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U. C. HEDIN

1,967,948

RELAY

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Fig. 1

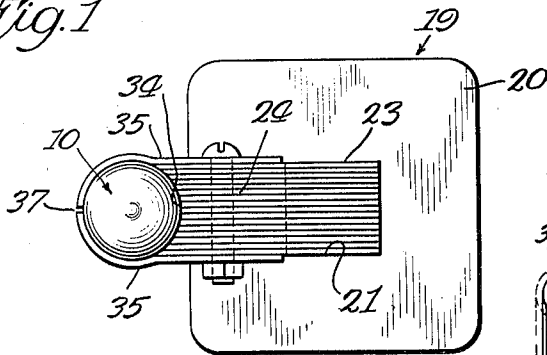
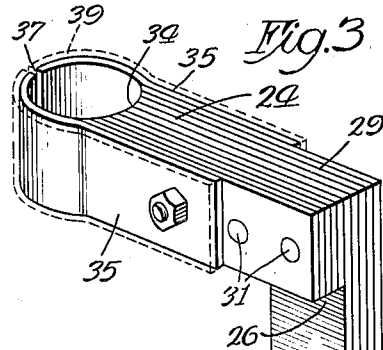
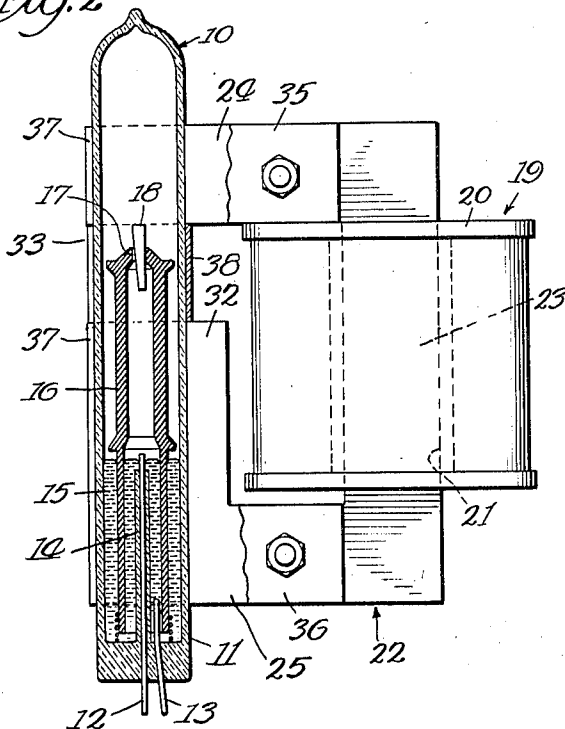
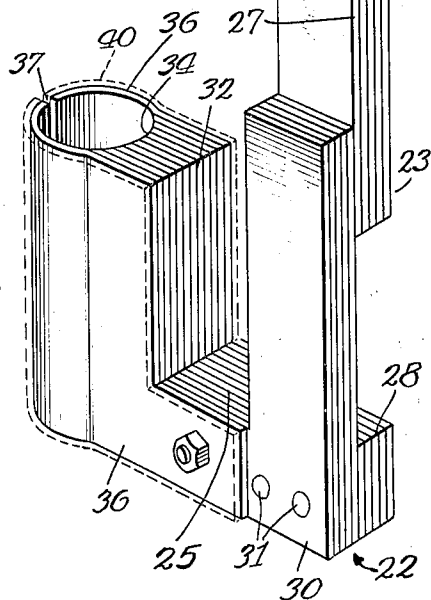


Fig. 2



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UNITED STATES PATENT OFFICE

1,967,948

RELAY

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Application February 15, 1933, Serial No. 656,806

9 Claims. (Cl. 200—112)

This invention relates to mercury switch relays and particularly to the magnetic circuit which controls the switch.

The objects of the invention include: mounting
5 the switch so that it is at all times visible for inspection; reducing energy losses resulting from heating effects; providing a magnetic circuit which is closed except for a single gap; and otherwise improving the efficiency and operating
10 characteristics of the relay.

Further and other objects and advantages will become apparent as the disclosure proceeds and the description is read in conjunction with the accompanying drawing, in which

15 Fig. 1 is a plan view of a relay made in accordance with this invention;

Fig. 2 is a view partly in section and partly in elevation of the relay; and

20 Fig. 3 is a perspective view of the magnetic circuit and switch mounting.

But this specific illustration and the correspondingly specific description are for the purpose of disclosure only and should not be construed as imposing limitations upon the appended
25 claims except as may be required by the prior art.

