

July 13, 1965

A. UEBERSCHUSS ETAL

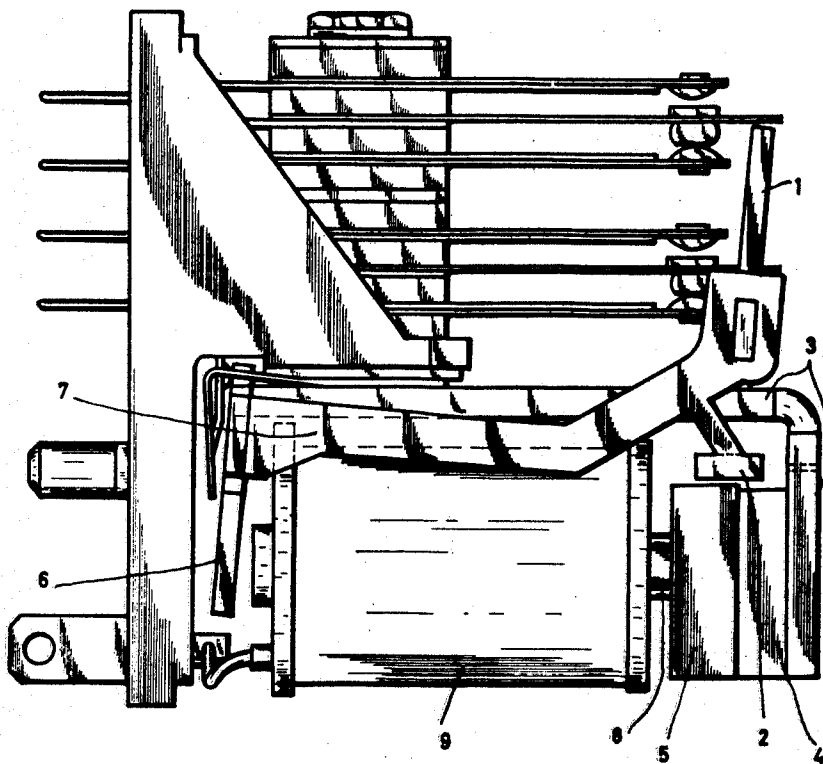
3,195,023

ELECTROMAGNETIC RELAY

Filed April 9, 1962

3 Sheets-Sheet 1

Fig. 1



July 13, 1965

A. UEBERSCHUSS ETAL

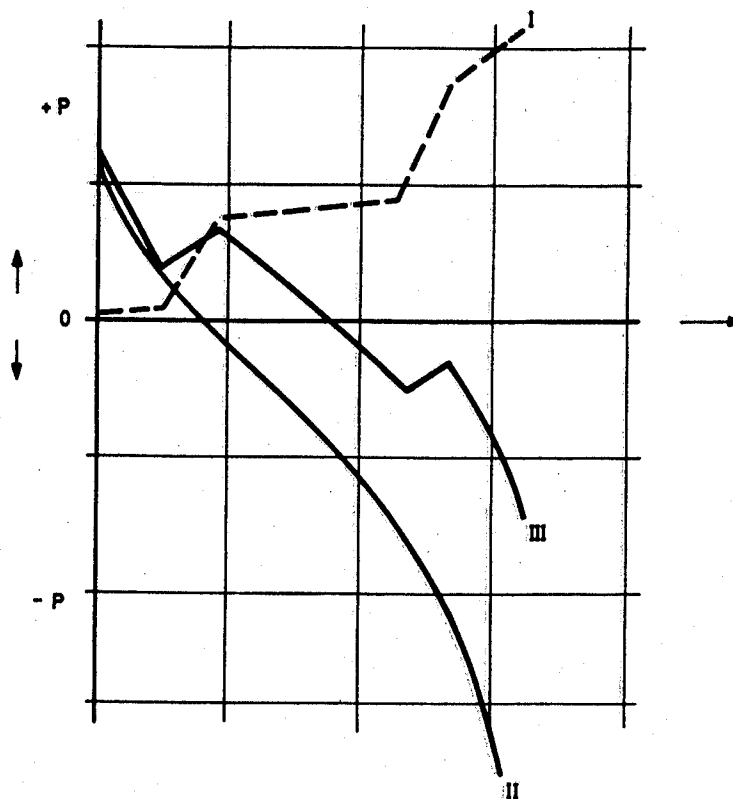
3,195,023

ELECTROMAGNETIC RELAY

Filed April 9, 1962

3 Sheets-Sheet 2

Fig. 2



July 13, 1965

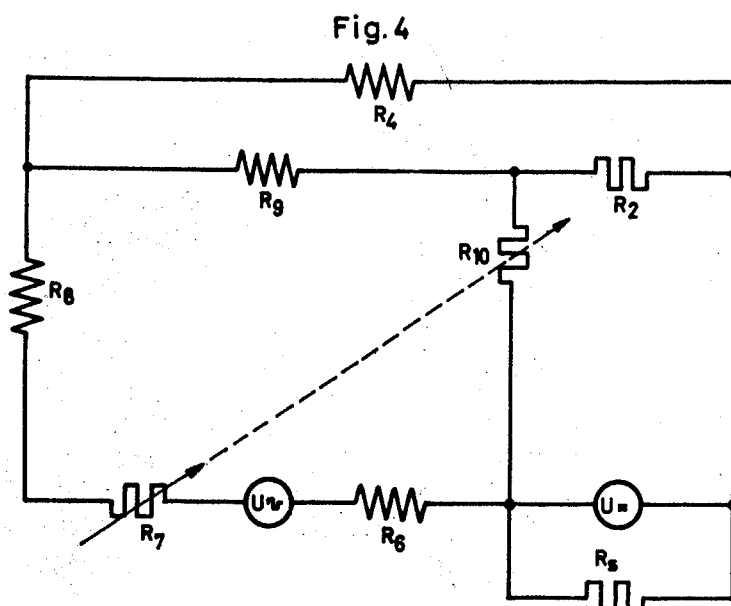
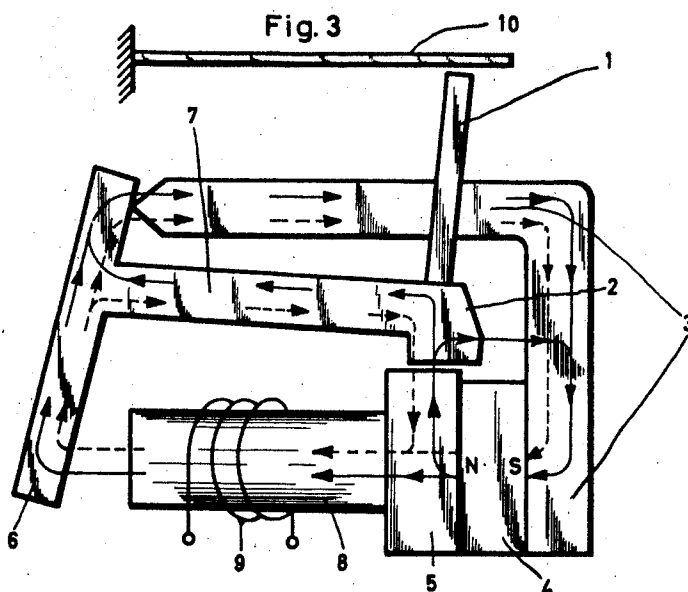
A. UEBERSCHUSS ETAL

3,195,023

ELECTROMAGNETIC RELAY

Filed April 9, 1962

3 Sheets-Sheet 3



1

3,195,023

ELECTROMAGNETIC RELAY

Albert Ueberschuss and Helmut Mielert, both of Munich, Germany, assignors to Siemens & Halske Aktiengesellschaft, Berlin and Munich, a German corporation

Filed Apr. 9, 1962, Ser. No. 186,122

Claims priority, application Germany, Apr. 28, 1961, S 73,748

2 Claims. (Cl. 317-172)

The invention disclosed herein is concerned with an electromagnetic relay having an armature which upon cessation of control energization of the relay winding remains in one of its two possible end positions until arrival of the next control impulse which effects switching over of the armature to its alternate end position.

Such operation has been accomplished in connection with known relays, by the provision of mechanical interlock means, entailing, however, undesired structural complications, consequently increasing the costs, and also increasing spatial requirements. Moreover, owing to the fact that the control impulses always act in the same direction, the corresponding mechanical switch-over or interlock devices give in the event of impulse distortions, due to contact chattering or the like, no assurance that the armature actually reaches the desired end position.

The invention overcomes these drawbacks by the provision of a relay, comprising a permanent magnet which cooperates with the control flux, produced by the electromagnet system, in such a manner that the armature is switched into one end position by superimposition of the control flux and the permanent flux, that is, by the sum of the two fluxes, while being switched into the other end position by the difference between the two fluxes, and being upon cessation of the control flux held in the respectively attained position.

