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S. D. VIGREN ET AL

2,652,464

POLARIZED RELAY

Filed May 31, 1951

2 Sheets-Sheet 1

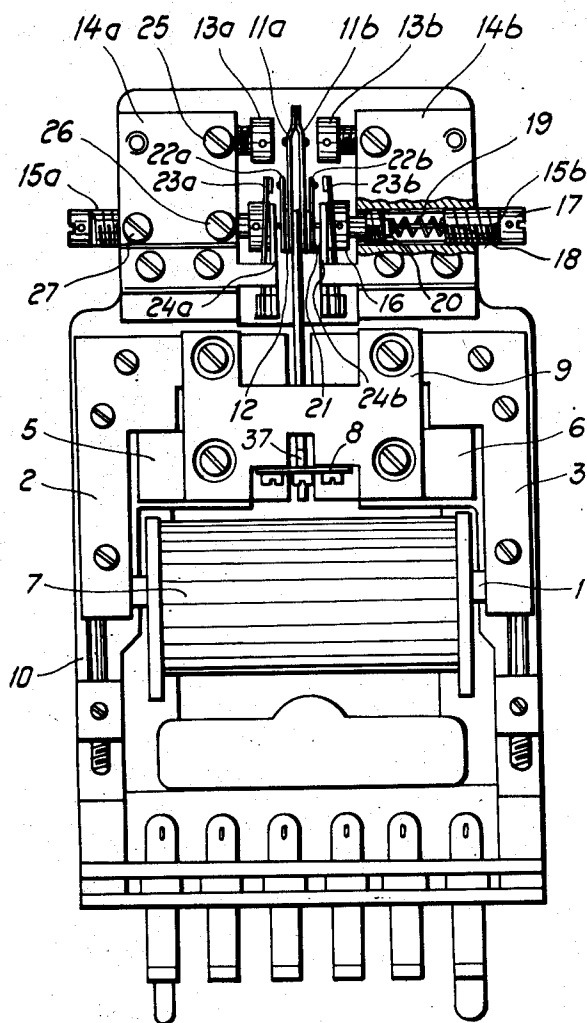


Fig. 1

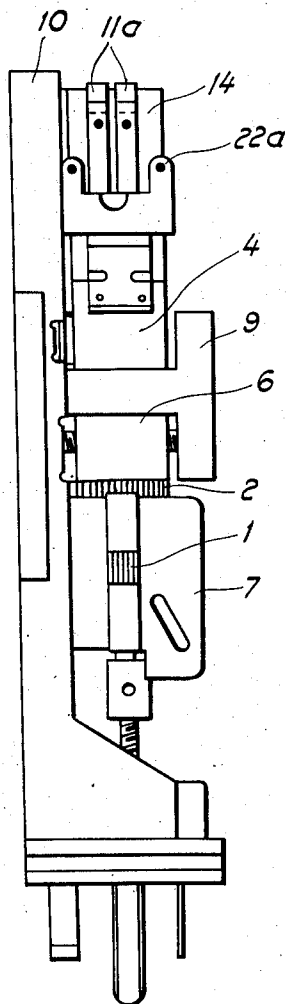


Fig. 2

Sten Daniel Vigren
Per Harry Elias Claesson
Rolf Albin Zander
INVENTORS

BY *Richardson, Davidson & Gordon*
ATTYS.

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2 Sheets-Sheet 2

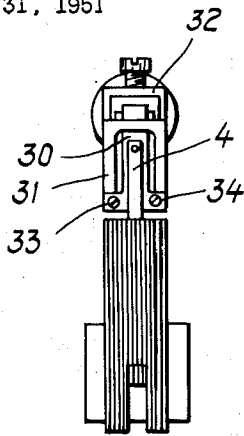


Fig. 4

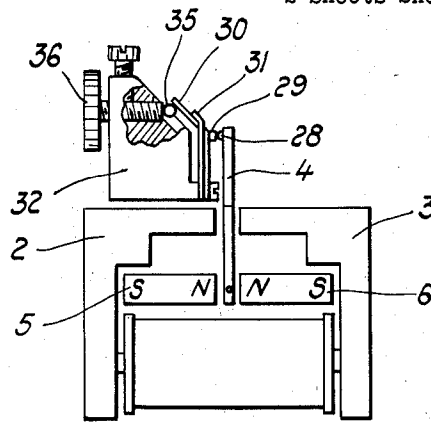


Fig. 3

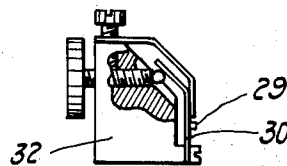


Fig. 5

Sten Daniel Vigren
Per Harry Elias Claesson
Rolf Albin Zander
INVENTORS

BY *Rickardson, Davidson, Gordon*
ATTYS.

