

D. C. DAVIS AND C. LE G. FORTESCUE.
RELAY.

APPLICATION FILED JUNE 17, 1918.

1,351,027.

Patented Aug. 31, 1920.

Fig. 1.

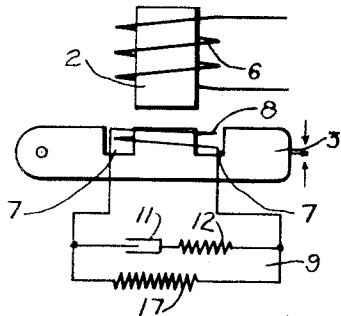
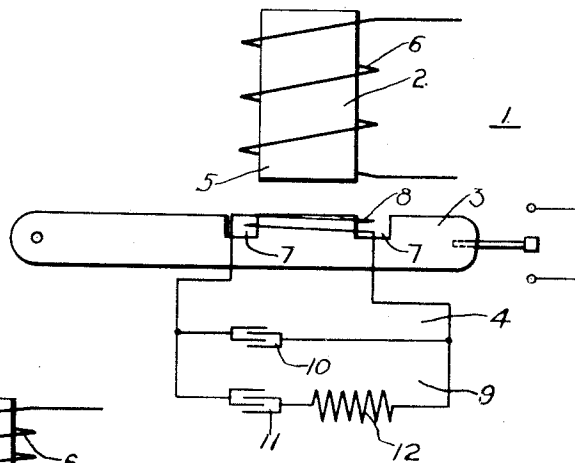


Fig. 2.

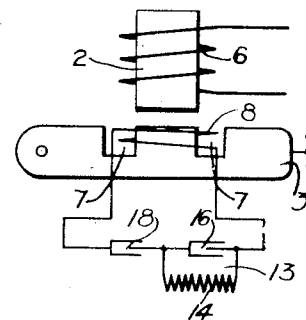


Fig. 4.

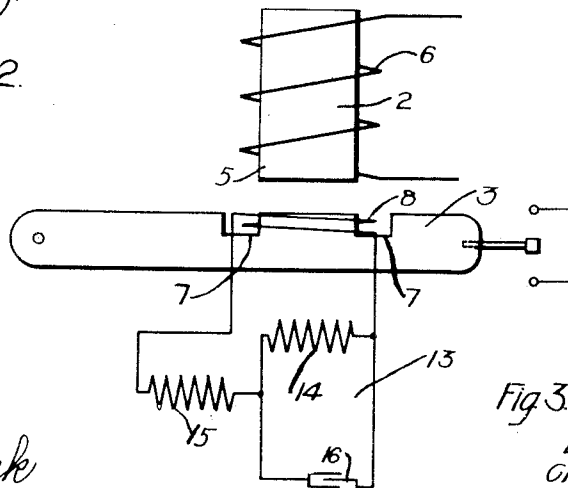


Fig. 3.

WITNESSES:

H. B. Tunk
J. A. Procter

INVENTOR
David G. Davis
Charles Le G. Fortescue
BY
Leslie E. Carr
ATTORNEY

UNITED STATES PATENT OFFICE.

DAVID C. DAVIS, OF WILKINSBURG, AND CHARLES LE G. FORTESCUE, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

RELAY.

1,351,027.

Specification of Letters Patent. Patented Aug. 31, 1920.

Application filed June 17, 1918. Serial No. 240,286.

To all whom it may concern:

Be it known that we, DAVID C. DAVIS, a citizen of the United States, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, and CHARLES LE G. FORTESCUE, a subject of the King of Great Britain, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Relays, of which the following is a specification.

Our invention relates to relays and particularly to electrical relays that are variably responsive to the frequency of the actuating current.

One object of our invention is to provide a relay the armature of which shall be actuated in a direction in accordance with the frequency of the actuating current.

Another object of our invention is to provide a relay of the above-indicated character that shall be inexpensive to construct and effective in its operation.

In practising our invention, we provide an actuating electromagnet, an armature therefor, a winding for the armature that is inductively related to the actuating winding of the electromagnet, and reactors and condensers so connected in closed-circuit relation to the winding of the armature that resonance may be effected under predetermined conditions of frequency and thus the impedance of the circuit of the armature winding be so controlled that, under predetermined conditions, it will permit the armature to be attracted by the actuating electromagnet and, under other predetermined conditions of frequency, will prevent the armature from being actuated or permit it to be actuated in another direction.

In the accompanying drawings, Figure 1 is a diagrammatic view of a relay embodying our invention; and Figs. 2, 3 and 4 are diagrammatic views of relays embodying modified forms of our invention.

The relay 1 comprises, in general, an actuating electromagnet 2, a pivotally mounted armature 3, and means 4 for controlling the operation of the armature.

The electromagnet 2 comprises a stationary core member 5 and a winding 6. The armature 3 is provided with slots 7 in which is disposed a winding 8 that is inductively related to the winding 6 of the electromag-

net 2. The device 4, as illustrated in Fig. 1 of the drawings, comprises a parallel resonant circuit 9 having condensers 10 and 11 and a reactor 12 of such characteristics that parallel resonance will obtain under predetermined conditions of frequency of the current traversing the winding 6. The parallel resonant circuit 9 is connected in circuit with the winding 8 and thus controls the current traversing the winding 8.

