

No. 863,791.

PATENTED AUG. 20, 1907.

L. EMERY.  
PROTECTIVE DEVICE.  
APPLICATION FILED JAN. 10, 1907.

2 SHEETS—SHEET 1

Fig. 2.

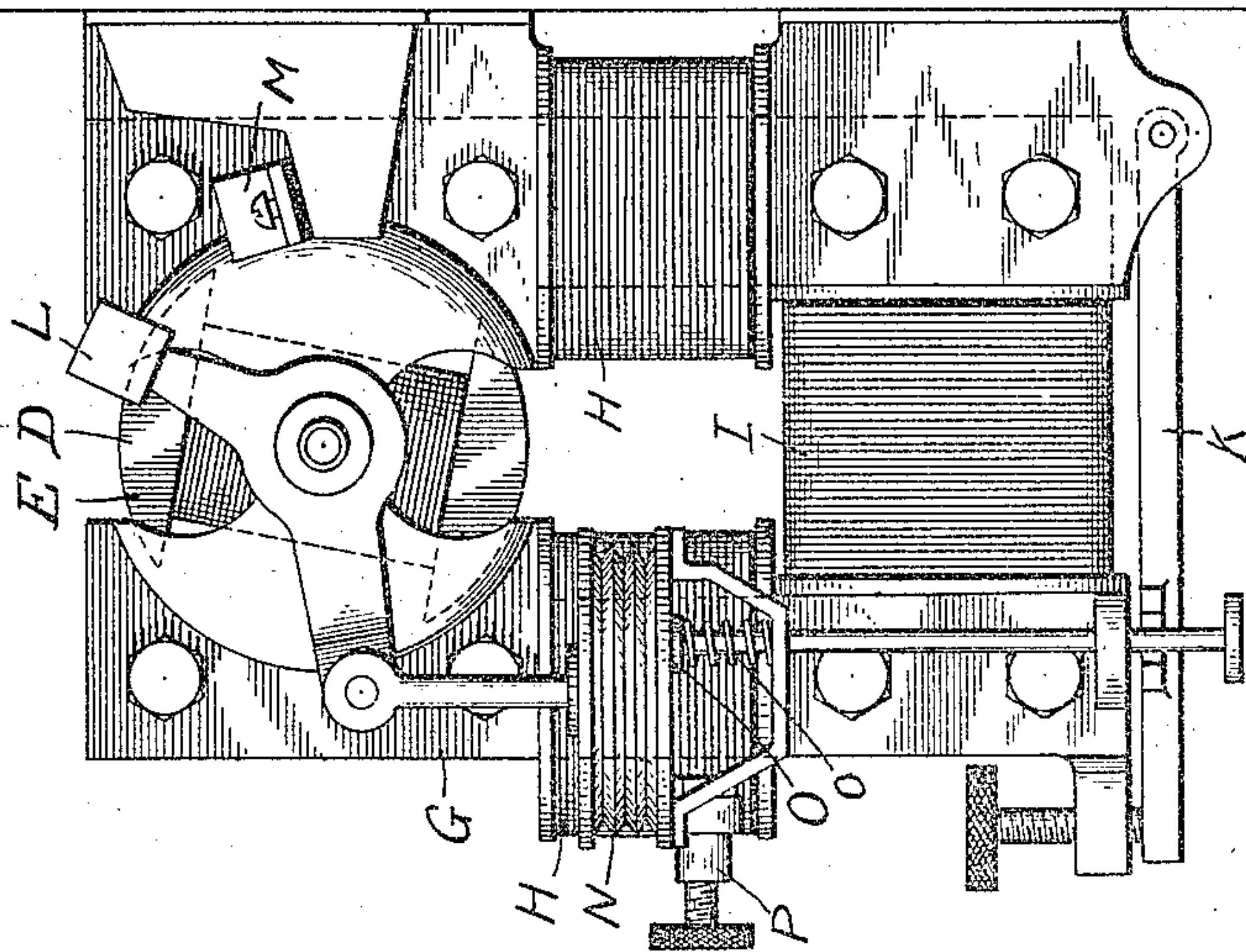
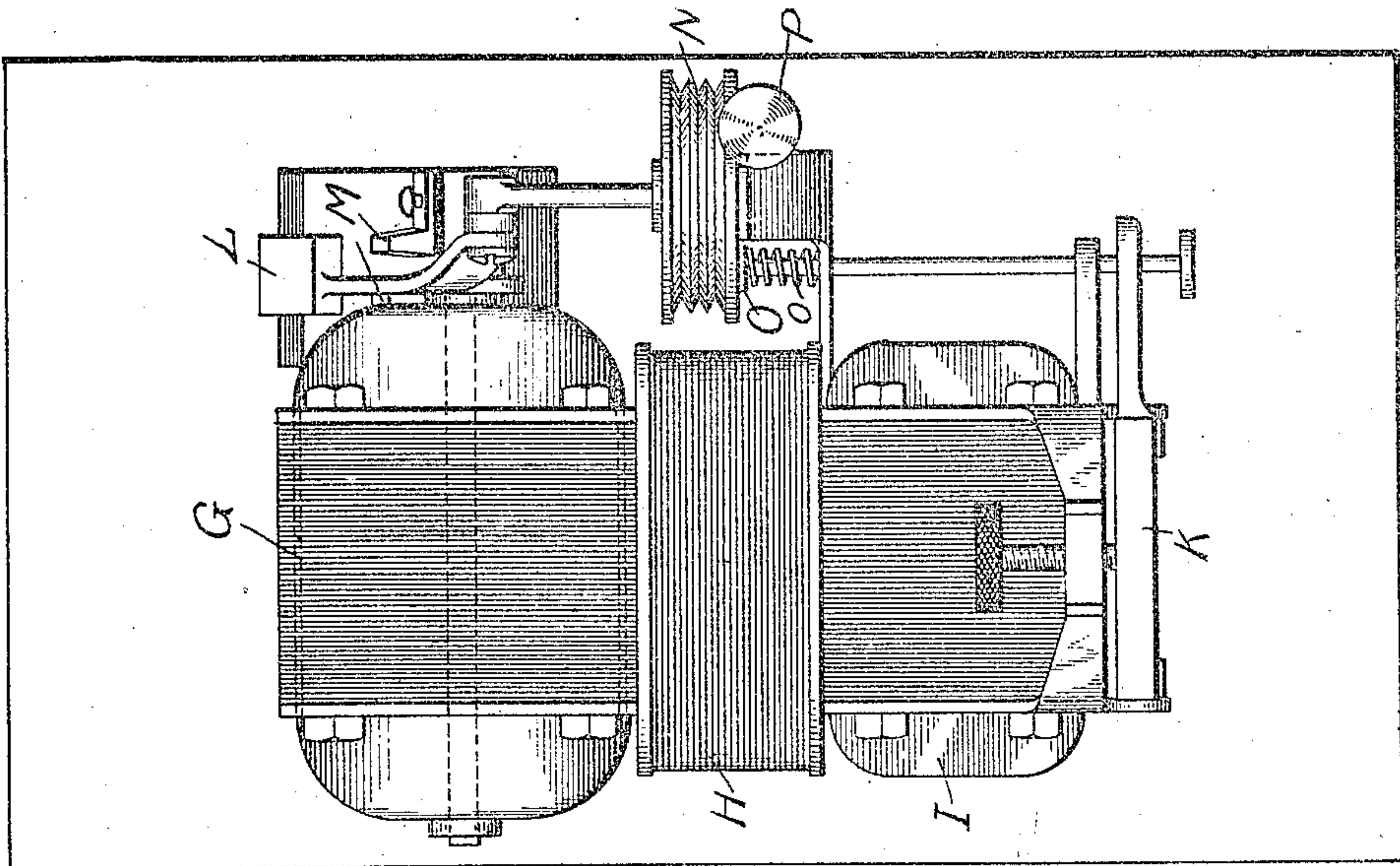


Fig. 1.



