

Sept. 19, 1967

W. GROBE
ADHESIVE RELAY

3,343,110

Filed May 11, 1966

2 Sheets-Sheet 1

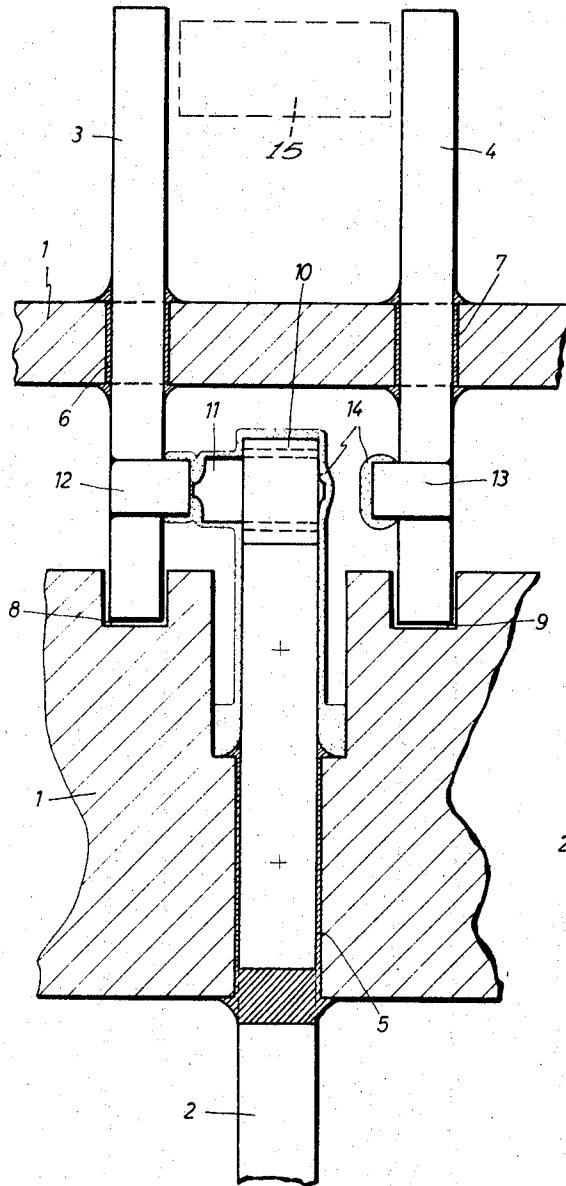


Fig.1

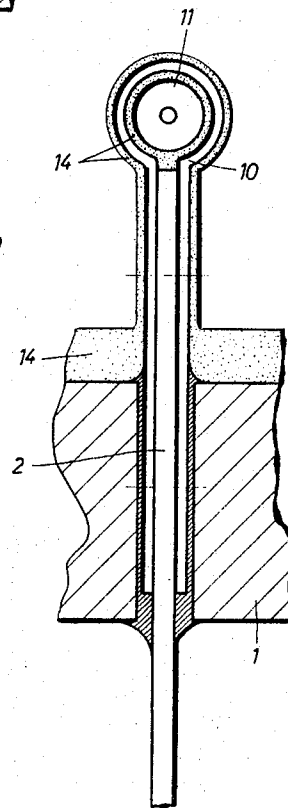


Fig. 2

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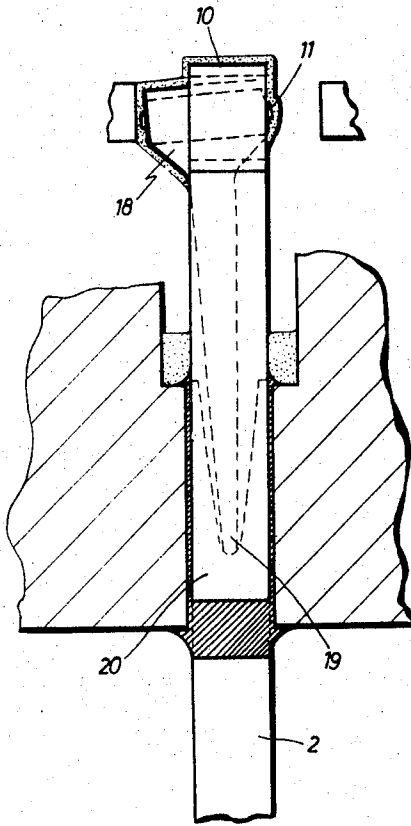