If it is desired to cause the armature 3 to move upwardly when current having a predetermined frequency, as, for example, 60 cycles, traverses the winding 6, the resonant circuit 9 is so proportioned that it is resonant at a frequency of 60 cycles. That is, parallel resonance will obtain at 60 cycles and no current will traverse the winding 8. Thus, when the proper current traverses the winding 6, the armature 3 will be attracted toward the core member 5. However, the armature 3 will be moved downwardly when the frequency of the current traversing the winding 6 is such that the condenser 11 and the reactor 12 are series resonant. This condition may obtain when the frequency is 25 cycles and thus cause the impedance of the circuit to be zero. Under this condition, such current will traverse the winding 8 as to permit of sufficient repulsion between the windings 8 and 6 to overcome the magnetic attraction of the winding 6 with respect to the armature 3.

It will, of course, be understood that attraction may be obtained at low frequencies and repulsion at high frequencies by properly proportioning the condenser 11, the reactor 12 and the reactor 17, as shown in Fig. 2, to obtain resonance at the frequency at which it is desired to obtain attraction of the armature 3. That is, at 25 cycles, the reactance of the condenser 11 may predominate over the reactance of the reactor 12 and the reactance of the two may be such as to obtain parallel resonance with the reactor 17. Thus, the impedance of the circuit of the winding 8 will be infinity and no current will traverse the same, and the armature 3 will be attracted. However, on 60 cycles, if the condenser 11 and the reactor 12 are of such characteristics as to be in series resonance, the impedance of the circuit will be zero and the armature will be repelled.

In Fig. 3 of the drawings, a series resonant

circuit 13 is provided having reactors 14 and 15 and a condenser 16 so arranged that, when the condition of series resonance obtains, as, for example, at 60 cycles, the impedance will be zero and the armature 3 will be repelled. Under other conditions, as, for example, 25 cycles, if the reactor 14 and the condenser 16 are such that parallel resonance obtains between the same, the magnetic attraction of the winding 6 will cause the armature 3 to move upwardly because the impedance of the circuit through the winding 8 is infinite.

If it is desired to cause the armature 3 to move upwardly at 60 cycles and downwardly at 25 cycles, the resonant circuit 13 shown in Fig. 4 must be such that, at 60 cycles, parallel resonance is established between the reactor 14 and the condenser 16 and the circuit of the winding 8 will be of infinite impedance. Under this condition, no current will traverse the winding 8 and the armature 3 will be attracted. Similarly, at 25 cycles, if the condenser 16 is of such reactance that series resonance obtains, the impedance of the circuit of the winding 8 will be zero and the armature 3 will be moved downwardly by reason of the repulsion between the windings 6 and 8 to overcome the magnetic attraction of the winding 6 on the armature 3.

The essential feature of our invention is that the circuits 9 and 13, comprising reactors and condensers are connected to the winding 8 and the circuits 9 and 13, are adapted to be series resonant under one frequency and parallel resonant under another to thereby cause the armature to be responsive to the frequency, as well as to the value of the current.

Our invention is applicable to overload relays or other similar devices in which different operations are desired under different conditions of frequency. However, our invention is not limited to the specific devices illustrated, as it may be variously modified without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim as our invention:

1. A relay comprising an electromagnetic actuating means, an armature therefor, means inductively related to the actuating means for controlling the operation of the armature and a resonant circuit connected to said means.

2. A relay comprising an electromagnetic means, a movable winding inductively related to the electromagnetic means, and a resonant circuit connected to said movable winding.

3. A relay comprising an electromagnetic actuating means, an armature therefor, electromagnetic means associated with the armature and inductively related to the actu-

ating means, and a resonant circuit connected to said second electromagnetic means.

4. A relay comprising an electromagnetic actuating means, an armature therefor, electromagnetic means associated with the armature and inductively related to the actuating means, and a series resonant circuit connected to said second electromagnetic means.

5. A relay comprising an actuating winding, an armature therefor, a winding associated with the armature and inductively related to the actuating winding, and means connected in circuit with the second winding for varying the impedance of the secondary winding in accordance with the frequency of the current traversing the actuating winding.

6. A relay comprising an actuating winding, an armature therefor, a winding associated with the armature and inductively related to the actuating winding, and means connected in circuit with the second winding for so controlling the induced current therein that the armature is attracted under predetermined conditions of frequency of the current traversing the actuating winding and is repulsed under other predetermined conditions of frequency.

7. A relay comprising an actuating winding, an armature therefor, a winding associated with the armature and inductively related to the actuating winding, and reactors and condensers connected in circuit with the second winding to constitute a resonant circuit for so controlling the induced current therein that the armature is attracted by the actuating winding under predetermined conditions and repelled under other predetermined conditions.

8. A relay comprising an actuating winding, an armature therefor, a winding associated with the armature and inductively related to the actuating winding, and reactors and condensers connected in circuit with the second winding to constitute a resonant circuit for so controlling the induced current therein that the armature is attracted by the actuating winding under predetermined conditions of the frequency of the current traversing the actuating winding only.

9. A relay comprising an actuating winding, a magnetizable armature therefor, a winding disposed on the armature and inductively related to the actuating winding, and means for effecting a condition of resonance in the circuit of the second winding under predetermined conditions.

10. A relay comprising an actuating winding, a magnetizable armature therefor, a winding disposed on the armature and inductively related to the actuating winding, and means for so controlling the impedance of the second-winding circuit that the armature is attracted only when a predetermined

current of a predetermined frequency traverses the actuating winding.

11. A relay comprising an electromagnetic actuating means, an actuated member, a winding associated therewith and influenced by the electromagnetic means, and a resonant circuit connected to the winding.

In testimony whereof we have hereunto subscribed our names this 29th day of May, 1918.

DAVID C. DAVIS.

CHARLES LE G. FORTESCUE.