WITNESSES  
W. Ray Taylor.  
J. Ellis Allen

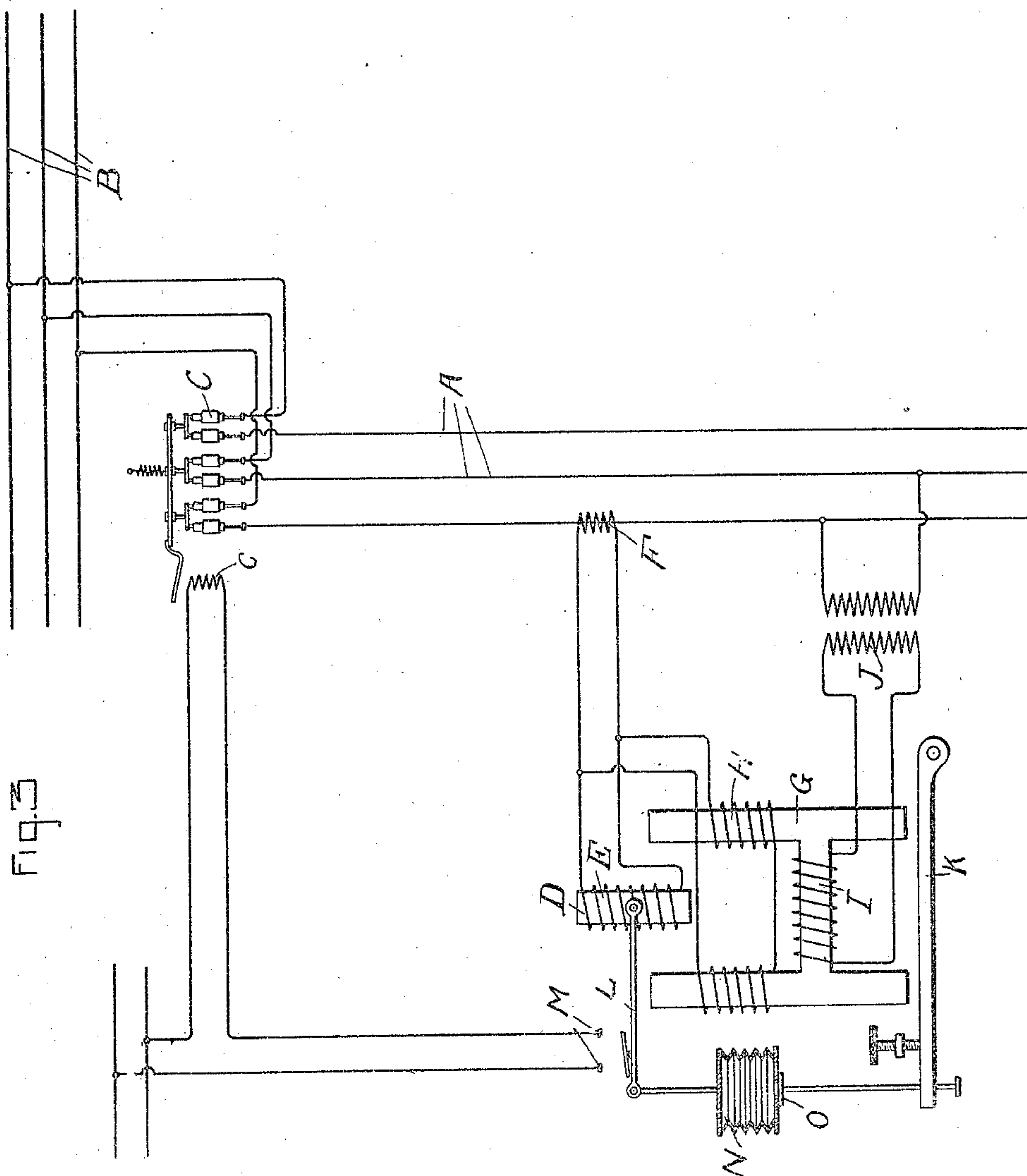
INVENTOR  
LOREN EMERY  
by *Albert H. Davis* Atty

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WITNESSES

*W. Ray Taylor.*  
*J. Ellis Glen.*

INVENTOR

LOREN EMERY.