Fig. 3

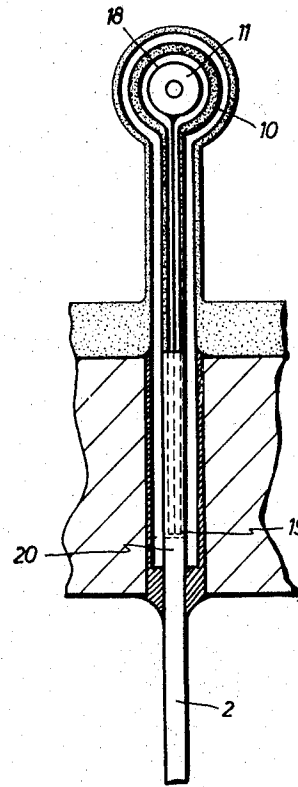


Fig. 4

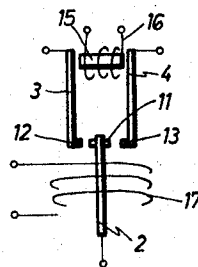


Fig. 5

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3,343,110

ADHESIVE RELAY

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5 Claims. (Cl. 335—55)

The invention relates to an adhesive relay with two air gaps and an armature which shows a resting or non-operative position.

Adhesive relays are known for use as coincidence relays with two excitation windings, actuating an armature in common. These relays for the excitation of which the current coincidence in both excitation windings is substantial, are used also in matrix-like switching grids at the crosspoints of which the relays are provided as bistable switching elements. Such matrix-type switches therefore provide the effect of storage, and serve, for example in automatic telephone technology as group selectors and final selectors for establishing a connection.

It has been proposed to obtain in these adhesive relays the holding force for the contacts through permanent magnets and/or springs. When producing a force for the break-contact through a permanent magnetic flux the formation of the magnetic circuits become somewhat intricate due to branches for the holding flux, therefore attempts were made to do it without a holding magnet. Another difficulty when using permanent magnets and springs is that in the miniaturization trend for the components in telephone engineering the relays become so small that the forces to keep the contact closed or opened are too low.

It is a primary object of the invention to provide an extremely small adhesive relay for crosspoint elements in crossbar switching grids which enables, without the use of permanent magnets and springs, a quick contact making, free from chatter and wear and tear, as well as a secure adhesion of the armature at the opposite poles. This is possible by applying the known principle of contact-making between the surfaces of liquids, because thereby only very small contacting forces are required and the adhesion of the liquid at a suitable formation of the surface of the contact elements serves as a holding force. This is achieved according to an embodiment of the invention in which the armature is wetted on its entire surface by a contact liquid in which said armature is borne floating and which liquid simultaneously serves as current feeder for the armature, contact-making being made between armature and the counter-poles through the surfaces of the liquid. The stable resting position of the armature is obtained, according to the invention, that the adhesive force of the armature is achieved through barrier layer forces on the surfaces of the liquid.

According to an embodiment of the invention an armature is shaped like a piston and borne in a sleeve, floating in the liquid.

According to a further embodiment of the invention the piston shaped armature is clamped into a fixing device, borne floatingly within the sleeve, the bottom end of said fixing device forming a knife-edge, supported in a seat of the contact element, associated to the armature, so that the armature, wetted by the liquid can move like a pendulum within the bearing sleeve.

According to a further embodiment of the invention the liquid consists of mercury.

According to a further embodiment of the invention the armature, the counter poles, the fixing device for

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the armature and the bearing sleeve consist of a ferromagnetic material that can be wetted by mercury, or of a ferromagnetic material with a coat that can properly be wetted by mercury.

According to a further embodiment of the invention only the internal surfaces of the bearing sleeve, the armature with its fixing device and the counter poles can be wetted by mercury.

In a further embodiment of the invention the exact position of the three contact elements, bearing the counter poles and the armature, is maintained through inside profiling of the casing.