The relay has been shown associated with a circuit breaker 10 which comprises a glass envelope 11 through the bottom of which electrodes 12 and 13 have been sealed. The electrode 12 is surrounded by an insulating sleeve 14 to a height
30 just below the top of the electrode.

A quantity of mercury 15 is placed in the envelope and is adapted to make or break an electrical circuit through the electrodes 12 and 13,
35 according to its level.

A displacer or plunger 16 normally occupies the position shown in Fig. 2 and displaces a sufficient quantity of mercury to bridge the electrodes 12 and 13. When the relay coil is energized, the
40 displacer is raised, and the mercury level recedes below the bared portion of the electrode 12. The displacer is made of suitable magnetic material, such as iron, and consists of a cylindrical sleeve which is closed at the top except for a small opening 17 that is partially plugged by a tapered pin 18.

The purpose of this construction is to cause the mercury column within the displacer 16 to effect a time delay in the making or breaking of the circuit through the electrodes 12 and 13 after the
50 relay coil has been de-energized or energized, respectively.

As the circuit breaker per se is not a part of this invention, no further description is necessary. It will be understood that any circuit
55 breaker consisting of a vertical glass envelope

equipped with an interior movable armature may be used with the magnetic circuit and switch mounting now to be described.

The energizing coil indicated at 19 is of ordinary construction and consists of a spool 20 upon
60 which the turns of the coil are wound. The spool is, in this case, provided with a substantially square central opening 21 for receiving a yoke 22 which serves as a conductor for the magnetic flux. It will be understood that the opening 21
65 may be of any suitable size or shape and that one or more yokes may be used as desired.

The yoke 22 is made of magnetic material, such as iron, and comprises a vertical portion 23 terminating in laterally extending legs 24 and 25,
70 one above the other. Preferably the yoke is laminated in vertical planes to increase the efficiency of the relay when operating on alternating current. The laminations have no appreciable effect one way or another when the relay is operating on
75 direct current.

The vertical portion 23 of the yoke is preferably divided into two parts, as shown in Fig. 3, to permit the coil 19 to be mounted in place. Obviously the yoke might be split apart in some
80 other manner or the opening 21 in the coil might be made sufficiently large to slip over one of the legs of the yoke.

In the embodiment of the invention shown in Fig. 3, in which the vertical portion 23 of
85 the yoke is cut apart along lines 26, 27 and 28, the upper portion 29 of the yoke takes the shape of an inverted L, while the lower portion 30 is in the form of the letter J. The laminations of both the upper and lower portions of the yoke
90 are secured together by rivets 31 or equivalent means.

The upwardly extending projection 32 on the lower half 30 of the yoke fixes the size and position of the air gap 33 between the two legs
95 24 and 25. Tests have shown that accurate positioning of the air gap is very important to obtain maximum efficiency.

The sides of the legs 24 and 25, in proximity to or abutting the envelope 11 of the circuit
100 breaker, are preferably milled out as indicated at 34 to conform to the curvature of the envelope. Much greater efficiency in the operation of the relay may be obtained by bringing the laminations as closely as possible to the switch
105 envelope so that the only air gap in the magnetic circuit is at 33. Of course the actual air gap at 33 includes the thickness of the glass envelope and the distance separating the displacer and the side walls of the envelope.

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The envelope is embraced by clips 35 and 36 which are secured by suitable means to the upper and lower portion, respectively, of the yoke. The clips are made of magnetic material and are preferably made in two parts, as indicated in Fig. 3, with the outer ends slightly separated as indicated at 37. The gap 37 has the effect of preventing magnetic lines of force from travelling around the envelope in the vicinity of the clips 35 and 36 when it is desired that all should pass across the air gap 33. When the relay is operated on direct current, the separation of the two parts of each clip is unimportant, but when alternating current is being used, the constant change in the direction of the magnetic field is opposed by induced forces which, unless checked in some way, materially lower the efficiency of the relay. The gap 37 between the two parts of the clips has the effect of checking the induced forces thus produced.

The clips 35 and 36 also serve the purpose of distributing the magnetic flux around the envelope so that there is no pronounced tendency for the displacer to be attracted to one side of the envelope more than to another.

The reluctance of the magnetic circuit may be changed very easily by slightly separating the upper and lower portions 29 and 30 of the yoke. This, however, is not ordinarily done because the efficiency of the relay is decreased accordingly.