UNITED STATES PATENT OFFICE

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POLARIZED RELAY

Sten Daniel Vigren, Stockholm, Per Harry Elias
Claesson, Jakobsberg, and Rolf Albin Zander,
Stockholm, Sweden

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The present invention relates to polarized relays of the type comprising a pivoted armature moving in the space between two opposite poles of a controlling magnetic circuit provided with a winding coil, and one or more permanent magnets for so polarizing the armature, that it will be operated in dependance of the direction of current through the winding coil.

Relays of this type are used for instance in telegraph receiving and repeater devices and for other purposes when a vibratory armature movement is required or when the armature shall be operated for current of one predetermined direction only or in one direction from a middle position by current of one direction and in the other direction from said middle position by current of the reverse direction.

It is important, that relays of this kind are very rapid in operation and to this end the moment of inertia of the armature shall be as small as possible. On the other hand the contacts of the relay will have to be so located as to permit easy accessibility for adjustment and inspection, and in devices hitherto known this has been possible to achieve only by arranging the armature as a two-armed lever having its contact end and the end actuated by the controlling magnetic flux on either side of its pivotal axis. Such an arrangement will, however, in practice cause the mass of the armature to be greater than wanted, and the contacts will be subject to considerable detrimental forces at the oscillatory movement of the armature.

One object of this invention is to provide a polarized relay of the type described above having its components so mutually arranged, that the use of an armature in the form of a one-armed lever is made possible without obstructing the accessibility of the contacts and that the relay will be highly sensitive, rapid and safe in operation.

Another object of the invention is to provide a polarized relay, which is operable in steps in dependance of different current strengths in the respective current directions.

These and other objects and features of the invention will appear from the following description of a few embodiments of the invention in connection with the accompanying drawings in which:

Fig. 1 shows a polarized relay according to the invention in plane view.

Fig. 2 shows the same relay in side view.

Fig. 3 shows in simplified form a similar relay provided with contact damping means.

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Fig. 4 shows the relay of Fig. 3 in side view.

Fig. 5 is a modified contact damping device.

In the embodiment according to Figs. 1 and 2 the magnetic circuit of the controlling or operating flux comprises a magnetic core 1, two pole pieces 2 and 3, which are connected with the magnetic core, and a portion of a pivoted armature 4, which is movable in its transversal direction in an air gap confined by pole faces at the ends of the pole pieces 2 and 3. The magnetic circuit of the polarizing circuit is divided into two portions or branches, each extending through a permanent magnet 5 or 6 respectively via air gaps through a portion of the pole piece 2 or 3 respectively and through the armature in its longitudinal direction. The last mentioned portion of each pole piece 2, 3 will thus form a common path of the controlling and the polarizing fluxes.

The controlling flux is effected by means of an energizing coil 7.

The armature 4 is in a manner known per se pivoted by means of a transversal leaf spring member 8, which is fixed by screws on one hand to a projection 37 on the armature 4 and on the other hand to a holding member 9 being in turn secured to the base plate 10 of the relay. The middle of the spring 8 is affixed to a lateral projection of the armature. The pole pieces 2 and 3 as well as the magnets 5 and 6 are clamped against the base plate and kept in the desired relative positions by means of screws in the said holding member 9.

Two contact springs 11a, 11b are riveted to the armature and insulated therefrom by means of washers 12 of insulating material, which contact springs in a manner known per se are bent at their free end so as to form portions abutting against each other having the purpose of serving as damping means. The end positions of the motion of the armature is determined by means of adjustable screws 13a, 13b, which are screwable in pieces 14a, 14b of non-magnetic material. In the pieces 14a, 14b there are also buffer devices 15a, 15b, by which it is made possible to have the armature stand in a middle or any other position between the end positions of the armature as determined by screws 15a, 15b. Each buffer device comprises a screw 16 screwable in piece 14 at the inner end of a bore through said piece, at the other end of which another screw 17 is inserted. A pin 18 passes through a central bore in screw 16 and is guided in another bore in screw 17 so as to be slidably movable in its longitudinal direction. The pin

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18 is pressed in a direction towards the armature by means of a pressing spring 19 acting between the screw 17 and a collar 20 on the pin 18, which collar abuts against the inner end surface of the screw 16 and thus determines the normal position of the pin 18. The end portion 21 of the latter abuts against the armature when this is attracted towards the buffer device, and if the attracting force is caused merely by the permanent magnet flux it is not capable of compressing the pretensioned spring 19. On the other hand the pre-tensioning is so chosen that a relatively small amount of controlling magnetic flux acting in the contemplated direction is required to subdue the counteracting force of the spring 19. It will be easily understood that the normal position of the armature can be readily adjusted by the screws 16 and the pretension of springs 19 is adjustable by turning screw 17.

In the shown embodiment the armature operates an additional pair of contacts comprising contact members 22a, 22b conductively or insulatedly fixed to the armature. These contact members are cooperating with countercontact members 23a and 23b respectively consisting of leaf springs being pre-tensioned to abut against stop members 24a, 24b with a predetermined pressure. Thus the armature may be operated in either direction in two steps, first closing the contacts at 23a or 23b respectively at a comparably small number of ampere turns, and then the contacts at 13a or 13b respectively when the energization is increased.

