March 11, 1952 A. O. JÖRGENSEN 2,588,534

ELECTROMAGNETIC RELAY WITH ADJUSTABLE LEVER-RELATION

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Fig. 1

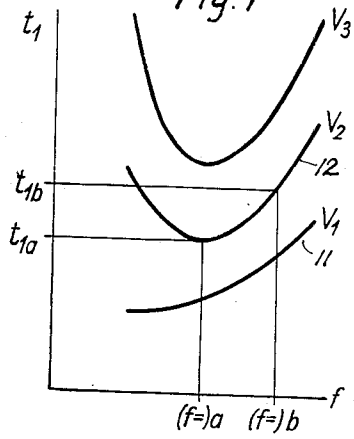


Fig. 2

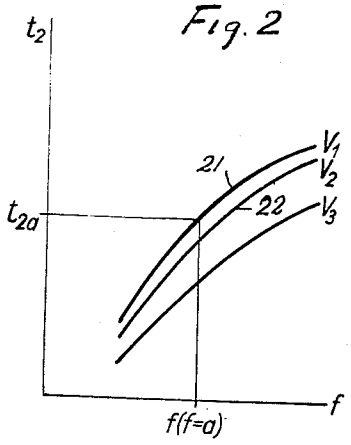


Fig. 3

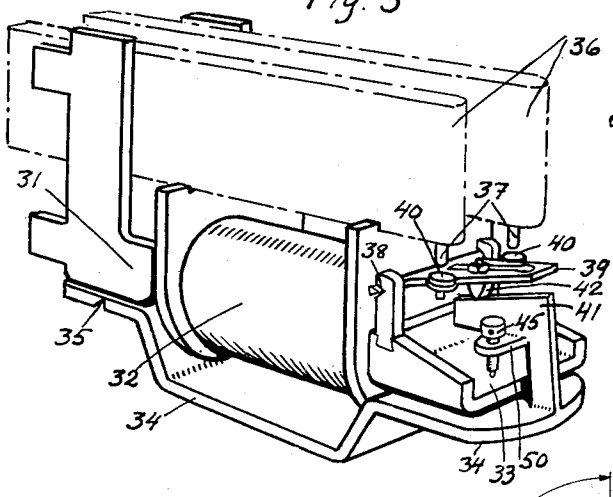


Fig. 4

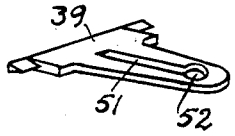
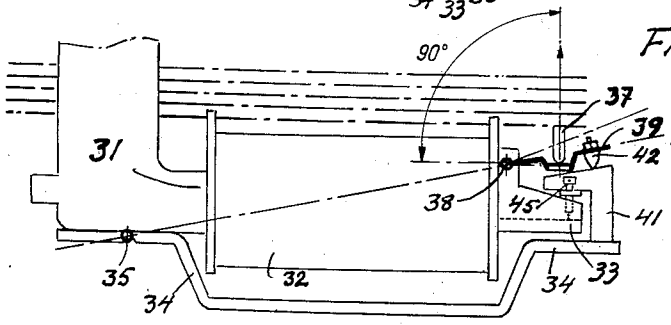


Fig. 5

Fig 6



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ELECTROMAGNETIC RELAY WITH ADJUSTABLE LEVER-RELATION

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6 Claims. (Cl. 200—104)

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The present invention relates to electromagnetic relays, and refers especially to the kind known as marginal relays, i. e. such relays in which an adjustment of make-time, release time, make-current etc. may be effected.

At production of a relay, which is to be used for a varying number of functions, it is known to choose a suitable value of the lever relation, i. e. the relation between the movements of the armature right in front of the pole piece and the movement of the armature or the associated lever right in front of the lifting member of the contact springs.

With a definite lever relation, the make- and release valves of the relay will naturally be unfavourable in quite a number of cases, and adjustment of the contact springs, the construction of the armature or the pole stud must take place. According to the present invention this tedious and complicated operation can be avoided by arranging such a lever for transmission of the movement of the armature to the lifting member of the contact springs so that said lever relation or arm ratio can be varied.

The invention will be described more clearly with reference to the accompanying drawing. Figs. 1 and 2 show graphs of the properties of a relay at varying lever-relations. Fig. 3 shows a perspective view of a relay according to the invention with an adjustable lever. Fig. 4 shows a detail of the lever, and Fig. 5 a sliding stud for this lever. Fig. 6 illustrates, by means of a side view of the relay according to Fig. 3, the movements of the armature and the lever.

A study of the properties of a relay in function of the lever-relation f shows, that the make-time t_1 varies according to Fig. 1. By "make-time" is meant the time from the moment, when the circuit to the relay is closed until a certain pair of contacts has been actuated. A voltage V_1 gives the curve 11, a voltage V_2 the curve 12 etc., whereby $V_1>V_2>V_3$. The higher the voltage, the shorter the make-time. It appears from the curves, that the regulation is good. By changing the lever-relation from b to a, the make-time t can be shortened from t_{1b} to t_{1a} at the same voltage V_2. This also happens in case of make-current.

The release-time t_2 of the relay in function of the lever-relation f appears from Fig. 2. By "release-time" is meant the time, which passes from the moment when the current to the relay has been broken until a certain pair of contacts has been actuated.

