(No Model.)

J. E. CRANDALL.

PROTECTOR FOR ELECTRICAL INSTRUMENTS.

No. 397,418. Patented Feb. 5, 1889.

Fig. 1.

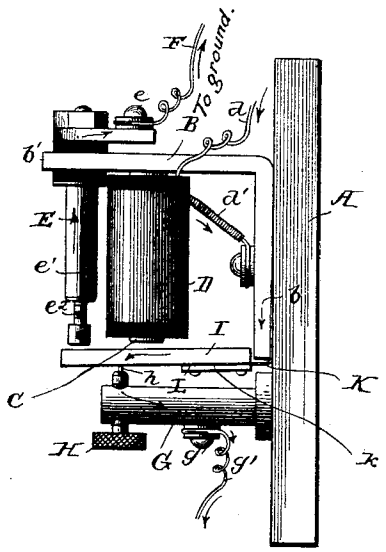


Fig. 2.

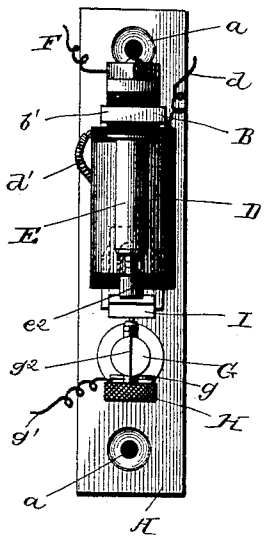
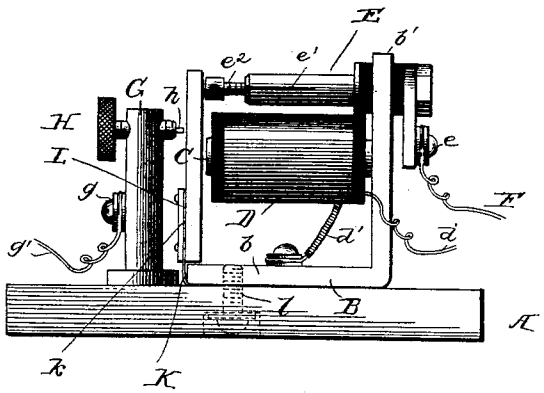


Fig. 3.



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UNITED STATES PATENT OFFICE.

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PROTECTOR FOR ELECTRICAL INSTRUMENTS.

SPECIFICATION forming part of Letters Patent No. 397,418, dated February 5, 1889.

Application filed November 6, 1888. Serial No. 290,109. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. CRANDALL, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Protectors for Electrical Instruments, of which the following is a specification.

My invention relates to protectors for electrical instruments, and more particularly to that class which is adapted to be connected in an electric circuit, and to operate to protect the instruments therein from the effects of any sudden overcharge of the circuit from what are known in the art as "sneak-currents," or other extraneous currents, either from other systems of conductors or from the natural disruptive discharge of lightning; and it has for its object to produce an automatic device which shall be simple and cheap in construction, and at the same time sensitive and accurate enough to operate under all required conditions without interfering with the normal operations of the instruments connected in the circuit, and especially to close the main circuit or line automatically after any disturbing current has passed over it. The necessity of some such protector has long been known, and many and various attempts have been made to produce a device which shall be successful commercially as well as electrically—in other words, to produce a device which may be used in connection with ordinary telephone, telegraph, and similar lines without materially interfering with the normal operation thereof, and at the same time be capable of operating to protect the instruments from injury or destruction under the various conditions of overcurrent, whether the high tension or great-quantity currents, both of which currents are injurious to sensitive instruments.

To these ends my invention consists in a device constructed and operating substantially as hereinafter set forth, and as illustrated in the accompanying drawings, in which—

Figure 1 is a side view of a device embodying my invention. Fig. 2 is a front view of the same; and Fig. 3 is another side view with the device turned on end.

In carrying out my invention I usually provide a suitable base-piece, A, of some insulating material—such as wood or the like—which is furnished with screw-holes *a*, or other means, whereby it may be readily attached in position to operate in connection with the electric circuits and instruments to be protected.

The device proper consists, essentially, of a piece of flat bar-iron, B, which is preferably of the best Swedish iron, and which is bent to form a right angle, as shown, one limb, *b*, of which is attached to the base-piece A, and the other limb, *b'*, of which projects laterally therefrom. Extending downward from the limb *b'* is a soft-iron core, C, which is permanently secured in any suitable way to the bent iron bar; and this core is surrounded with a coil, D, one terminal, *d*, of which connects directly with the circuit to be protected, and the other terminal, *d'*, of which is connected electrically to the bent iron bar B in any suitable way. This coil is preferably made of insulated copper wire, and has about a dozen turns, and a resistance of about one ohm.

