June 30, 1936. C. H. LARSON ET AL 2,046,272

MERCURY SWITCH RELAY

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Fig. 1

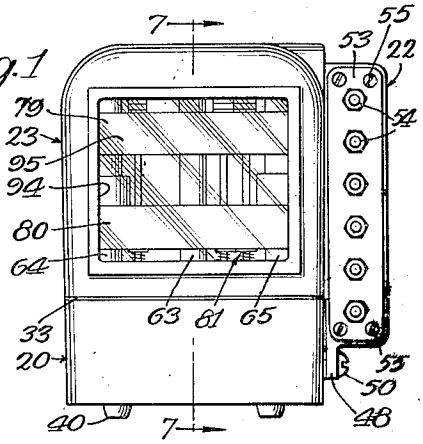


Fig. 3

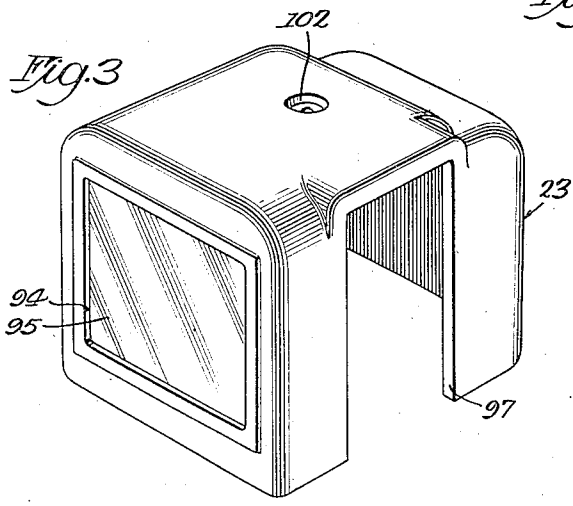


Fig. 2

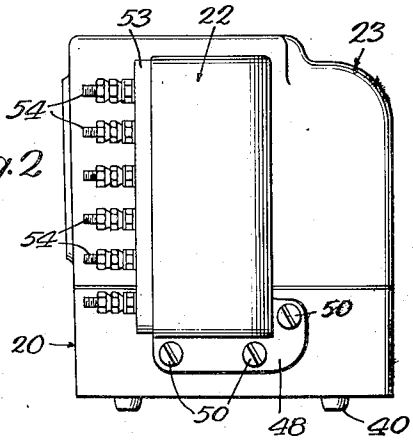


Fig. 4

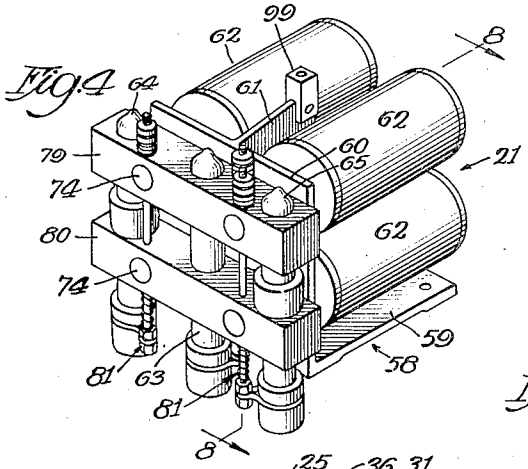


Fig. 6

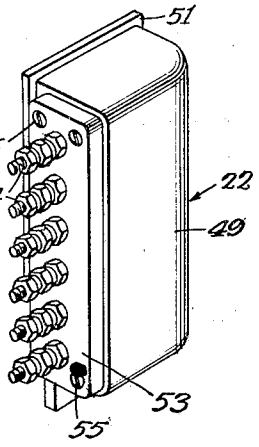
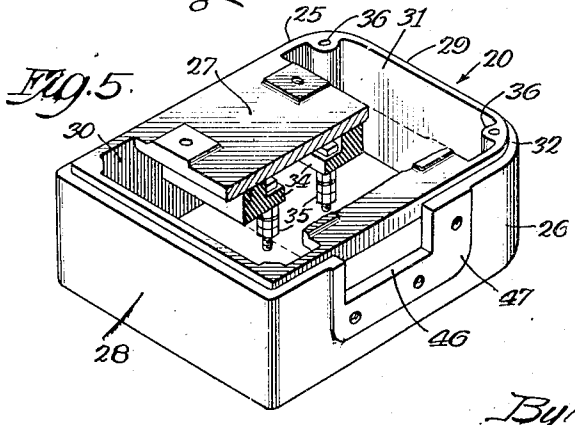