In accordance with the present invention, this is accomplished by means cooperating with the armature, for producing a restoring force which always acts in the same direction, whereby the armature is held in one end position by the restoring force while being held in the other end position by the force of the permanent magnet. So far as the principle is concerned, the restoring force could be supplied by a spring. However, in an embodiment to be presently described the restoring force is in particularly advantageous and structurally simple manner, produced by an auxiliary armature extending from the arm of the main armature, said auxiliary armature branching from the main magnetic circuit of the relay an auxiliary flux which exerts the holding force upon the armature in the normal position thereof.

Further details of the invention will appear from the description which is rendered below with reference to the accompanying drawings.

FIG. 1 shows in schematic manner an example of the structure of a relay according to the invention;

FIG. 2 is a force-way diagram for the operating and the holding forces which are effective in connection with the relay shown in FIG. 1;

FIG. 3 represents the flux course in its principal features; and

FIG. 4 is a substitution circuit for the magnetic circuits.

In the example shown in FIG. 1, the auxiliary armature 2, which extends from the arm 7 of the main armature 6,

2

is attracted by the permanent magnet 4, the resulting force of attraction operating in opposition to the operatively effective pull of the arm 7 of the armature 6. The dimensions of the auxiliary armature 2 and the position thereof, are so selected that the force predominates which is exerted by the arm 7 of the main armature 6 upon operative attraction thereof, while the force of the auxiliary armature 2 predominates when the main armature is in normal or deenergized position. The main armature and auxiliary armature and parts thereof are made of one piece. The spacing between the auxiliary armature 2 and the permanent magnet 4 and its pole piece 5 can be adjusted by bending the arm of the auxiliary armature. The contact leaf 10 is adapted to be actuated by the extension 11 mounted on the arm 7.

FIG. 2 shows the force-way curves which are to be considered in connection with the relay illustrated in FIG. 1.

Curve I is the force-way characteristic of the contact arrangement; curve II is the force-way characteristic of the magnet system; and curve III is the resultant of the curves I and II. It will be seen that the resultant III extends nearly symmetrically to the zero line, showing that the holding forces acting in the two end positions are approximately equal and oppositely oriented.

In FIG. 3, the course of the control flux and of the permanent flux are indicated respectively by dash lines and full lines. In the illustrated normal position of the main armature 6, the permanent flux extends substantially over the small air gap, that is, over the auxiliary armature 2. This flux over the auxiliary armature produces, in the illustrated position of the armature, the holding force. Upon attraction of the main armature responsive to a control impulse, the flux of the magnet will after cessation of the impulse flow over the armature and hold it in the attracted position.

FIG. 4 shows a substitution circuit for the principal-flux course described in connection with FIG. 3. The permanent magnet 4 is indicated in the form of a generator $U=$; the control flux producer is indicated in the form of a generator $U\sim$; R_2 is the scatter resistance between the auxiliary armature 2 and the yoke 3; R_4 indicates the magnetic resistance of the upper portion of the yoke 3; R_5 indicates the effective resistance across the magnet 4; R_6 indicates the resistance in the core 8 of the energizing coil 9; and R_8 and R_9 represent the magnetic resistance in the main armature 6 and the armature arm 7. Finally, R_7 and R_{10} indicate the resistances obtaining respectively in the air gap between the main armature 6 and the cooperatively associated pole piece and between the auxiliary armature 2 and the pole piece 5.

Changes may be made within the scope and spirit of the appended claims which define what is believed to be new and desired to have protected by Letters Patent.

We claim:

1. An electromagnetic relay having a permanent magnet which coacts with the control flux produced by the electromagnet system so that the armature is by superposition of the control flux and the permanent flux actuatable to assume its two respective end positions and being upon cessation of the control flux held in the attained end position, comprising an auxiliary armature extending from the main armature for deriving from the permanent magnet disposed in the control flux circuit an auxiliary flux which produces a restoring force, always acting in the same direction, said auxiliary flux exerting a

3

holding force upon the armature in the normal position thereof, with the armature being held in one end position thereof by the restoring force, while being held in the other end position by the force exerted by the permanent magnet.

2. An electromagnetic relay according to claim 1, wherein the forces for holding the armature in its two end positions are produced by the same permanent magnet.

5

4

References Cited by the Examiner

UNITED STATES PATENTS

2,908,783	10/59	Ugon	200—93
2,913,639	11/59	Coppola	317—171
2,928,029	3/60	Norton	317—171

LARAMIE E. ASKIN, *Primary Examiner*.

E. JAMES SAX, JOHN F. BURNS, *Examiners*.