

No. 615,186.

Patented Nov. 29, 1898.

J. F. KELLY.
ELECTRIC SAFETY DEVICE.

(Application filed Apr. 14, 1898.)

(No Model.)

2 Sheets—Sheet 1.

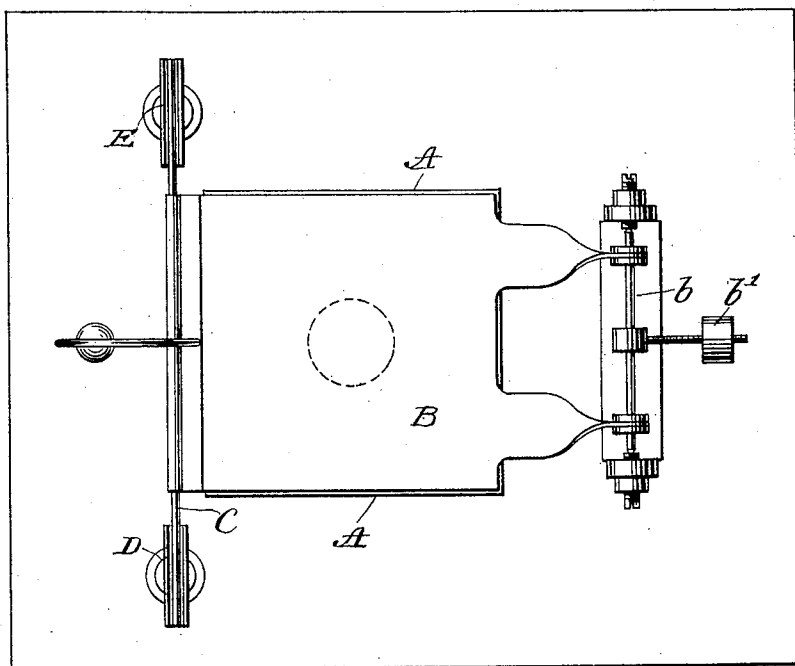


Fig. 1.

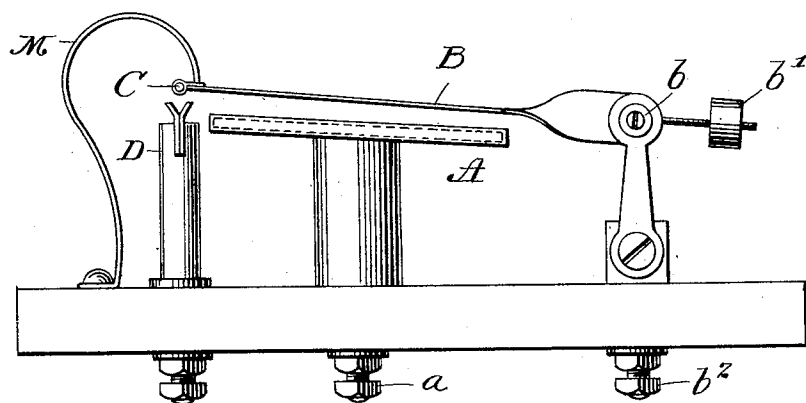


Fig. 2.

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2 Sheets—Sheet 2.

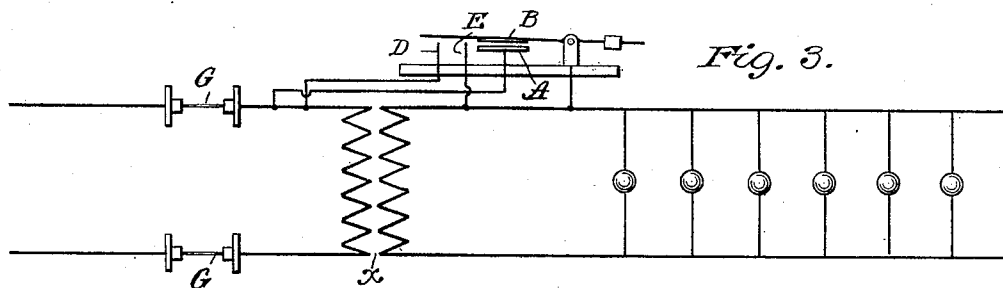


Fig. 3.