Fig. 5



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Fig. 7

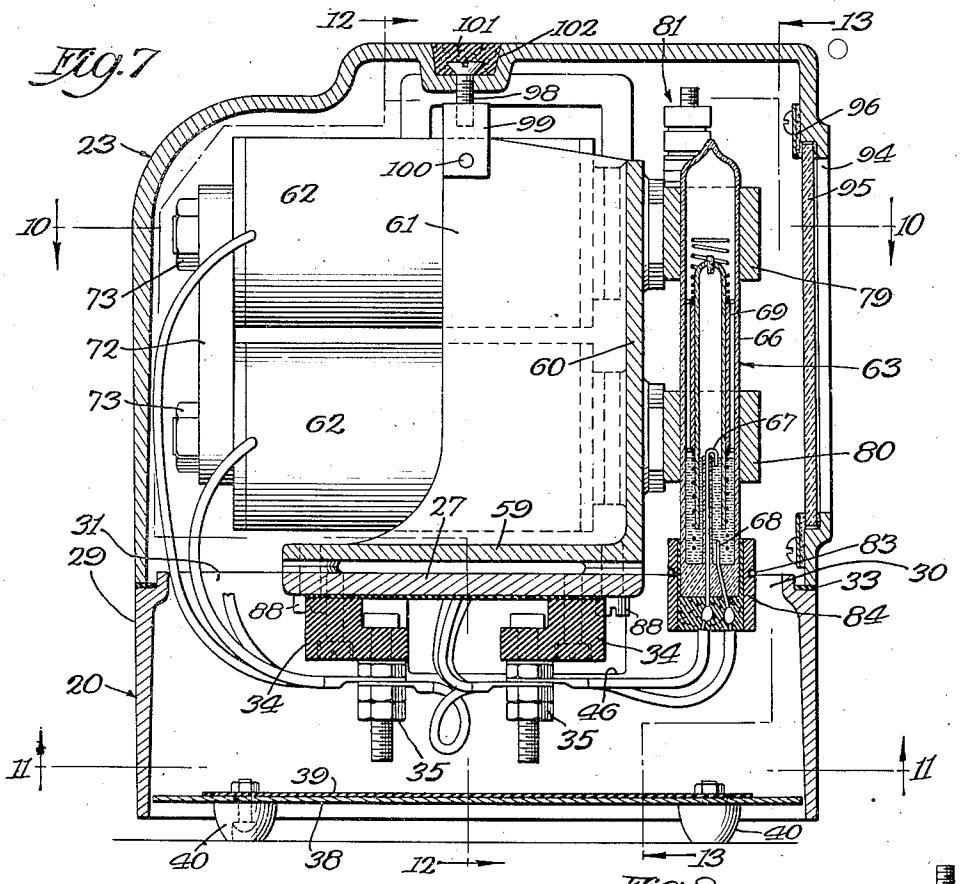


Fig. 8

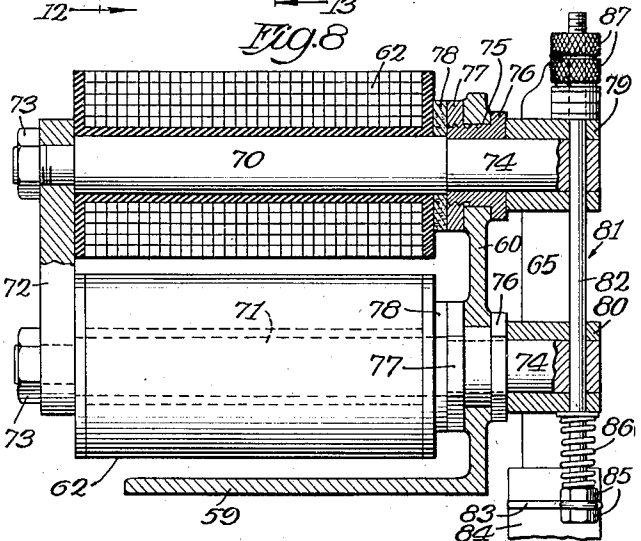