The adhesive relay according to the invention shows various substantial advantages. For example, a very simple and small construction, free from wear and tear, is possible being particularly suitable for crossbar switching grids with regard to principle, space and excitation power, at a safe contact-making, free from chatter, in particular small flux cross-sections are sufficient for the relay according to the application in order to move the small "freely" floating armature or the armature element responding upon small forces due to the knife-edge bearing, quickly enough.

Further features of the invention may be gathered from the following description of an example, schematically shown on the drawings:

FIG. 1 shows a part of the relay according to the invention, seen from the front on enlarged scale,

FIG. 2 shows a sectional view of the relay according to FIG. 1, seen from the side,

FIG. 3 shows an embodiment of an armature supported in a bearing of the relay according to the invention as seen from the front,

FIG. 4 shows a sectional view of the armature and bearing according to FIG. 3, seen from the side, and

FIG. 5 shows a sketch of an arrangement of the coils in the relay according to the invention.

In FIG. 1 the casing 1 may consist of plastics or ceramics, for example. The contact elements 2, 3 and 4 are positioned in slots 5, 6 and 7 or fixed inside profiled grooves 8 and 9 of the housing 1, and fastened through suitable methods (e.g. glueing) in said housing. The counter-poles 12 and 13 are inserted into the contact elements 3 and 4. The contact element 2 shows at its top end a sleeve 10 in which the piston-shaped armature 11 is borne. The armature 11, the sleeve 10 and the counter-poles 12 and 13 consist of ferromagnetic material that can be wetted by mercury (Hg) 14. The block 15 refers to the core of a coil.

FIG. 2 shows a part of the housing 1 with the therein inserted contact element 2, from the side. Fixing of the sleeve 10 onto the contact element 2 is shown. The armature 11 is borne within the sleeve 10 in the contact-making liquid 14 "freely" floating.

FIG. 3 shows another kind of armature bearing whereby the armature 11 is clamped into a fixing device 18, borne within the sleeve 10 floating, its bottom end forming a knife-edge 19. Said knife-edge is supported by a seat 20 of the contact element 2. The sleeve 10 encloses the fixing device 18 and serves for lateral guidance of the armature element.

FIG. 4 shows the arrangement according to FIG. 3 from the side.

FIG. 5 shows, as an example, how the coils 16 and 17 of the relay according to the invention can be arranged, in order to obtain a coincidence relay. The other reference numerals correspond to the ones used in the preceding figure.

While the principles of the invention have been described above in connection with specific apparatus and applications, it is to be understood that this description

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is made only by way of example and not as a limitation on the scope of the invention.

1. An adhesive relay forming a double air gap, comprising:

an armature of substantially cylindrical form wetted 5
on its entire surface by a contact-making liquid,
a sleeve having a substantially cylindrical opening float-
ing said armature in a supply of said contact-making
liquid,

a first contact element supporting said sleeve, 10
second and third contact elements insulated from
said first contact element and supporting counter-
poles normally separate from opposite ends of said
armature by air gaps, a coating of said contact-
liquid on said counter-poles, an electromagnet posi- 15
tioned with respect to said second and third con-
tact elements to cause said armature to close one of
said air gaps and provide a path for current to flow
through said first contact element, said contact-
making liquid, and one of said counter-poles to a 20
selected one of said second and third contact ele-
ments.

2. An adhesive relay substantially as claimed in claim 1, in which

the armature is clamped in a fixing device,
the fixing device has a substantially cylindrical end 25
on its outer surface around said armature and is
borne floatingly within the sleeve,

the fixing device has a second end forming a knife-
edge opposite the cylindrical end, and

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said first contact element includes a seat receiving and
supporting said knife-edge,
whereby the armature, wetted by the contact-making
liquid, moves like a pendulum within the sleeve.

3. An adhesive relay substantially as claimed in claim 1, in which

said contact-making liquid is mercury, and the arma-
ture, the counter poles and the sleeve consist of
ferromagnetic material that is wetted by mercury.

4. An adhesive relay substantially as claimed in claim 2, in which

the contact making liquid is mercury, and
the internal surface of the sleeve, the armature with
its fixing device and the counter poles are made
of material that is wetted by mercury.

5. An adhesive relay substantially as claimed in claim 1, in which

the relay is enclosed in a housing, and
the exact positioning of the three contact elements bear-
ing the counter-poles and the armature is determined
by inside profiling of the housing.

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