Of course it will be understood that I do not limit myself to the precise number of turns or the amount of resistance in the coil, as they may be varied to suit the circumstances of any particular case; but I have found from long experience and practical demonstration that this furnishes the most sure and accurate operation under all circumstances; also, secured to the projecting end of the bent iron bar, and arranged outside of the coil, is a post, E, which is insulated from said bar and provided with a binding-screw, *e*, connected to a ground-circuit, F. This post E is preferably slotted at its lower end, as shown at *e'*, and provided with a screw, e^2, which may be adjusted to any desired position to limit the movement of the armature, hereinafter referred to.

Secured to the base-piece A below the magnet is a standard, G, having a suitable binding-screw, *g*, connected to the circuit-wire *g'*, including the instruments or cable-conductor to be protected, and provided near its extremity with an adjusting-screw, H, preferably having a platinum or similar point, *h*. The end of this standard is preferably slit at g^2, as shown in Fig. 2, so as to securely hold the adjusting-screw in position, in a manner well understood.

Connected to the lower end of the limb *b* of the iron bar B is an armature, I, which extends in front of the core C and normally rests upon the contact-point *h* of the adjusting-screw H, its upward movement being limited by the adjusting-screw e^2 in the post or standard E.

A small contact-piece of platinum is preferably attached to the armature to contact with the point to prevent burning or corrosion and to establish good electrical contact. It will be seen that in this arrangement the circuit to be protected normally passes through the coil D, thence to the limb *b* of the bar B to the armature I, and thence by the adjusting-screw H and standard G to the circuit *g'*, thus including both the bent iron bar and the armature in the normal circuit, and it will be readily understood that the adjustment must be such that the variations of the normal current in operating the instruments included in the circuit will not be sufficient to cause the armature to be attracted and leave the point *h*, while an abnormal current or other current of greater intensity or quantity than is proper for the instruments connected in the circuit will so affect the magnet-core that it will instantly attract the armature I and draw it away from the point *h*, causing it to complete the circuit through the screw e^2 and post E to the ground-connection F, so as to direct the abnormal current from the main circuit to the ground through a circuit of practically no resistance.

I have found the construction and arrangement of this part of my device to be very delicate and sensitive, and after long experiment and experience in the use of such a device I have found what I consider to be the most practical and accurately-operating arrangement of these parts. This consists in connecting the armature I to the limb *b* by means of a strip, K, of conducting material, which has a certain amount of resiliency, and I preferably form this strip in a bifurcated or U shape, as indicated in dotted lines in Fig. 2, the free end *k* being secured to the armature by any suitable means, as by a plate, L, and the connected portions embracing a screw, *l*, which also operates to secure the bent arm B to the base A. In this way I attain a good electric contact between the parts under all conditions, and the resiliency of this connection is such that it normally acts to maintain the armature in an upright position between the two contacts *h* and e^2, as illustrated clearly in Fig. 3. When the device is in the position shown in Fig. 1, the weight of the armature is sufficient to overcome the resiliency of the connector and secure contact with the point *h*.

It will thus be seen that the armature I is capable of being very delicately and accurately adjusted, so that upon the slightest increase of magnetism over the normal it will instantly operate to direct the current from the main circuit to the ground-circuit whatever resiliency there is in the connector tending to assist in the first part part of this operation to bring the armature more within the attractive power of the magnet, and when the excessive current has passed tending to restore the parts to the normal position to complete the main or operating circuit. This construction and arrangement of parts, whereby the armature is supported in equilibrium between the contact-points by the connector, is an important feature of my invention, for the reason, as before stated, that I have found it operates in the manner set forth to insure effective service of the protector under all conditions of current to which it is liable to be subjected.

While I have thus specifically described and illustrated what I consider to be the best and most practical embodiment of my invention, it is evident that the details of construction may be varied without departing from the spirit of my invention.

I claim—

1. In a protector for electrical instruments, the combination of the bent plate, one limb of which supports an electro-magnet and to the other limb of which is attached the armature, and contacts arranged on each side of the armature, one connected to the main and the other to the ground line, substantially as described.

2. In a protector for electrical instruments, the combination of a bent bar, one limb of which supports a magnet and the other limb of which supports an armature, contacts arranged on each side of the armature, and a connector between the armature and bar biased to tend to hold the armature in equilibrium between the contacts, substantially as described.

3. In a protector for electrical instruments, the combination of a bent iron bar, one limb of which supports a magnet and the other limb of which supports an armature, a standard attached to but insulated from the bar and connected to the ground-circuit, and another standard connected to the main circuit and arranged in normal electric contact with the armature, substantially as described.

4. A protector for electrical instruments, consisting, essentially, of an insulating-base, a bent iron bar secured thereto, one arm of which extends laterally and supports an electro-magnet and an adjustable contact connected with the ground, and the other arm of which is electrically connected to the armature, and a standard having a contact-piece normally supporting the armature when in operative position, substantially as described.

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

JOSEPH E. CRANDALL.

Witnesses:
F. L. FREEMAN,
W. S. MCARTHUR.