A. PETERSEN.
ELECTRICAL RELAY.
APPLICATION FILED JAN. 9, 1914.

1,185,240.

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Fig. 1.

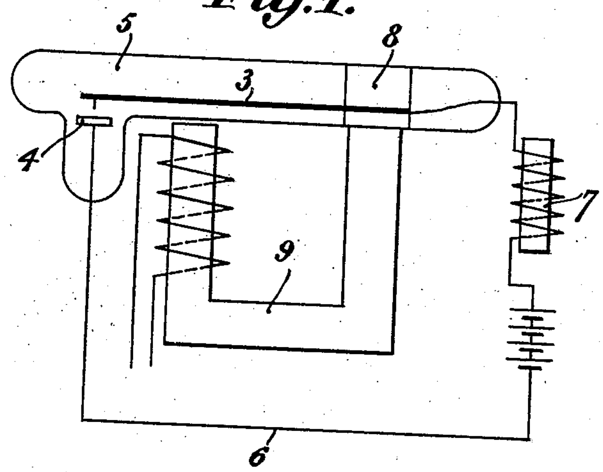
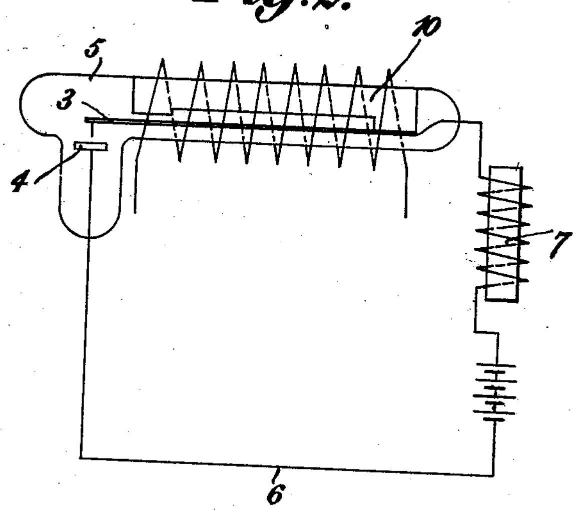


Fig. 2.



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ELECTRICAL RELAY.

1,185,240. Specification of Letters Patent. Patented May 30, 1916.

Application filed January 9, 1914. Serial No. 811,164.

To all whom it may concern:

Be it known that I, AAGE PETERSEN, electrical engineer, residing at Copenhagen, Denmark, and whose post-office address is No. 11 Vestervoldgade, Copenhagen, have invented certain new and useful Improvements in Electrical Relays; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to vibrating electrical relays of the kind in which the closing of an electrical circuit or circuits is effected by vibrating circuit closing members.

According to the invention the circuit-closing members are located in a closed space or chamber charged with gas which is so highly attenuated that it possesses an adequate electrical conductivity for the purpose of keeping the circuit or circuits, closed by the said members, completed for a certain time after the instant of contact of the vibrating circuit-closing members.

Two constructions of the improved relay are shown in Figures 1 and 2 of the accompanying drawing.

In each construction the member, such as a spring 3, or members, which is or are caused to vibrate by the action of the current, and also the part, such for example as a contact piece 4, or parts, with which the circuit-closing member or members comes or come into contact when it or they vibrate, for the purpose of closing one or more circuits, are located in a closed space, such for example as a tube 5. This tube contains gas such as atmospheric air, or preferably a gas such as nitrogen, helium, hydrogen or the like, in such a state of attenuation, which may vary according to the different gases, say for example about 1 mm. (one millimeter) pressure of mercury, that while the damping action of the gas on the circuit-closing members is very small, the gas nevertheless possesses sufficient electrical conductivity to keep the circuit or circuits for example the circuit 6, closed by the contact of the parts 3 and 4, completed, in consequence of a suitable self induction 7, for a considerable period of time after the instant of contact, that is to say until the actions which it is intended shall take place by the closing of the circuit have been initiated and, it may be completed, with certainty.

The tube 5 may be a glass tube closed by fusion and one end of the spring 3 may be attached to a piece of iron 8 carried in the tube. In front of this piece of iron is placed one pole of the electromagnet 9, which pole may be in the form of a ring surrounding the tube 5. The electromagnet may be entirely inclosed in the tube in some constructions.

In the construction shown in Fig. 2 only the iron core 10 is inclosed in the tube 5, the winding of the electromagnet being placed around the tube so that the vibrating member and the iron core both receive the same polarity. In order that the resistance to conductivity between the contact piece 4 and the spring 3, when the latter moves away from the contact piece after coming in contact therewith, shall be as small as possible and in order to avoid the formation of an arc, the negative pole, namely the contact piece 4, must have a large surface area. It is best made so large that with the material employed for the electrodes and the gas inclosed in the tube, no extraordinary cathode drop in voltage takes place with the current strength designed for contact. When an alternating current is employed both contacts must have a large surface area as will be understood.

The operation of my improved relay is as follows: The current, which is alternating or undulatory in character, in this embodiment, is passed through the coils of the electromagnet 9. As a result, the freely swinging spring 3 is attracted by the magnet 9 to contact with part 4 and close the circuits. When, however, the current is broken, the natural elasticity of the spring 3 causes it to move away from the part 4 and break the circuit. The opening and closing of the circuit made by the contact of spring 3 and part 4 operates the relay. In the ordinary form of relay of this character, the closing of the circuit only lasts for a very short time, because at the moment of contacting of spring 3 and part 4, there is already a tendency on the part of spring 3 to assume a reverse pendulum swinging, and move away from the stationary contact 4. But this very short contact, which is of a mere sur-

face character, and is, therefore, a very poor contact, is entirely unsuitable for many relay purposes, which arise continually in technical operations, if high security is desired.

