

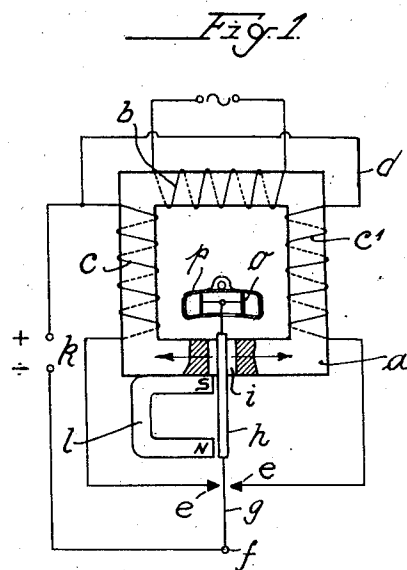
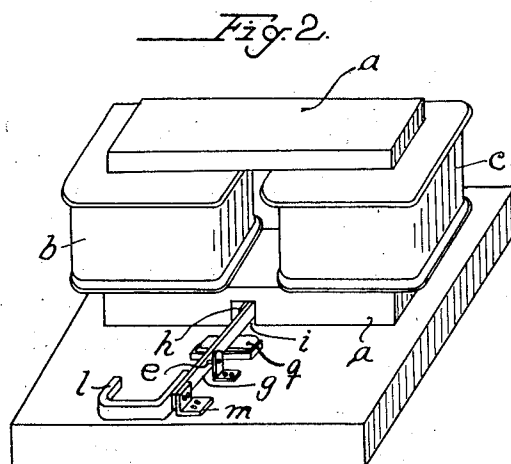
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ELECTROMAGNETIC RELAY

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ELECTROMAGNETIC RELAY

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In electrical vibratory devices, for instance, electromagnetic relays comprising an oscillating armature or lever for converting direct current into alternating current or vice versa, the alternating system tends to vibrate with a frequency which corresponds to the natural vibration of the system. In such devices, if the oscillating armature has a natural vibration the frequency of which differs from the frequency of the alternating current to be converted, the said tendency causes spark formations and other disturbing phenomena during the closing and breaking of the current passing through the said armature or a contact mechanism controlled thereby.

If an oscillating armature is influenced by an alternating flux the frequency of which is not in resonance with the natural vibration of the said system, this armature will, when started by the alternating flux, tend to vibrate more slowly or quickly than the alternating flux in proportion as the frequency of its natural vibrations is less or larger than the frequency of the alternating flux. The impulses from the alternating flux which should cause and maintain a regular vibration of the oscillating armature would, therefore, within the different periods of vibration, appear at different moments, wherefore the motions of the vibrating system will be irregular and cause short-circuits and subsequent disturbances.

It is necessary to entirely restrain the tendency of the vibrating armature to oscillate with its natural frequency for which reason the said oscillations should be made aperiodic. The present invention serves this purpose, and according to the invention the oscillating armature is combined with damping means such as a friction brake which constantly engages the oscillating armature and secures face coincidence between the exiting current and the oscillating armature.

The friction brakes used according to the present invention should be of such nature that they restrain the tendency of the vibrating armature to vibrate in conformity with its natural vibration, and besides, restrain all mechanical oscillations other than those

which are transferred to the armature by way of the alternating flux influencing it. Such undesired mechanical vibrations are, for instance, the secondary oscillations which are due to the contact strokes in the contact mechanism controlled by the armature during the motion of the same and such vibrations which are due to external mechanical vibrations. It has previously been proposed to restrain such secondary oscillations by way of damping means, such as leaf springs or damping layers mounted on the armature and influencing the contact mechanism, but these damping means are not able to influence the vibration of the armature itself otherwise than by way of a resilient counter pressure which ordinarily influences the armature when its movable contact strikes against the stationary contact or contacts.

The damping means used according to the present invention are friction brakes of any suitable structure engaging the armature during its oscillations, and may be cushions against which the vibrating armature or the tongue or lever carrying the armature slides during the oscillations.

The damping cushion or cushions may be in contact with the vibratory tongue or lever along a single or two opposite surfaces or edges, being vertical to the direction of vibration, or the said cushion or cushions may be arranged in contact with one or more of the surfaces or edges on the vibrating systems which are parallel to the direction of motion, for instance, in such a manner that one surface or edge on the vibrating system continuously slides on the damping cushion during the vibrations.

Instead of cushions, any suitable damping means of well known kind, such as liquid or air dashpots, may be used and as a special embodiment of the invention, the entire vibrating system may be immersed in an oil bath which in known manner acts as a damper device.

The further details of the invention will appear from the following description of the device shown on the drawings.

Fig. 1 shows the wiring diagram for a double-acting electromagnetic rectifier con-

constructed according to the present invention for conversion of alternating current into direct current.

