

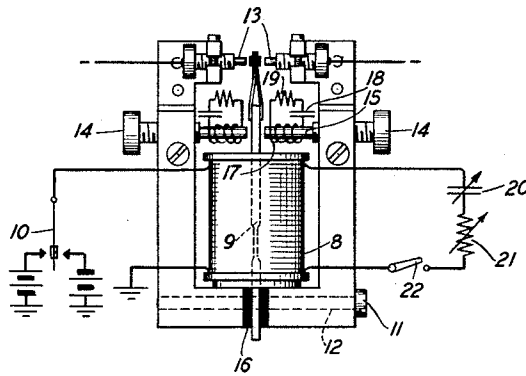
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RELAY

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RELAY

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This invention relates to high speed magnetic relays of the polar type.

The armatures of such relays frequently bounce upon striking their contacts or pole-pieces. They may rebound more than once and such single and multiple rebounds are commonly known as chatter.

An object of the present invention is to reduce or eliminate chatter.

This object is achieved by means of electrical damping; an electrical damping circuit magnetically coupled to the armature is tuned preferably to the principal frequency at which the relay armature tends to chatter.

In one form the electrical damping means may consist of tuned circuits including windings mounted upon and surrounding the pole-pieces of an otherwise conventional relay; in another form one or more of the windings of the energizing coil which surrounds the armature may be included in the tuned circuit.

The nature and details of these improvements may be more conveniently further described with reference to the accompanying drawings in which the figure is a top view of semi-diagrammatic nature of a standard type of polar telegraph relay having the improvements of the present invention incorporated therein.

In its fundamental features of construction the specific relay disclosed in the present application may be similar to that disclosed in the patent to Cummings 1,624,476, granted April 12, 1927, or Curtis 1,680,667, granted August 14, 1928; it may be considered as an improvement upon relays of the type disclosed in those patents.

The relay consists of an electromagnet comprising an energizing coil 8 through which armature 9 extends. The coil 8 may and does in practice consist of one or up to several windings which may be connected to different sources, such as line current sources, polarizing current sources, etc., but is conventionally illustrated as being connected to a source of positive and negative battery over a line or other conductor, which may be of any length, to an armature 10 of an impulse originating relay which supplies impulses to vibrate the armature 9. The armature 9 is clamped by means of a screw 11 or any other suitable means between magnetic members of a permanent magnet structure 12. The armature 9 vibrates between adjustable contacts 13 and is limited in motion by contact members (not shown) on adjustable stop screws 14 which are of magnetic construction and terminate in pole-pieces 15 through which the flux to operate the arma-

ture flows into the armature structure. The armature is generally clamped between non-magnetic shims 16. So far as described the construction is conventional and known.

A description will now be given of the novel features constituting the improvements to which this specification is primarily directed.

The pole-pieces 15 may be surrounded with a winding 17 included in series with a capacity 18 and a resistance 19. The capacity, resistance and winding are connected in series and their values may be initially proportioned or they may be made adjustable so as to be tuned to the principal frequency of chatter and the resistance may be adjusted to introduce the required dissipating effect for oscillatory electrical energy.

The natural period of vibration of the armature establishes the periodicity or frequency at which the most troublesome chatter takes place. This frequency may be estimated, for a relay of a particular design, from examination of oscillograms of the output current of the relay when low driving currents are used to operate it or it may be estimated from the shadow of the armature projected upon a rapid recording oscillograph film. Another method which could be used is to connect an oscillator to one or more windings of the relay and vary the frequency of the oscillator until maximum response of the armature is observed, always using a driving current low enough to prevent complete operation of the armature. During this process the armature should remain on one contact except for possible chatter and a slight motion near the pole-pieces may be observed. This observation may be made with a magnifying glass and the armature has the appearance of being thickest when the frequency corresponding to the natural period is reached. The circuit consisting of the elements 17, 18 and 19 is then tuned or the elements predeterminedly calculated in value for this frequency. If desired, an alternating current meter may be included temporarily in the tuned circuit while an oscillator set supplies a sinusoidal current to the main relay winding at a frequency varying through the natural period of the armature and the tuning adjusted until the meter shows the maximum response which will be the point at which the damping circuit produces the maximum damping effect. If desired, also, the line windings may be connected to the line and a direct current kept flowing in the line winding about equal to the highest value attained by the line current upon a single impulse of telegraph frequency; the purpose of this is to keep the relay winding in substantially

the same condition that it is in when the damping of the armature is useful.

An alternative form comprises connecting one of the windings of the coil 8 in a series circuit including an adjustable condenser and a resistance. The coil 8 usually has several windings and one of the otherwise unused windings may be used for this purpose or the relay may be specially constructed, if desired, with a spare winding. The condenser 20 and the resistance 21 may be proportioned and the damping circuit tuned in accordance with the same general principles as discussed in connection with the elements 17, 18 and 19. The switch 22 may be employed to open the circuit consisting of the elements 20 and 21 at times and these elements may be employed either alternatively to the elements 17, 18 and 19 or all of them may be used together in the same relay. Preferably, however, either set but not both may be employed.

The windings 17 may be mounted upon the pole-pieces in the form of insulated spools the body of which may consist of any suitable insulating material such as wood, hard rubber or a phenol condensation product. These spools may be slidably mounted upon the pole-pieces but fixed in place by any suitable means such as screws, adhesives, or frictionally during use.

What is claimed is:

1. A polar relay having means to reduce armature vibration and chatter consisting of tuned circuits each having a winding about an operating pole face of the relay and characterized in that the circuits are tuned to the natural frequency at which the armature tends to vibrate or chatter.
2. A polar relay having an armature subject to

spurious vibration or chatter, one or more windings for operating said armature, and a winding electromagnetically related to said armature included in a circuit tuned to approximately the principal frequency at which said spurious vibrations or chatter tend to occur.

3. A high speed polar relay comprising an armature, a permanent magnet structure having opposing poles within which the armature is mounted, one or more operating windings for said armature to which currents of suitable polarity and magnitude may be applied to move the armature in either one of two opposing directions, and an anti-chatter winding surrounding said armature, said winding being included in a tunable circuit consisting of inductance and capacity with a variable resistance.

4. A polar relay having main operating winding means and means to reduce armature vibration and chatter consisting of tuned circuits each included in a supplemental winding about an operating pole face of the relay and characterized in that the circuits are tuned to the natural frequency at which the armature tends to vibrate or chatter.

5. A polar relay having an armature subject to spurious vibration or chatter from mechanical causes independent of forces applied to its operating winding to operate the armature thereof, one or more windings for operating said armature, and a winding electromagnetically related to said armature included in a circuit tuned to approximately the principal frequency at which said spurious vibrations or chatter tend to occur.

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