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ALTERNATING-CURRENT RELAY

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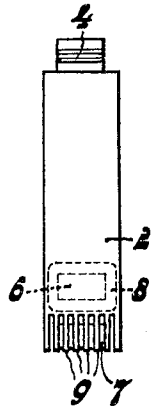


Fig. 2.

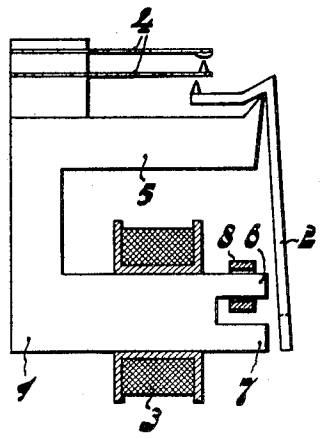


Fig. 1.

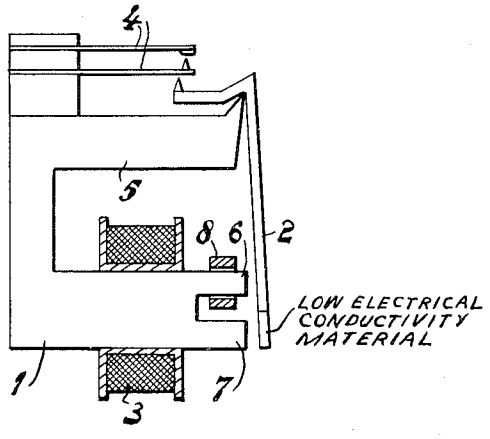


Fig. 3.

INVENTORS

Willy Ober

Koenraad Drooglever Fortuyn

By Fred M Vogel

Agent

United States Patent Office

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ALTERNATING-CURRENT RELAY

Willy Ober and Koenraad Droogleever Fortuyn, Eindhoven, Netherlands, assignors to Hartford National Bank and Trust Company, Hartford, Conn., as trustee

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5 Claims. (Cl. 317—184)

This invention relates to alternating-current relays comprising an armature adapted to be attracted by one end of a core surrounded by an energising winding, and comprising a short-circuit winding embracing part of the cross-section of the end of the core. Known alternating-current relays generally comprise a laminated core and an armature constituted by a sheet of solid ferromagnetic material, part of the cross-section of the core being surrounded by a short-circuit winding. As is well-known, the short-circuit winding, which may be a simple brass ring, brings about a phase-shift of the magnetic flux embraced by the short-circuit winding, thus preventing chattering of the armature attracted by the core.

In large alternating-current relays it is known to provide parts of the core and of the armature, which parts are opposite one another, each with a short-circuit winding to ensure further improvement in operation.

The use of the above-mentioned step in alternating-current relays is, however, objectionable since the provision of a short-circuit winding on the armature increases the weight of the moving parts, which should be as light as possible.

An alternating-current relay comprising an armature which may be attracted by an extremity of a core surrounded by an energising winding, and comprising a short-circuit winding which embraces part of the cross-section of said extremity of the core, is characterized in that eddy currents in the armature are prevented, for example, by lamination of the armature, at the area where the armature is opposite that part of the extremity of the core which does not comprise a short-circuit winding, whereas eddy currents may occur freely in the part of the armature opposite the other part of the extremity of the core.

The lamination of the armature, which may be effected by incisions, saw-cuts or the like, will preferably extend in a direction parallel to the magnetic flux in order to minimize the magnetic reluctance as much as possible.

The short-circuit winding may surround part of the extremity of the core provided on the inner side of the alternating-current magnet and the lamination constituted by the provision of parallel slots extending from the edge of the armature.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying diagrammatic drawing, given by way of example, in which:

Fig. 1 is a side-view partly in section and

Fig. 2 is an elevation view of one embodiment of an alternating-current relay according to the invention;

Fig. 3 is a view similar to Fig. 1 of a modification.

The alternating-current relay shown in Figures 1 and 2 comprises a laminated core 1, an armature 2, an energising winding 3, and relay springs 4 supported from a limb 5 and insulated from one another. The extremity of the core opposite the end of the armature is divided into two parts 6 and 7. Part 6 of the core extremity, which

is provided on the inner side of the limb carrying the winding 3, is surrounded by a short-circuit winding 8.

Upon energisation, two spatially separate magnetic fluxes emanating from the parts 6 and 7 of the core occur in the air-gap between the core and the armature 2, said fluxes being relatively shifted in phase. Each time one flux becomes zero, the other flux has a value other than zero and dependent upon the phase difference between the two fluxes. Consequently, the attraction exerted on the armature 2 by the parts 6 and 7 is constituted by the sum of two components, of which the first has a constant value and the second fluctuations in the rhythm of double the frequency of the energising current. The periodically occurring minimum values of the attraction force determine the maximum force by which the armature may be loaded without chattering occurring. With a phase difference between the two fluxes which is smaller than 90°, this force increases with increasing phase difference.