*Albert H. Davis*

Att'y



# UNITED STATES PATENT OFFICE.

LOREN EMERY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## PROTECTIVE DEVICE.

No. 863,791.

Specification of Letters Patent.

Patented Aug. 20, 1907.

Application filed January 10, 1907. Serial No. 351,676.

To all whom it may concern:

Be it known that I, LOREN EMERY, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Protective Devices, of which the following is a specification.

My invention relates to protective devices for electric circuits, and its object is to provide a device which will operate to open the circuit upon either an overload or a reversal of energy; which may be arranged with a time-limit retarding device operative on normal overloads, but inoperative on an excessive overload, or on a reversal of energy; which may be used on either direct or alternating-current circuits; and which is reliable under all conditions.

Many devices, which have been proposed heretofore for the protection of circuits against reverse-current, fail to operate upon a reverse-current of so great a magnitude that the voltage of the circuit falls far below its normal value. In order to prevent such failure, I arrange the device so that even if the voltage should fall entirely to zero, it would still be operative upon either overload or reversal of energy. I accomplish this by providing two relatively movable members, one provided with a series winding, and the other with differential shunt and series windings. On normal loads the shunt winding on the second member overpowers the series winding, but on an overload the series winding overpowers the shunt winding and reverses the torque on the other member, while upon a reversal of energy the shunt and series windings are no longer differential, but cumulative in producing a reversal of torque in the device. In either case the device is not dependent on the shunt winding but will operate upon a heavy flow of current in the series windings, even though the shunt current falls to zero.

For ordinary overloads it is desirable that the device should have a time-element in its action, but upon excessive overloads or upon any reversal of energy, it is desirable that the action of the device should be instantaneous. To give this result I provide a retarding device which is normally operative, but which is rendered inoperative by an abnormal fall of voltage, or upon a reversal of energy. I accomplish this by providing an armature shunting the potential winding, and normally held attracted by this winding, and provide means controlled by this armature for rendering the retarding means inoperative when the armature is allowed to fall.

My invention will best be understood by reference to the accompanying drawings, in which

Figure 1 shows a front elevation of a protective device arranged in accordance with my invention; Fig. 2

shows a side elevation of the same; and Fig. 3 is a diagram of the circuit connections.

Referring first to Fig. 3, A represents the circuit to be protected. It is shown as a branch circuit from the main circuit B. A suitable switch C, adapted to open the circuit A is provided with a trip-coil c, which is controlled by the protective device. The protective device comprises a pivoted armature D, carrying the winding E, which is supplied from the series transformer F inserted in one of the conductors of the circuit A.

G represents a field magnet provided with a winding H, which is also supplied from the series transformer F, and a winding I, which is supplied from the shunt transformer J.

K represents a pivoted armature, which magnetically shunts that part of the field magnet G which carries the shunt winding I, and is normally held in raised position, as shown, by the flux due to this winding. The pivoted armature D carries an arm L, which is provided with a contact adapted to bridge the stationary contacts M and close the circuit of trip-coil c when armature D is rotated in a clockwise direction. The arm L is connected to a retarding device N, which is shown as of the well-known bellows or diaphragm type. This device has an opening in its base, which is normally closed by the valve O, which is normally held raised by a spring o, shown in Figs. 1 and 2. As long as valve O is closed, the device N acts to retard the movement of the armature D, but when valve O is lowered, the retarding device is rendered inoperative. The lowering of the valve O is brought about by the falling of the armature K.

