

Feb. 4, 1930.

W. E. TRUMPLER

1,745,878

VOLTAGE RELAY

Filed Sept. 19, 1927

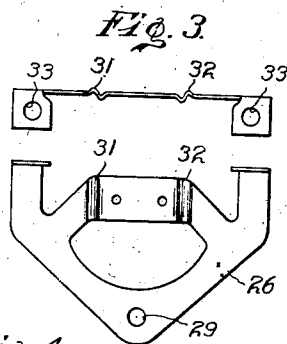
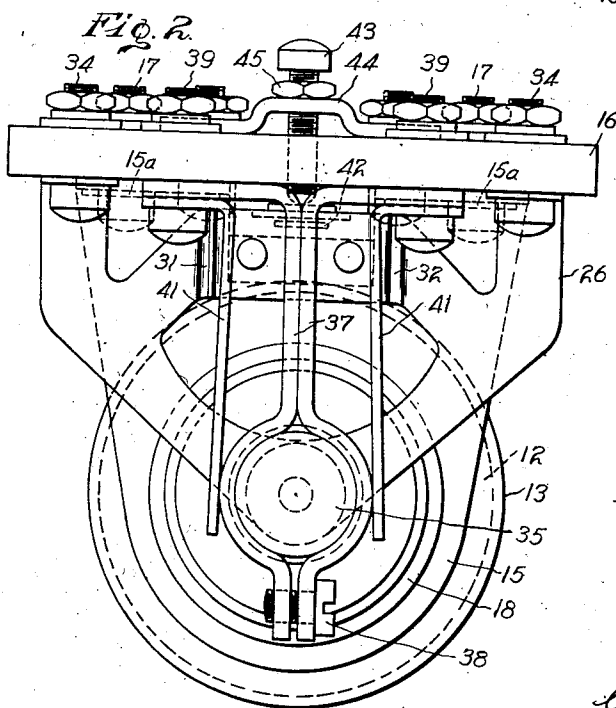
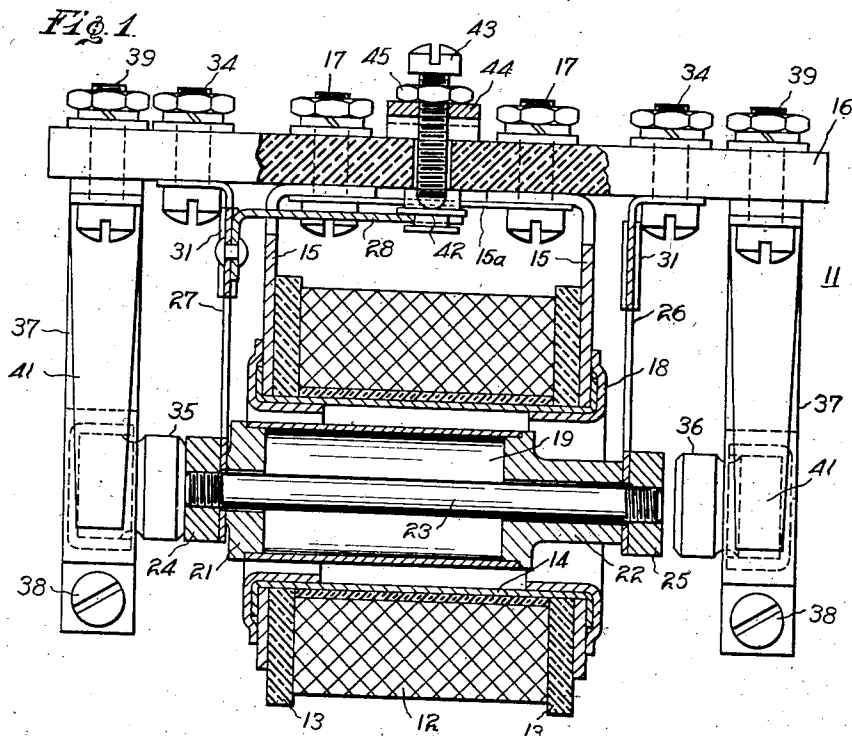


Fig. 4

INVENTOR

William E. Trumpler

BY *Charles E. Barr*
ATTORNEY

UNITED STATES PATENT OFFICE

WILLIAM E. TRUMPLER, OF EASTON, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

VOLTAGE RELAY

Application filed September 19, 1927. Serial No. 220,540.