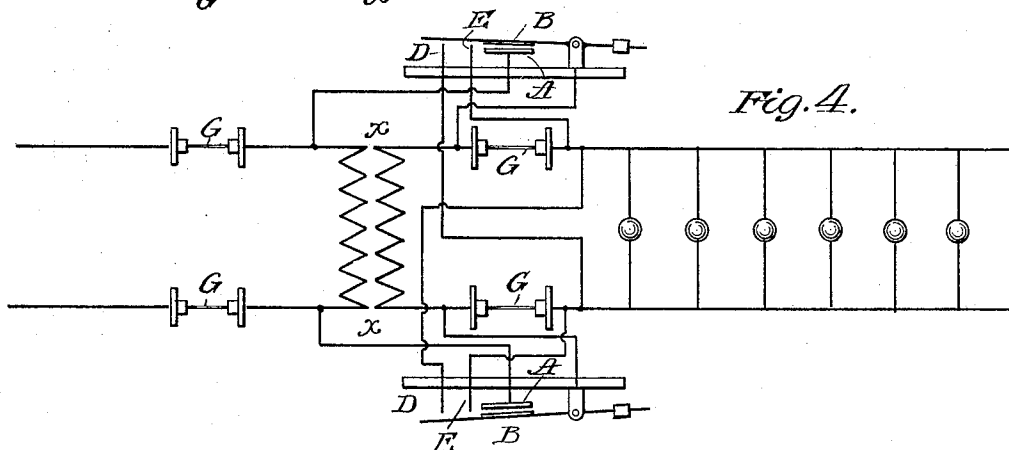


Fig. 4.

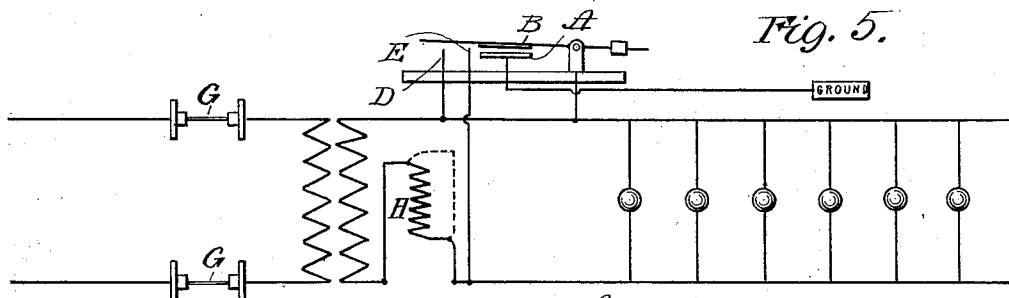


Fig. 5.

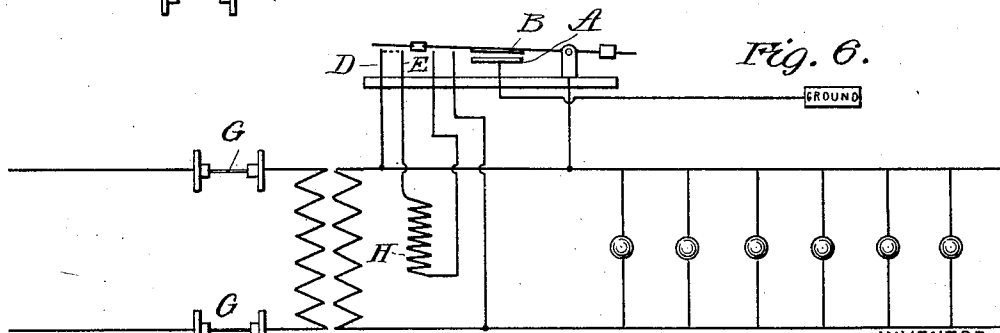


Fig. 6.

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ELECTRIC SAFETY DEVICE.

SPECIFICATION forming part of Letters Patent No. 615,186, dated November 29, 1898.