In order to increase the maximum force exerted on the armature 2 by the parts 6 and 7, a plurality of parallel slots 9 of approximately equal depth are provided in the extremity of the armature opposite the part 7 of the core. The laminations are shown more clearly in Fig. 2, the parts 6 and 7 of the extremity of the core being shown in dotted lines for the sake of clearness. The slots 9 extend in a direction substantially parallel to that of the magnetic flux. In the part of the armature opposite part 6 of the extremity of the core, eddy currents are produced by the magnetic flux emanating from this extremity of the core, which eddy currents increase the phase shift of this flux brought about by the short-circuit winding 8. The effect of the eddy currents thus corresponds to that of a short-circuit winding.

On the other hand, in the part of the armature opposing the part 7 of the extremity of the core, the slots 9 impede the flow of eddy currents therein, thus tending to reduce the phase shift of the flux emanating from the part 7 of the core. Consequently, the phase shift between the fluxes emanating from the parts 6 and 7 of the core is greater than if the slots were not provided.

The separation of the flux into two parts shifted in phase is maintained in the armature. It is thus ensured that the armature may be loaded to a greater extent without chattering occurring.

The armature described may be manufactured in a simple manner, for example, by a single punching or stamping operation.

It is surprising that advantage may be taken of eddy currents occurring in the armature by reducing eddy currents at a given area.

Suppression of the eddy currents in the armature at the area at which the armature is opposite that portion of the extremity of the core which does not comprise a short-circuit winding, may take place not only by lamination as shown in Figs. 1 and 2 but alternatively, for example, by manufacturing the said part of the armature from poorly-conductive ferromagnetic material such, for example, from powdered iron or ferrite. This construction is illustrated in Fig. 3.

What we claim is:

1. An alternating current relay comprising a core one end of which has at least two outwardly extending portions, a short-circuit winding surrounding one of said outwardly extending core portions, and an armature adapted to be moved toward said outwardly extending core portions when said core is magnetized, said armature having a portion disposed opposite said outwardly extending core portion free of said short-circuit winding having a relatively high electrical resistance to the flow of eddy currents therein, said armature having a portion thereof disposed opposite said outwardly extending core

portion surrounded by said short-circuit winding having a relatively low electrical resistance to the flow of eddy currents therein.

2. An alternating-current relay comprising a core one end of which is split into two portions, a short-circuit winding embracing only one of said two portions, and a pivotably mounted armature adapted to be moved toward said one end of said core when the latter is magnetized, said armature comprising a ferromagnetic metal plate including a first portion disposed opposite said one portion of said one end of said core and exhibiting a relatively low electrical resistance to the flow of eddy currents therein, said armature including a second portion laminated in a direction of length of the armature to exhibit a relatively high resistance to the flow of eddy currents therein and disposed opposite the other portion of said one end of said core.

3. An alternating-current relay comprising a core one end of which is split into two portions, a short-circuit winding embracing only one of said two portions, and a pivotably mounted armature adapted to be moved toward said one end of said core when the latter is magnetized, said armature comprising a ferromagnetic metal plate including a first portion disposed opposite said one portion of said one end of said core and exhibiting a relatively low electrical resistance to the flow of eddy currents therein, said armature including a second portion constituted of a ferromagnetic material of low electrical conductivity to exhibit a relatively high resistance to the flow of eddy currents therein and disposed opposite the other portion of said one end of said core.

4. An alternating-current relay comprising a U-shaped ferromagnetic core one end of which is split into two spaced portions, a short-circuit winding surrounding only the portion of said two spaced portions adjacent the other end of said U-shaped core, and a plate-like armature

closing off said U-shaped core and pivotably mounted on said other end of said core, said armature comprising a ferromagnetic metal member including an end portion disposed opposite the portion of said split end of said core more remote from said other end of said core, said end portion being slotted in the direction of length of the armature to increase the electrical resistance to eddy currents therein, said armature further including a solid portion adjacent said end portion and opposite the portion of said split end of said core adjacent said other end of said core, said solid portion exhibiting a relatively low resistance to the flow of eddy currents therein.

5. An alternating-current relay comprising a U-shaped ferromagnetic core one end of which is split into two spaced portions, a short-circuit winding surrounding only the portion of said two spaced portions adjacent the other end of said U-shaped core, and a plate-like armature closing off said U-shaped core and pivotably mounted on said other end of said core, said armature comprising a ferromagnetic metal member including an end portion disposed opposite the portion of said split end of said core more remote from said other end of said core, said end portion being constituted of ferromagnetic material of low electrical conductivity to increase the electrical resistance to eddy currents therein, said armature further including a solid portion adjacent said end portion and opposite the portion of said split end of said core adjacent said other end of said core, said solid portion exhibiting a relatively low resistance to the flow of eddy currents therein.

References Cited in the file of this patent

UNITED STATES PATENTS

1,501,733	Traver	July 15, 1924
2,539,547	Mossman et al.	Jan. 30, 1951
2,546,740	Goldberg	Mar. 27, 1951