My invention relates to relays and more particularly to electromagnetic relays.

An object of my invention is to provide a relatively simple and compact electromagnetic relay embodying a resilient spring support for the movable core member and resiliently supported contact terminals.

Another object of my invention is to provide an electromagnetic relay that shall be operable with but slight changes of energy input into the coil thereof.

In practicing my invention, I provide an insulated coil having magnetic heads or ferrules associated with the insulating heads of the coil. I provide prestressed, substantially flat, sheet-metal-spring supports for a movable armature or core member embodying, more particularly, a tubular magnetic core portion. Resiliently mounted contact heads are provided, having associated therewith auxiliary strip members for absorbing, by friction, the impact of the core when engaging the contact heads. One of the spring-supporting members is provided with an auxiliary sheet-metal arm which may be adjusted by a suitable adjusting bolt or stud.

In the single sheet of drawings,

Figure 1 is a view, partially in longitudinal section and partially in side elevation, of a device embodying my invention,

Fig. 2 is a view, in end elevation, thereof,

Fig. 3 is a view, in end elevation, of a spring-supporting member, and

Figure 4 is a top plan view thereof.

An electromagnetic relay 11 embodies a coil 12 of any suitable dimensions and size of wire which is provided with insulating heads 13 at each end thereof, as well as with tubular portions 14 of non-magnetic metal covered by any suitable or desired electric-insulating material usually employed in coils of this type.

No specific terminal construction of the coil is shown, as the particular design and construction of such terminals will depend upon whether the coil is wound of wire or of flat copper strip. As the terminal construction constitutes no particular part of my invention, I have not thought it necessary to illustrate this in detail.

The coil is maintained in a substantially fixed position, with the axis thereof preferably horizontal, by a pair of cooperating bracket members 15 of relatively thin sheet metal which is preferably made of magnetic material, such as soft iron. The one end portion of each of the brackets 15 is provided with an integral portion extending at right angles to the plane of the other part thereof to be secured against a base 16, of electric-insulating material, by a plurality of bolts 17 provided with cooperating lock washers and nuts, in a manner well-known in the art.

Each end of the coil 12 is provided with a magnetic tubular head or ferrule 18, a longitudinal portion of which extends a short distance into the core and the outer portion of which is turned or spun over the end or head of the coil, in a manner shown more particularly in Fig. 1 of the drawings. The outer portions of the heads or ferrules 18 are spun over against the outer face of the brackets 15 in order to clamp these securely in place against the ends of the coil and, more particularly, against the members 13 as well as to provide a good magnetic path between the ferrules and the respective brackets. Strips 15a, of magnetic material, may be located between, and in engagement with, the end portions of brackets 15 and be held by the bolts 17 to still further improve the magnetic path around the coil.

An armature assembly, movable longitudinally within the coil 12, comprises a tubular core member 19 of a magnetic material such as iron or steel, two bearing members 21 and 22 of non-magnetic material and a central stud 23 also of non-magnetic material, the end portions of which extend a short distance beyond the outer ends of the respective bearing members 21 and 22. These outer end portions of the stud 23 are provided with screw threads to permit of mounting thereon contact members 24 and 25. The stud 23 is preferably made of copper, for conducting heat away from the contact members 24 and 25.

Supporting means for the armature or core assembly comprise a spring member 26 made of sheet metal and of substantially

A-shape, as shown more particularly in Fig. 4 of the drawing, and a second spring member 27 which has associated therewith a strip of sheet metal 28, of substantially L-shape. An opening 29 is located near the apex of the member 26 through which the stud 23 extends, the apex of each of the members 26 and 27 being clamped between the contact members and the adjacent bearing members, as shown more particularly in Fig. 1 of the drawings.

Tightening up on either or both of the contact members 24 and 25 will effect a close engagement of all of the parts and hold them in substantially the positions shown in Fig. 1 of the drawings.

The members 26 and 27 are substantially alike and the main spring portion is shown more in detail in Figs. 3 and 4 of the drawings. Each of the members 26 and 27 is made of spring material such as phosphor bronze or sheet steel, of substantially A-shape, the cross member of which is crimped or buckled at two points 31 and 32, intermediate its ends, in order that the apex of each of the members may be subjected to an initial stress. A preshaped spring of this kind provides a force opposing movement of the core in one direction which force decreases with the travel of the core in that direction.