Fig. 2 shows a perspective view of an electromagnet rectifier constructed according to the invention.

a is a closed iron core which for instance as shown may be of the same shape as the iron core in a single-phase transformer. The iron core a is of known laminated construction. b is the primary winding, and c and c' are the secondary windings of a single-phase transformer. The primary winding b is fed with current from a source of alternating current $\sim$. The two secondary windings c and c' are interconnected at one end by means of a wire d , while the two other ends of the said two windings are joined each to one of two fixed contacts e and e' , which suitably are resilient and co-operate with a tongue g oscillating about an axis f and supporting at its end an armature h made of iron and extending into a lateral slot in the iron core a . If the electromagnet armature h in some way or other is caused to oscillate about the axis f , so as to swing back and forth in the directions indicated by the arrows in Fig. 1, then the alternating field in the iron core a will maintain this oscillating motion, which produces periodical closures and breaks of current between the contacts e and e' and the tongue g . Thereby the alternating voltages induced in the windings c and c' will be rectified in known manner, so as to form a continuous voltage to be taken off at the terminals k .

The armature h will be set into oscillation as soon as current is closed to the primary winding b . The field thereby created at the first moment in the iron core a will actuate the armature h , as a portion of the field passes through the slot i . It will, however, depend on chance whether the armature h , if it is not magnetic, swings out to one or the other side in consequence of the first instantaneous influence of the field produced in the iron core a by the closure of current. If the armature swings out to the wrong side the current closures produced will be wrong, whereby the polarities plus and minus on the continuous-voltage side of the relay or rectifier will be reversed. In order to avoid such a reversal it will be suitable to polarize the armature h , which may be done by means of a permanent magnet l , the poles S and N of which face towards the side of the armature h and cause the armature to become magnetic, so that the portion of the armature situated in the slot will have a definite magnetic potential. At the moment of start the armature will then move towards the side of the slot that has a magnetic potential opposite the magnetic potential resting on the free end of the armature. Thus the advantage is attained that by a closure

of current in the primary circuit the armature will always swing out in the right direction. The contacts e and e' are suitably arranged in such a manner that they can be adjusted in the direction at right angles to the axis of oscillation of the armature.

By adjustment of the contacts e more or less close to the tongue g a regulation of the length of the period of current closure will consequently be attainable.

In the embodiment shown in Fig. 1 the rectifier is constructed as a double-acting rectifier, but the essence of the invention will of course be covered by constructing a single-acting rectifier according to the same principle (see Fig. 2).

In the construction of Fig. 2 only one single resilient and fixed contact e is provided which cooperates with the oscillating tongue at a point situated between the point of fixation m of the same and the iron core a .

In order to secure an accurate agreement between the periodic oscillation of the armature and the periodic oscillations of the alternating current, so as to attain properly timed closures and breaks of current it will be suitable to adjust the mass of the armature in such a manner that the natural frequency of the armature will be smaller than the frequency of the alternating current, and to use, in connection with the armature, some damping devices, for instance, as shown in Fig. 1, an air dashpot comprising two plate-shaped pistons o which are rigidly attached to the oscillating armature and vibrate under the influence of the armature in a curved cylinder p surrounding the pistons as closely as possible without touching the edges, or, as shown in Fig. 2, a stationary cushion q of felt, leather, rubber or similar material which forms a friction body along which one edge of the armature h , or of the spring g , slides while oscillating.

The damping devices o , p and q form in fact pneumatical or mechanical friction brakes, which will restrain natural vibrations of the armature and the contact mechanism $g-e$ controlled by the armature, and cause the oscillating member to vibrate aperiodically.

In the above described constructions the slot i is shaped like a groove in one of the side faces of the iron core, but the frame of the invention will not be transgressed by using, instead of such a groove, a bore passing through the iron core a which bore, however, must be directed transversely to the direction of lines of force in the iron core a . The said slot or bore, however, does not have to be perpendicular to the direction of the lines of force in the iron core, but may intersect the same at an angle differing from a right angle.

Having now particularly described and ascertained the nature of our said invention

and in what manner the same is to be performed, we declare that what we claim is:

1. A rectifying electromagnetic relay, comprising a closed iron core provided with a slot, a primary winding mounted upon said iron core for energizing the same periodically, a spring armature extending into said slot and movable therein by magnetic action of the core, a secondary winding mounted upon the iron core, a contact mechanism controlled by the movement of the armature, connections from said secondary winding to the contact mechanism, and a friction brake constantly engaging the armature mechanically so as to restrain undesired mechanical vibrations thereof.

2. A rectifying electromagnetic relay, comprising a closed iron core provided with a slot, a primary winding mounted upon said iron core for energizing the same periodically, a spring armature extending into said slot and movable therein by magnetic action of the core, a secondary winding mounted upon the iron core, a contact mechanism controlled by the movement of the said armature, connections from said secondary winding to the contact mechanism, and a cushion mechanically engaging the armature so as to restrain undesired mechanical vibrations thereof.

In testimony whereof they affix their signatures.

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