G. McALPINE.

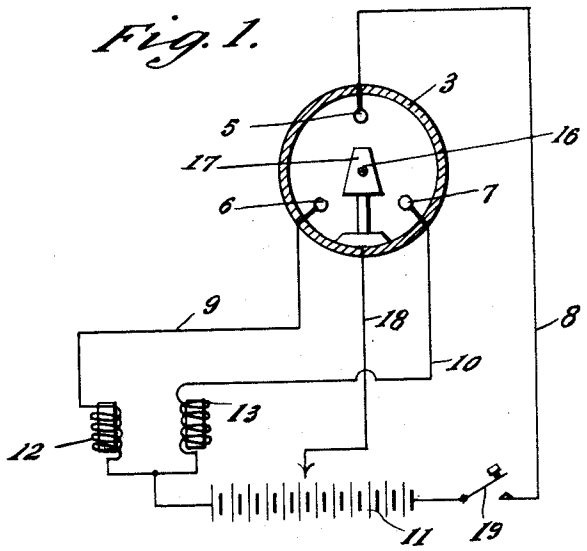
ELECTRIC RELAY.

APPLICATION FILED DEC. 10, 1919.

1,360,235.

Patented Nov. 23, 1920.

Fig. 1.



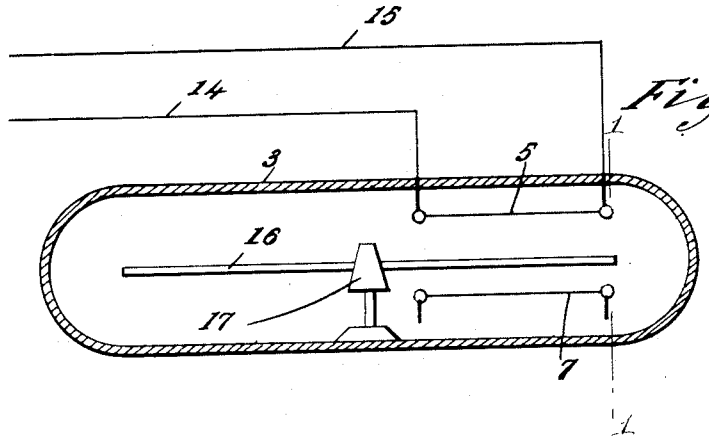


Fig. 2.

Witnesses:
C. L. Poole.
Norris L. Sunby.

Inventor
Gustavus McAlpine
by James L. Norris,
Attorney

UNITED STATES PATENT OFFICE.

GUSTAVUS McALPINE, OF LONDON, ENGLAND.

ELECTRIC RELAY.

1,360,235. Specification of Letters Patent. Patented Nov. 23, 1920.

Application filed December 10, 1919. Serial No. 343,903.

To all whom it may concern:

Be it known that I, GUSTAVUS McALPINE, a subject of the King of Great Britain, residing in London, England, have invented certain new and useful Improvements in Electric Relays, of which the following is a specification.

This invention relates to electric relays and has for its primary objects to obtain increased sensitiveness and to avoid time lag.

To this end, the improved relay is constructed with a thermionic valve having a fixed cathode and anode system wherein a control element or screen movable relative to the cathode and anode of the valve is adapted to render the valve conductive or not, by allowing or interfering with the flow of current between the heated cathode and the anode from an electric source of current which controls a part to be operated as hereinafter described.

The invention is illustrated diagrammatically in the accompanying drawings, in a form of construction embodying a compass needle as the control element, and the application of other forms of control element will be obvious therefrom.

In the drawings Figure 1 is a transverse section on line 1—1, in Fig. 2, of the valve and shows some of the electric connections; and Fig. 2 is a longitudinal section, and shows other electric connections.

As shown, the valve comprises a glass vacuum tube 3, a heated cathode or filament 5, and anodes 6, 7, the cathode and anodes being fixed relatively to each other, that is to say, that the operation of the control hereinafter described is not dependent upon any relative movement of the elements.

The filament is connected by a conductor 8 with the negative terminal, and the anodes are connected by parallel conductors 9, 10 with the positive terminal of a source of electric current 11, and 12, 13 are two electromagnets in the conductors 9, 10.

The filament is further connected through conductors 14, 15 with a source of alternating current by which the filament is heated. 16 is a compass needle pivoted at 17 and connected by a conductor 18 with the source of electric current 11 in such a manner that its potential may be adjusted. 19 is a switch.

As shown, the filament is mounted vertically above one end of the compass needle and lies parallel thereto when the latter is in its zero or neutral position. The anodes are mounted below and one on each side of the compass needle end and lie at such an angle to the needle and to one another when the latter is in its zero or neutral position, that a small deflection say of 10° to either side wall will bring the needle parallel with the anode on that side.

When the needle is in its zero position midway between the anodes, the shielding influence of the needle is adjusted to be sufficient to produce a sensible diminution of the normal current between the filament and the anodes. When the needle has a relative deflection to either side so that it lies closer to one anode than the other, the balance of electrostatic forces is upset and the valve becomes more conductive between the filament and the anode farthest from the needle, and the current from the electric source operates the electromagnet in known manner.

The invention is particularly suitable in its application to aerial navigation, wherein, for example, the relay can be used to automatically control a rudder for steering a craft.

For example, the valve may be rotatably mounted on a suitable support so that while traveling on a set course it may be turned until the anodes and compass needle are in the relative positions above referred to as the zero position with the N pole pointing to the north. Under these conditions, any deviation of the craft from the course will result in relative movement so that the compass needle will be closer to one anode and farther from the other. This will permit the flow of current to operate one or other of the electromagnets, which in turn will appropriately operate the rudder through an electric or other type of motor, not shown, until the course is regained and the electrostatic balance is restored. Gimbal or equivalent bearings may be used to support the valve in a horizontal plane.

As a further example, for controlling lateral or longitudinal flying angles of aircraft, the valve is arranged upright and the compass needle is replaced by a pendulum which is in its zero position when the craft is flying in correct trim, and when there is angular variation in the trim, acts like the compass needle to control the flow of current to the electromagnets which directly or

indirectly give the necessary correcting movement to the ailerons, elevators or the like.

It will be understood that the invention is not limited to the constructions herein described, and may be modified in details as will be obvious to those skilled in the art.

In lieu of being automatically movable by reason of its magnetism, the member 16 may be moved by an outside magnet.

Such a construction, for example, is suitable for using the invention in conjunction with a gyro-compass. In this case, the valve may be rotatably mounted on the compass frame above the compass card, and a magnet may be mounted on the compass card or part which is controlled by the rotor to move the member 16, above it, by means of the magnetic coupling.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

1. An electric relay comprising a thermionic valve having a cathode system and an anode system fixed with respect to each other in which is mounted a movable control element adapted to render it more or less conductive, substantially as described.

2. An electric relay according to claim 1, wherein the control element consists of a pivoted magnet adapted to allow or interfere with the flow of electrons between the heated cathode and the anode, substantially as described.

3. An electric relay comprising a thermionic valve having a cathode system and a anode system fixed with respect to each other, and a control element movable about a pivot to render said valve more or less conductive, said anode system consisting of a plurality of members arranged on opposite sides of the pivot of the control element.

4. The combination with a relay according to claim 1, of a source of electromotive force connected with the control element, substantially as described.

5. The combination with an electric relay comprising a thermionic valve having cathode and anode members, of a movable element mounted within the valve, and controlling the conductance thereof, an electric circuit including a source of electric current and the cathode and anode members, and electromagnetic mechanism controlled by the circuit, substantially as described.

In testimony whereof I have signed my name to this specification.

GUSTAVUS McALPINE