The ends of the legs of the member of A-shape are bent at right angles to the plane thereof to provide clamping portions which are adapted to engage the supporting base 16. Each leg is provided with an opening 33 therethrough, through which a clamping bolt 34 extends. Each bolt is provided, in the usual manner, with cooperating lock washers and nuts.

Two resiliently mounted contact heads 35 and 36 are provided, each of which is clamped between two cooperating sheet-metal strips 37, each of substantially L-shape. The two members 37 are located in back-to-back relation, the intermediate portions being riveted together, the outer end portion of one leg thereof being bent into arcuate shape, as shown more particularly in Fig. 2 of the drawings, to clamp one of the contact heads 35 and 36 therebetween. A clamping screw 38 extends through one of the members 37 and has screw-threaded engagement with the other member to securely clamp the head therebetween.

The other end portions of the members 37 are located against the front surface of the base 16 and are held thereagainst by a plurality of bolts 39, each provided with suitable lock washers and nuts.

In order to prevent excessive movement of the resilient members and the contact heads when engaged by the core, I provide flexible members 41, each of substantially L-shape, one leg portion of which is held by one of a plurality of bolts or machine screws

39. The outer ends of the members 41 frictionally engage the arcuate portion of the members 37.

The member 28, of substantially L-shape, has its shorter leg portion riveted to the member 27 and has an opening therethrough near the outer end of the other leg portion in which is located a bushing 42 of electric-insulating material. Adjusting means for the outer end of the member 28 is constituted by a bolt or machine screw 43, a saddle 44 of a strip of metal and a lock nut 45.

It may be noted that the device embodying my invention provides a core member having a tubular magnetic portion which is located eccentrically of a central lateral plane of the coil 12. This is effected by making the bearing 21 relatively short and the bearing 22 relatively long. The result is that one end of the magnetic core 19 is substantially in the plane of the spun-over portion of one of the heads 18, the left hand head or ferrule, as shown in Fig. 1 of the drawings. There is a small longitudinal distance between the other end of the tubular core 19 and the inner end of the right-hand head or ferrule 18. Normally, the head 24 is in operative engagement with the contact member 35, the amount of pressure therebetween depending entirely upon the adjustment of the screw 43.

A relay of this type is particularly applicable to a circuit which is normally energized at a substantially constant voltage and in which operation of the relay is desired upon a relatively small change of the voltage. So long as the voltage remains normal, the magnetic force on the core is almost equal, but opposite to, the pressure of the spring supports, so that the contact member 24 remains in engagement with the cooperating head 35. Should the voltage vary from the normal value in such manner as to cause the magnetic pull to exceed the force of the spring supports, the core would move in such direction as to cause the contact member 25 to engage the head 36. The movement of the core and the engagement of the cooperating contact members is effected with a snap action, as the magnetic pull increases with the movement of the core toward the right, (as shown in the drawings) while the opposing forces of the two spring members 26 and 27 decrease. This decrease in the opposing spring force is obtained by the prestressed or buckled condition of the members 26 and 27. The core member will not float between its opposed limiting positions, but will be located at either the one or the other and will move therebetween with a sudden or snap action.

An adjustment of the spring 28 by means of a screw 43 will increase or decrease the force opposing the magnetic pull, and the relay will, therefore, be adjusted for some other normal voltage.

A relay of this kind, and particularly a voltage relay, is subjected to substantially constant energization, and it is highly desirable that the largest possible magnetic force be generated for any given value of current traversing the wire of the coil. This is, of course, of interest in connection with the reduction in the amount of energy lost, as well as to prevent overheating of the coil. In my device, a relatively large magnetic pull is obtained by the relatively small distances between the movable core and the ferrules 18, the supports 15 and the strip 15a constituting a closed magnetic circuit over the rest of the path.

Large wear of the contacts is prevented by reducing the arcing and the hammer blow therebetween. The arcing is reduced by the snap action, and hammer blow is reduced by reducing the weight of the movable core and by making the magnetic forces large. The stationary contact members must be resiliently mounted, and sufficient friction must be applied thereto to absorb a part or all of the impact attendant upon engagement so that no rebound will occur.