The operation of the device is as follows: The windings H and I on the field magnet normally oppose each other; the winding I being the stronger for ordinary loads. Consequently the torque on the armature D is determined by the current in the shunt winding I, and is normally in a counter-clockwise direction. Upon an overload the increase of current in winding H will cause it to overpower winding I, so as to reverse the torque on the armature D and cause it to close the circuit of the trip-magnet. If the direction of energy in the circuit A reverses, the current in winding H will assist the current in winding I, while the current in winding E will be reversed, so that the torque on the armature D will be reversed and it will be moved to close the circuit of the trip-magnet. Thus, the device operates either upon an overload or upon a comparatively small reversal of energy. During ordinary overloads the device N operates to retard the movement of the armature D, so as to give the time-element which is ordinarily desired in overload protective devices; but upon the occurrence of a short-circuit, which would



lower the potential, and consequently the current in winding I, armature K would be allowed to fall, pulling down the valve O, and rendering the retarding device N inoperative. Similarly, upon a reversal of energy, if the air-gap between the armature D and the field magnet G is small, the reluctance offered by the magnetic circuit passing through the armature D to the shunt flux may be made much smaller than that offered by the magnetic circuit passing through the armature K, so that the greater part of the shunt flux will be diverted from the armature K. Thus, the armature K can be caused to drop on a comparatively small reversal of energy and render the retarding device N inoperative.

The preferred construction of the device is shown in Figs. 1 and 2. The several parts are lettered as in Fig. 3. All the parts are the same as in Fig. 3, with the addition of the spring o for holding the valve O normally closed and a needle-valve P for adjusting the action of the retarding device N in the well-known manner.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In combination with an electric circuit, a protective device comprising relatively movable members, one provided with differential shunt and series windings and the other with a series winding, and means operative upon a relative movement of said members for opening said circuit.
2. In combination with an electric circuit, a protective device comprising relatively movable members, one provided with differential shunt and series windings and the other with a series winding, means operative upon a relative movement of said members for opening said circuit, and means for retarding said relative movement.
3. In combination with an electric circuit, a protective device comprising relatively movable members, one provided with differential shunt and series windings and the other with a series winding, means operative upon a relative movement of said members for opening said circuit, means for retarding said relative movement, and means for rendering the retarding means inoperative upon an abnormal fall of voltage in said circuit.
4. In combination with an electric circuit, a protective

device comprising a pivoted armature having a series winding and a field magnet having differential shunt and series windings, and means operative upon the movement of said armature for opening said circuit.

5. In combination with an electric circuit, a protective device comprising a pivoted armature having a series winding and a field magnet having differential shunt and series windings, contacts controlled by said armature, a magnet in circuit with said contacts, and a switch controlled by said magnet adapted to open said circuit.

6. In combination with an electric circuit, a protective device comprising a pivoted armature having a series winding and a field magnet having differential shunt and series windings, means operative upon the movement of said armature for opening said circuit, and means for retarding the movement of said armature.

7. In combination with an electric circuit, a protective device comprising a pivoted armature having a series winding and a field magnet having differential shunt and series windings spaced apart thereon, means operative upon a movement of said armature for opening said circuit, means for retarding the movement of said armature, and an armature magnetically shunting that portion of the field magnet carrying the shunt winding and controlling said retarding means.

8. In combination with an electric circuit, a protective device operative to open said circuit upon an overload and upon a reversal of energy therein, means for retarding the operation of said device, and means for rendering said retarding means inoperative upon an abnormal fall of voltage in said circuit and upon a reversal of energy therein.

9. In combination with an electric circuit, a protective device comprising relatively movable members, one provided with differential shunt and series windings and the other with a series winding, means operative upon a relative movement of said members for opening said circuit, means for retarding said relative movement, and means for rendering the retarding means inoperative upon an abnormal fall of voltage in said circuit and upon a reversal of energy therein.

In witness whereof, I have hereunto set my hand this 9th day of January, 1907.

LORIN EMERY.

Witnesses:

BENJAMIN B. HULL,  
HELEN ORFORD.