. P. M. MILLARD,
Clerk to Messrs. Abel & Imray, Consulting Engineers and Patent Agents, 28 *Southampton Buildings, London, W. C.*