The curve 21 shows the release-time at a voltage V_1 of the relay, the curve 22 at a voltage V_2

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etc., whereby $V_1>V_2>V_3$. At a normal lever-relation $f=a$, a release-time t_{2a} is obtained at a voltage V_1. By adjusting the relation f, a change of ±30% of the release-time can usually be obtained without difficulty, which is a considerable adjustment for marginal relays.

The adjustable lever-arrangement shown in Fig. 3 has been applied to a flat-type relay. The lever arrangement can naturally also be used in case of other types of relays.

On a core 31 with a winding 32 and a pole-shoe 33, an armature 34 is mounted, which turns round a shaft 35. One or more spring contact sets 36 are attached to the core in a way known per se. These spring contact sets are each actuated by means of a lifting member or pin 37.

A lever 39 is mounted alongside or as a part of a shaft 38 fulcrumed on the pole shoe 33. This lever is provided intermediate its end with two laterally spaced adjustable lifting screws 40, which, at movement of the lever, respectively actuate the lifting pins 37.

An L-shaped arm 41 is fixed to the armature 34, and overhangs the pole shoe 33. A tap 50 extends laterally from 41 and mounts a screw for limiting the stroke of the armature. In a longitudinal slot 51 in the lever 39, an adjustable or sliding stud 42 is arranged having a wedge-like lower end to bear on the upper arm of 41. When the armature 34 operates, on energization of the winding 32, the arm 41 moves upwards. The stud 42 is thereby lifted and so is the lever 39, which by means of the screws 40 actuates the lifting pins 37 and the spring contact sets 36. In order to obtain the smallest possible slippage during the movement of the armature between the stud 42 and the arm 41, the adjustment path of movement of the stud lies in a geometric plane, which passes through the axis of the fulcrum 35 of the armature and the fulcrum 38 of the lever support, Fig. 6. Since the engagement point between the stud 42 and the arm 41 during the operation of the armature changes in respect to the line through the shafts 35 and 38, these conditions are fulfilled when the armature lies between the extreme positions, i. e. make- and release position at the greatest possible lever-relation.

In order to obtain the smallest possible slippage between the lifting pins 37 and the lifting screws 40, the angle between a line through the rotating shaft 38 and the upper side of the lifting screw 40, and a line through the direction of movement of the lifting screws, is arranged to be 90° when the armature is right between the extreme positions at the greatest possible lever-relation.

In Fig. 5 a design of the stud 42 is shown.

The stud is inserted in a hole 52 at the end of the groove 51, Fig. 4, on the lever 39. The grooves 62 in the stud will thus be directed by the edges of the lever groove. The grooves 62 are made so that a certain friction against the lever is obtained.

Furthermore, the design is so arranged, that the adjustment path of the stud on the lever and the upper surface of the arm 41 are parallel when the armature is operated. A favourable adjustment is thereby obtained. This can be made at make-position of the relay. At constant movement of the spring set a dislocation of the adjusting stud only requires that the stroke of the armature be changed by adjusting the stop screw of the armature. When the adjusting stud is moved along the arm, the stroke of the armature is continually changed with the lever-relation if the stop screw is not moved. If the adjusting stud with its adjustment path is attached to the arm 41 of the armature and if the stop screw of the armature is placed in the adjusting stud similar results may be attained.

I claim:

1. In an electromagnetic relay, in combination, a magnet having a core, contact springs supported adjacent said magnet, an armature fulcrumed to and associated with said core remote from and to actuate said springs when the magnet is energized, a lift member for said springs, a lever interposed between said armature and lift member and having a fixed fulcrum remote from the armature fulcrum and an actuating arm of fixed length for actuating said lift member, a stud positioned to move said lever from said armature, and means whereby the stud may be adjusted toward or from said lever fulcrum to change the activated arm of the lever.

2. The relay as defined in claim 1 in which the adjustment path of said stud lies on a line passing through said fulcrums when the lever is in midposition.

3. The relay as defined in claim 2 in which the armature is provided with a lever moving arm with a surface parallel to said line for engaging the stud in any of its adjusted positions.

4. In an electromagnetic relay, in combination, an elongated core, a winding intermediate the ends of said core, an armature fulcrumed to one end of said core and having a part cooperating with the opposite end, an arm on said armature overhanging said opposite end and having an adjustable stop for cooperation therewith, a lever fulcrumed adjacent said winding and having an adjustable lifting screw intermediate its ends, a contact spring extending substantially parallel to said core and having an operating pin bearing on said lifting screw, a stud intermediate the lever and overhanging arm to actuate the former from the latter, and means providing a path through which said stud may be adjusted to change the effective length of the actuated arm of the lever.

5. The relay as defined in claim 4 in which the parts are so constructed and arranged that the lever in midposition lies in a plane passing through the axes of the armature and lever and the surface of said overhanging arm provided for engagement by said adjustable stud is parallel to said plane.

6. The relay as defined in claim 5 in which the said plane is inclined to the plane of said contact spring, said adjustable lifting screw being arranged on an axis normal to the plane of the spring.

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The following references are of record in the file of this patent:

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