Application filed April 14, 1898. Serial No. 677,555. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. KELLY, a citizen of the United States, residing at Pittsfield, Massachusetts, have invented certain new and useful Improvements in Electric Safety Devices, of which the following is a full, clear, and exact description.

The object of my invention is to provide a safety device for transformers and other apparatus in which two electric conductors, normally separate, are in close relation to one another, being applicable even to apparatus in which one of such conductors is a metallic portion, such as the core of a field-magnet, which is never intentionally traversed by an electric current. The device is such that when the insulation breaks down between the two conductors or a connection is made by other means the circuit will be automatically interrupted in such a manner as to prevent danger to life and other dangers that would arise. In an alternating transformer when the insulation between the primary and secondary coils breaks down the potential of the primary becomes impressed upon the secondary and renders the device extremely dangerous, and some means should be provided to prevent this danger. The ordinary safety-fuse in the primary has been relied upon with the expectation that the failure of the insulation between primary and secondary would lead to a short circuit in one of the coils, thereby increasing the primary current to such an extent as to blow the fuses. This, however, is far from being always the case and is obviously not an adequate protection. Ground-shields also have been provided—that is, a conductor interposed between the primary and the secondary and grounded so that the primary current would necessarily make connection with this shield before reaching the secondary circuit, and in like manner the secondary itself has either been permanently grounded or arrangements have been introduced between it and the ground, which, under the abnormal increase of potential due to the failure of the insulation between the two coils, would short-circuit, causing a ground. In all these last-mentioned cases the idea has been to secure safety by grounding the injured transformer. To a certain

extent this is successful in that it lessens the risk consequent upon touching the transformer or the secondary circuit. It, however, causes a dead ground upon one side of the primary line, and thereby vastly increases the danger throughout the rest of the system, since all the other transformers in the system are subjected to abnormal strains, and the risk of coming into contact with the live side of the circuit or other transformers is vastly increased. To insure entire safety, the injured transformer should not be grounded. It should be disconnected from either the primary or secondary wires, or both. The device shown herein accomplishes this.

In the accompanying drawings, Figure 1 represents a plan view of one embodiment of part of my device. Fig. 2 is a side elevation thereof. Fig. 3 is a diagrammatic view of the same as applied between the primary and secondary circuits. Fig. 4 is practically the same diagrammatic view with the safety device duplicated to provide for a breakdown toward the other end of the transformer, but connected up in a way to short-circuit the secondary circuit. Figs. 5 and 6 show modifications of the arrangement of the broad idea.

A is a fixed vane of an electrostatic device and which is preferably covered with insulation and which, as shown, is connected to the primary circuit by a conductor attached to a suitable binding-post *a*. B is a movable vane of said device preferably pivoted at *b* and carrying an adjustable counterweight *b'*. M is a stop for this vane. The vane B also carries a contact-arm C for the purpose hereinafter specified, and to it is led a wire from the secondary circuit through the binding-post *b*², as shown in Fig. 2 and in the diagrams.

D and E are relay-contacts on the base F, crossed by the contact-arm C, and are connected to the terminals of the local circuit, as shown. In this construction fuses G or other circuit-rupturing devices are provided at any proper points, as shown.

Fig. 3 shows A connected to one side of the primary coil, whereby it is maintained at the potential of one of the primary mains, and B connected to the corresponding side of the

secondary. The local circuit is connected to the corresponding points, as shown. Ordinarily there is no effective difference of potential between the movable and fixed vanes, as the counterweight *b'* may be adjusted to overbalance the normal pull between the vanes. When, however, the insulation breaks down between the primary and secondary coils toward the opposite end, as at X, the potential of the primary acts directly upon the secondary, and substantially the entire difference of potential of the primary will appear between the vanes, and since the attractive force between the vanes varies directly as the square of the difference of potential the vanes will be instantly drawn together. The contact-arm C will then close the local circuit and throw the secondary coils into parallel with the primary, and the rush of current from the primary through the secondary as a consequence will blow at least one of the fuses G, cutting the injured transformer out of circuit.

The arrangement shown in Fig. 4 shows the duplication of the instrument, providing for a breakdown toward either end, and the local circuit so connected that the short circuit is on the secondary. This arrangement will blow either the secondary or the primary fuses, according to which is more sensitive.