The different adjusting screws 13, 16 and 17 are lockable in their positions by means of locking screws 25, 26 and 27 respectively.

At the portion where the armature 4 has passed the pole pieces 2 and 3 its area may be materially reduced so that its mass becomes small and the operation speed of the relay is correspondingly increased. This front portion of the armature may be formed as a tongue, the width of which only is determined by the fact, that it shall withstand the contact pressure and that it shall not come into resonance at the highest operation frequency of the relay, which will be about 2500 c./s.

The mass of the armature may be further reduced by the choice of a suitable material, preferably electrolytic iron or iron having a carbon proportion less than 0.015%. Another suitable material is iron alloyed with about 50% cobalt, so-called permendur. Generally the knee value of the magnetization curve should be at least 15,000 gauss. With knee value is meant the value defined by the point of intersection between the saturation asymptote in the magnetization diagram and the tangent to the magnetization curve at the point representing the maximum permeability. Certainly such magnetic materials do not have so high a permeability as for instance Permalloy, but since the knee value of this material is about twice that of Permalloy, the armature needs be only half as thick, and accordingly the controlling flux can be forced through the armature by a comparably small number of ampere turns, provided the saturation of the magnetic circuit of the permanent flux is not too high.

In the embodiment according to Figs. 3 and 4 the magnetic circuits of the relay shown in Figs. 1 and 2 are unchanged and, therefore, shown schematically only, whilst the contact devices are

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modified and provided with damping means according to the invention. Only one set of contact and damping devices is shown on one side of the armature, although two such sets preferably are symmetrically arranged relative to armature 4.

A contact 28 is rigidly fixed to the armature 4 and cooperates with a countercontact 29 attached to a leaf spring 30 in front of which an additional leaf spring 31 is arranged in juxtaposed relation to spring 30 so as to resiliently press against the same. The springs 30 and 31 are commonly attached to a holding piece 32 by means of fastening screws 33 and 34. The end portion of the spring 30 is bent into an angle to the main portion of the spring and abuts at this end portion against a body 35, preferably a roll, or the like, of insulating material inserted in a recess connected with a threaded bore through the holding piece 32, in which an adjusting screw 36 is screwable. The end portion of the leaf spring 31 is bent into the same angle as the corresponding portion of spring 30, so that the pressure exerted by spring 31 is concentrated to the bent end portion of spring 30. The latter carrying the contact member 29 will thus be pressed between the roll 35 on one side and the end portion of spring 31 on the other side. By means of the adjusting screw the roll 35 may be displaced in its recess and the position of the contact 28 may thus be adjusted. An important feature of the shown device is that the main portion of spring 30 extends parallel with the armature 4, whereby only a small sliding action arises between the contacts 28 and 29. The surfaces of the latter become often rough and uneven after having been in use for some time, and if the main portion of spring 30 then forms a relatively large angle to the longitudinal axis of the armature, as is the case in similar known devices, the resilience of the spring 30 becomes irregular at the contact point and consequently the break and closure functions become unsafe. In practice it has proved, that the portion of the spring 30 extending between the fixed-in end and the bend ought to be comparably stiff, and this spring is, therefore, preferably weakened by a cut-out portion adjacent to the point, where the spring 31 abuts against the spring 30. The modification according to Fig. 5 differs from the one shown in Figs. 3 and 4 only in that the pressing spring 31 is fixed to a holding piece 32 so as to extend from above and engage the spring 30 close to the contact 29.

What we claim is:

1. A polarized relay comprising an armature, means for defining a pivotal axis of said armature, a magnetic circuit comprising pole projections forming an air space confined by pole faces facing opposite sides of said armature and a core having an energizing coil for the energization of said magnetic circuit said armature extending substantially perpendicularly to said core and having its pivotal axis situated adjacent to the middle portion of said coil, said pole projections further extending substantially parallel with said core and being spaced apart from said coil, pieces connecting said core with said pole projections and two permanent magnets being each magnetically coupled with its one pole to each one of said pieces and having their other poles magnetically coupled to said armature at a portion adjacent to the pivotal axis of the latter, which permanent magnets extend substantially parallel

with said core in the spaces between said coil and said pole projections, and contact members operable by said armature, said pole face and said contact members being situated on the same side of said pivotal axis.

2. A polarized relay according to claim 1, comprising means for keeping said armature in a middle position between said pole faces in non-energized condition, and two sets of contact members on either side of the armature one of the said sets of contact members being adapted to be closed at a smaller deviation of the armature from said middle position than the other, spring means for resiliently supporting a contact member of the first-mentioned set of contact members, and stop means for defining one end position of the last-mentioned contact member in a direction towards the armature, said spring means being pre-tensioned to abut with a predetermined pressure against said stop means.

STEN DANIEL VIGREN.

PER HARRY ELIAS CLAEISSON.

ROLF ALBIN ZANDER.

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