One advantage of the present construction is that it can be manufactured very cheaply. The laminations constituting the yoke may be readily stamped from sheet metal and then secured together by rivets to form the upper and lower portions of the yoke. The coil, switch, yoke, and clips can then be assembled in a minimum of time. The switch is frictionally held against longitudinal movement by a resilient sleeve 38 of non-magnetic material, preferably brass, that is interposed between the legs 24 and 25 of the yoke. The sleeve grips the envelope to hold it in place, but permits longitudinal adjustments of the switch to be made.

In addition to the fact that a mercury switch mounted exteriorly of the coil in the manner above described is more readily visible for inspection and is not heated by induced currents from the coil, there is a further advantage in that the vertical portion 23 of the yoke serves as a core and increases the efficiency of the relay approximately 8% when the relay is operated on direct current and 10% when operating on alternating current.

Still greater efficiency can be obtained by providing additional clips 39 and 40, as indicated in dotted lines at Fig. 3, similar in all respects to the clips 35 and 36, respectively. The additional clips distribute the magnetic flux more evenly around the switch envelope.

An obvious modification of the present invention would consist in extending the arms 24 and 25 laterally a sufficient distance to permit holes to be drilled in vertical alinement for receiving the switch envelope.

What I claim, therefore, is:

1. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope, spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes ac-

cording to its level, a displacer for changing the mercury level, said displacer being magnetically controlled by the coil, and clips of magnetic material secured to the pole pieces and embracing the switch.

2. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope, spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes according to its level, a displacer for changing the mercury level, said displacer being magnetically controlled by the coil, and clips of magnetic material secured to the pole pieces and embracing the switch, one of said clips being provided with a longitudinal slit.

3. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, one of the pole pieces being provided with a projection extending in the direction of the other pole piece to fix the position of the air gap.

4. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope, spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes according to its level, a displacer for changing the mercury level, said displacer being magnetically controlled by the coil, and means for supporting the switch in operative relation to the pole pieces, said means including a clip of magnetic material adapted to embrace the switch and hold it against the ends of the pole pieces, said clip being carried by one of the pole pieces and forming in effect a continuation of the yoke whereby the magnetic flux is distributed relatively uniformly around the envelope.

5. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope, spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes according to its level, means for changing the mercury level in response to the coil, and means for supporting the switch in operative relation to the yoke, said means including a clip of magnetic material secured to one of the pole pieces and embracing the switch whereby the magnetic flux is distributed relatively uniformly around the envelope.

6. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope, spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes according to its level, means for changing the mercury level in response to the coil, and means

for supporting the switch in operative relation to the yoke, said means including a clip of magnetic material secured to one of the pole pieces and embracing the switch whereby the magnetic flux is distributed relatively uniformly around the envelope, the portion of the clip which embraces the switch having substantial depth and projecting in the direction of the other pole piece so as to position and lessen the air gap in the magnetic circuit between the pole pieces.

7. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, one of said pole pieces having an integral extension at its end projecting in the direction of the other pole piece, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes according to its level, means for changing the mercury level in response to the coil, and means for supporting the switch in operative relation to the ends of the pole pieces.

8. In a relay, a coil having a central opening, a yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, one of said pole pieces having an integral extension at its end projecting in the direction of

the other pole piece, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope, spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes according to its level, means for changing the mercury level in response to the coil, and means for supporting the switch in operative relation to the ends of the pole pieces, said means including a clip of magnetic material secured to one of the pole pieces and embracing the switch.

9. In a relay, a coil having a central opening, an iron yoke including a core portion adapted to fit within the coil opening and pole pieces extending laterally one above the other from the core portion, one of said pole pieces having an integral extension at its end projecting in the direction of the other pole piece, a mercury switch mounted adjacent to the pole pieces exteriorly of the coil, said switch including a glass envelope, spaced electrodes in the envelope, a mercury fill adapted to make or break an electrical circuit through the electrodes according to its level, means for changing the mercury level in response to the oil, and means for supporting the switch in operative relation to the ends of the pole pieces, the core portion of said yoke being formed so that it is extensible to vary the distance between the pole pieces without breaking the continuity of the iron circuit within the coil.

UNO C. HEDIN.

CERTIFICATE OF CORRECTION.

ent No. 1,967,948.

July 24, 1934.

UNO C. HEDIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 112, claim 4, for "lever" read level; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of September, A. D. 1934.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.

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