Arcing may also be reduced by relatively low temperature of the contact members and of the parts closely adjacent thereto and I prefer to make the contact members of a metal which is a good conductor of heat, to permit of quickly carrying away such heat as may be generated.

As has been heretofore stated, the sensitivity of the coil may be varied by adjusting the screw bolt 43.

Since various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof, I desire that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

I claim as my invention:

1. An electromagnetic relay comprising a coil, magnetic ferrules at the ends of said coil, a horizontally-movable magnetic core member unsymmetrically located axially relatively to said ferrules, and a non-magnetic spring member, of substantially plate shape, at each end of the core member for yieldingly supporting said core.

2. An electromagnetic relay comprising a coil, magnetic ferrules at the ends of said coil, a horizontally-movable magnetic core member unsymmetrically located axially relatively to said ferrules, a contact member adjacent to each end of the core member, and means associated with one of said spring members for forcing the core member into operative engagement with one of said contact members.

3. In an electromagnetic relay, the combination with a coil, magnetic ferrules at the ends of said coil, substantially fixed contact members adjacent to the ends of the coil, and

a magnetic core member in said coil, of resilient metal plate members, having an initially stressed portion therein, for supporting the core.

4. In an electromagnetic relay, the combination with a coil, magnetic ferrules at the ends of said coil, substantially fixed contact members adjacent to the ends of the coil and a magnetic core member in said coil, of resilient metal plate members having an initially stressed portion therein for supporting the core and for yieldingly opposing movement of the core member in one direction.

5. In an electromagnetic relay, the combination with a coil, magnetic ferrules at the ends of said coil, substantially fixed contact members adjacent to the ends of the coil and a magnetic core member in said coil, of resilient metal plate members having an initially stressed portion therein for supporting the core and for yieldingly opposing movement of the core member in one direction and means for varying the opposing force of one of said resilient members.

6. An electromagnetic relay comprising a coil, a movable core member within said coil and leaf springs for yieldingly supporting said core, said leaf springs extending substantially at right angles to the axis of the coil and the core.

7. An electromagnetic relay comprising a coil, a movable core member within said coil, leaf springs for yieldingly supporting said core, said leaf springs extending substantially at right angles to the axis of the coil and the core, and means operatively associated with one of said leaf springs for varying its initial position.

8. An electromagnetic relay comprising a coil, a movable core member within said coil, leaf springs for yieldingly supporting said core, said leaf springs extending substantially at right angles to the axis of the coil and the core and having an initial bias in one direction.

9. An electromagnetic relay comprising a coil, a movable core member within said coil, leaf springs for yieldingly supporting said core, said leaf springs extending substantially at right angles to the axis of the coil and the core and having an initial bias in one direction, and means for varying said initial bias.

10. An electromagnetic relay comprising a coil, a movable core member within said coil, leaf springs for yieldingly supporting said core, said leaf springs extending substantially at right angles to the axis of the coil and the core and having an initial bias in one direction, and spring means for varying said initial bias.

11. An electromagnetic relay comprising a coil, a movable core member within said coil, leaf springs for yieldingly supporting said core, said leaf springs extending substan-

tially at right angles to the axis of the coil and the core, and resiliently mounted contact members selectively engageable by said core member.

- 5 12. An electromagnetic relay comprising a coil, a movable core member therein, leaf springs for yieldingly supporting said core, a plurality of resiliently supported contact members selectively engageable by the ends
10 of said core member, and auxiliary strips frictionally engaging the contact members at lateral faces thereof.

13. An electromagnetic relay comprising a coil, an axially movable core in said coil, and
15 a pair of spaced leaf-spring members for yieldingly supporting said core and for providing a force opposing movement of the core in one direction which is greater than the force opposing movement of the core in
20 the opposite direction.

14. An electromagnetic relay comprising a coil, an axially movable core in said coil, and a pair of spaced members for yieldingly supporting said core, and means associated with
25 one of said members for providing a force opposing movement of the core in one direction which is greater than the force opposing movement of the core in the opposite direction.

- 30 15. An electromagnetic relay comprising a coil, an axially movable core in said coil, yielding means for supporting said core at each end thereof, and means arranged to provide a force opposing movement of the core in
35 one direction which is greater than the force opposing movement of the core in the opposite direction.

In testimony whereof, I have hereunto subscribed my name this 7th day of September
40 1927.

WILLIAM E. TRUMPLER.

45

50

55

60

65