In Fig. 5 A is connected to the ground, being thus maintained at practically zero potential, and B to the secondary circuit. In this case the operation is as follows: As soon as the insulation fails the secondary takes the potential of one side of the primary, and consequently a difference of potential greater than before between the secondary and the ground is established. This greater difference of potential will bring the vanes together and will bring the contact-arm into contact with the terminals of the local circuit, and in this case is shown the secondary short-circuited through the coil of any common circuit-breaker H, normally inoperatively included in the working secondary circuit. The increased current due to the short circuit would operate the circuit-breaker and disconnect the transformer from the secondary circuit.

Fig. 6 differs from Fig. 5 in that the circuit-breaker coil shown is not included in the working secondary circuit, but is thrown into parallel therewith by the operation of the electrostatic device. As shown in Fig. 6, two sets of terminals of the local circuit are connected by action of the device. One of the terminals might, however, be permanently connected, as shown in dotted lines, so that the device would have to close but one.

It will be obvious that circuit-breakers and fuses are interchangeable—for instance, as shown in dotted lines in Fig. 5—and that where one is shown the other might be used.

The devices shown in Figs. 5 and 6 have the advantage over those in Figs. 3 and 4 in that a part of the device can be located indoors

without bringing in high-potential wires, and also that one device is required for complete protection as against two in the others. They are, however, less sensitive.

My invention is particularly useful in preventing the dangers above referred to from arising in connection with systems employing alternating-current transformers, and I have therefore illustrated it in connection with such a system. It will be readily seen, however, that it can be applied to provide against dangers similar to those mentioned in other relations.

What I claim is—

1. In combination, a part carrying electrical energy, a part to be protected, a normally open local circuit, both terminals of the local circuit being connected to the system at points traversed by normal currents and means moved by electrical action adapted to automatically close said local circuit on electrical connection between said first part and said part to be protected, and means to vary the flow of current in one of said parts operated as a consequence of the current in said local circuit when it is closed.

2. In a device of the character described in combination, a part carrying electrical energy, a part to be protected, two vanes insulated from each other and in electrostatic relation and relatively movable, one of said vanes being electrically connected to said part to be protected, a local circuit, both terminals of the local circuit being connected to the system at points traversed by normal currents, a circuit-breaking device operated as a consequence of the current in said local circuit when it is closed, and means for closing said local circuit operated as a consequence of the relative movement of said vanes.

3. In a system of distribution by alternating currents, the combination of a transformer, a normally open local circuit having both its terminals electrically connected to said transformer, an electrostatically-operated device closing said local circuit upon the passage of current from the primary to the secondary circuit of said system and a circuit-interrupting device operated as a consequence of the current flowing in said local circuit when closed.

4. In a device of the character described in combination, a transformer, an electrostatically-operated device having two relatively movable vanes insulated from each other, one being electrically connected to the secondary conductor, a local circuit in parallel with a translating device in the secondary circuit, means for closing said local circuit operated by the relative movement of said vanes, and a circuit-rupturing device, whose operation is due to the closing of said local circuit.

5. In combination, a part carrying electrical energy, a part to be protected, a normally open local circuit, one of the terminals

of which is electrically connected to said part to be protected and the other to one of said parts, and means moved by electrical action to automatically close said local circuit on
5 electrical connection between said first part and said part to be protected, and a circuit-breaking device operated as a consequence of the flow of current through said local circuit.

6. In a device of the character described
10 in combination, a part carrying electrical energy, a part to be protected, two vanes insulated from each other and in electrostatic relation and relatively movable, one of said
15 vanes being electrically connected to said part to be protected, a local circuit, both ter-

minals of the local circuit being connected to the system at points traversed by normal currents, a circuit-breaking device operated as a consequence of the current in said local circuit when it is closed, and means for closing said local circuit operated as a consequence of the relative movement of said vanes.

Signed at Pittsfield, Massachusetts, this 2d day of April, 1898.

JOHN F. KELLY.

Witnesses:

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H. M. PLATT.