In the improved relay, as above set forth, the contact 4 and the spring 3 are surrounded by a conducting gaseous medium. The voltage of the batteries in the relay circuit is not sufficiently great to discharge through the gap ordinarily between spring 3 and part 4, but after the contact is made, and has been broken, the self-induced voltage of part 7 is sufficiently great to maintain the discharge. Thereby, the short period in which the working current is produced by the contact between the freely swinging spring 3 and the stationary part 4 will now be lengthened by the continuation of the circuit through the gaseous conductor, and the short impulses of the working current ordinarily produced by the various metallic contacts will be joined together, so that a continuous and more or less perfect contact will be obtained during the entire period of excitation of the magnetic coils. At the cessation of the current exciting the field coils of the magnet, the current created by the contact of the swinging spring 3 with the part 4 will be self-broken.

I have described one embodiment of my invention, but it is clear that numerous changes could be made in the details without departing from the spirit thereof as set forth in the following claims.

I claim—

1. An electrical relay, comprising a relay circuit having a self-induction therein, a movable spring arm capable of free vibration at a definite period connected to a first terminal of said relay circuit, means operated by the passage of the current to be relayed for moving said movable arm into contact with the second terminal of said relay circuit, a gaseous conducting medium surrounding and electrically connecting said movable arm and said second terminal, said spring arm being normally separated from said second terminal, whereby said relay circuit is closed only upon the passage of the current to be relayed, and said self-induction continues to discharge through said gaseous medium, and maintain the relay current after said movable arm has been separated from said second terminal, said relay circuit having a source of electric power, the voltage of which is too low to discharge through said gaseous medium.

2. An electrical relay, comprising a relay circuit having a source of electrical power therein, means at a portion of said circuit for creating a higher voltage than the voltage of said source of electrical power, said means being energized by said source of electric power and absorbing a limited amount of said energy, a movable spring arm capable of free vibration at a definite period connected to the first terminal of said relay circuit, means operated by the passage of the current to be relayed for moving said movable arm into contact with the second terminal of said relay circuit, said arm being normally separated from said second terminal of said relay circuit, and a medium intermediate and connecting said movable arm and said second terminal, the electrical resistance of said medium being too great to permit the passage of the current generated by said source of electrical power, and being sufficiently low to permit the passage of the current generated by said means for creating a higher voltage than said source of electrical power, when said relay circuit is broken.

3. An electrical relay, comprising a relay circuit having a self-induction therein, a movable spring arm capable of free vibration at a definite period attached to the first terminal of said relay circuit, and adapted to be brought into contact with the second terminal of said relay circuit, said spring arm normally tending to remain apart from said second terminal, an electro-magnet having its field coils connected with the electric current to be relayed, said electro-magnet when energized causing the movement of said spring arm to contact with said second terminal, and a tube inclosing said spring arm and said second terminal, and having a gas therein at a low pressure, said relay circuit having a source of electric power therein, the voltage of said source of electrical power being insufficient to discharge through a gap intermediate said spring arm and said second terminal when they are not in contact, the voltage created by said self-induction being sufficiently great to discharge a current through the gap formed between said spring arm and said second contact, after the separation of said spring arm and said second terminal.

4. An electrical relay, comprising a relay circuit having a self-induction therein, a movable spring arm capable of free vibration at a definite period attached to the first terminal of said relay circuit, and adapted to be brought into contact with the second terminal of said relay circuit, said spring arm normally tending to remain apart from said second terminal, an electro-magnet having its field coils connected to the electric current to be relayed, said electro-magnet when energized causing the movement of said spring arm to contact with said second terminal, and a tube inclosing said spring arm and said second terminal, and having a gas therein at a low pressure, said relay circuit having a source of electric power therein, the voltage of said source of electrical power being insufficient to discharge through

a gap intermediate said spring arm and said second terminal when they are not in contact, the voltage created by said self-induction being sufficiently great to discharge a current through the gap formed between said spring arm and said second contact, after the separation of said spring arm and said second terminal, the contacting parts of said spring arm and of said second terminal being of large surface area, whereby sparking is prevented.

5. An electrical relay, comprising a relay circuit having a self-induction therein, a movable spring arm capable of free vibration at a definite period attached to the first terminal of said relay circuit, and adapted to be brought into contact with the second terminal of said relay circuit, said spring arm normally tending to remain apart from said second terminal, an electro-magnet having its field coils connected to the electric current to be relayed, said electro-magnet when energized causing the movement of said spring arm to contact with said second terminal, and a tube inclosing said spring arm and said second terminal, and having a gas therein at a low pressure, said relay circuit having a source of electric power therein, the voltage of said source of electrical power being insufficient to discharge through a gap intermediate said spring arm and said second terminal when they are not in contact, the voltage created by said self-induction being formed between said spring arm and said second terminal, the core of said electro-magnet being in said closed tube, and the coils of said magnet being wound around said tube, whereby said spring arm has the same magnetic polarity as said magnetic core.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

AAGE PETERSEN.

Witnesses:
H. BOUTARD,
EMIL MOURITZEN.