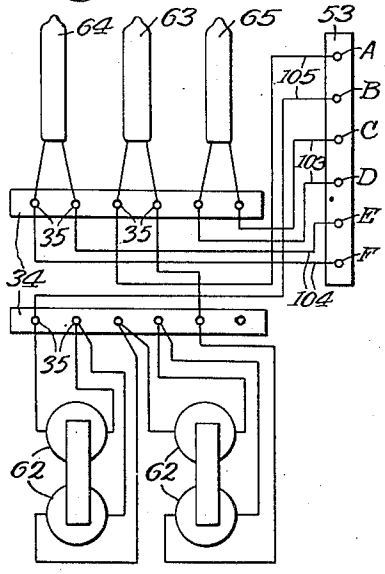


Fig. 9



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Fig. 10

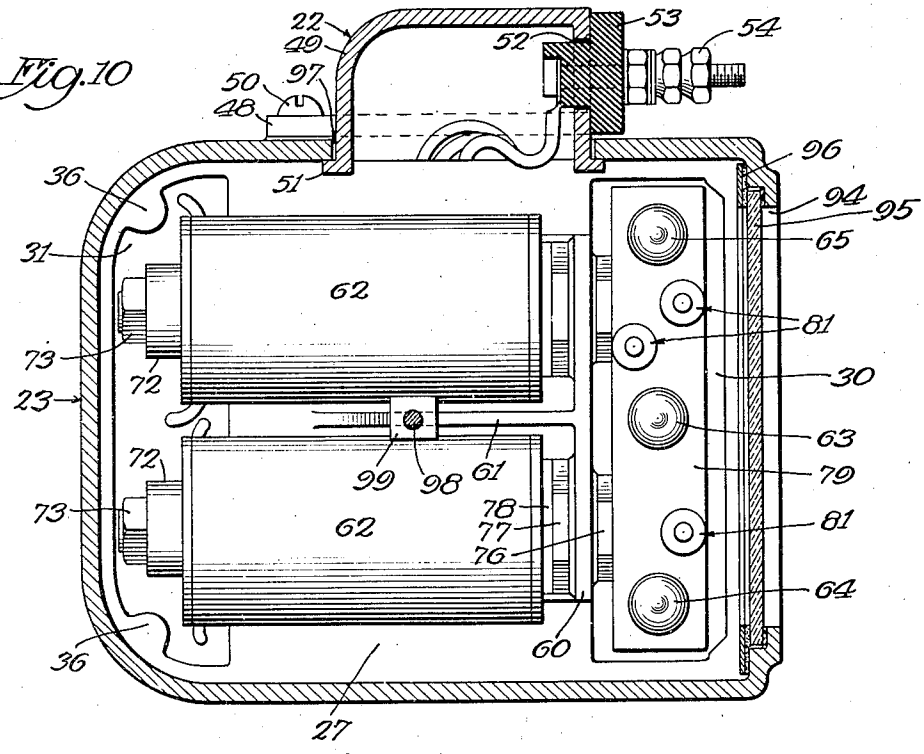
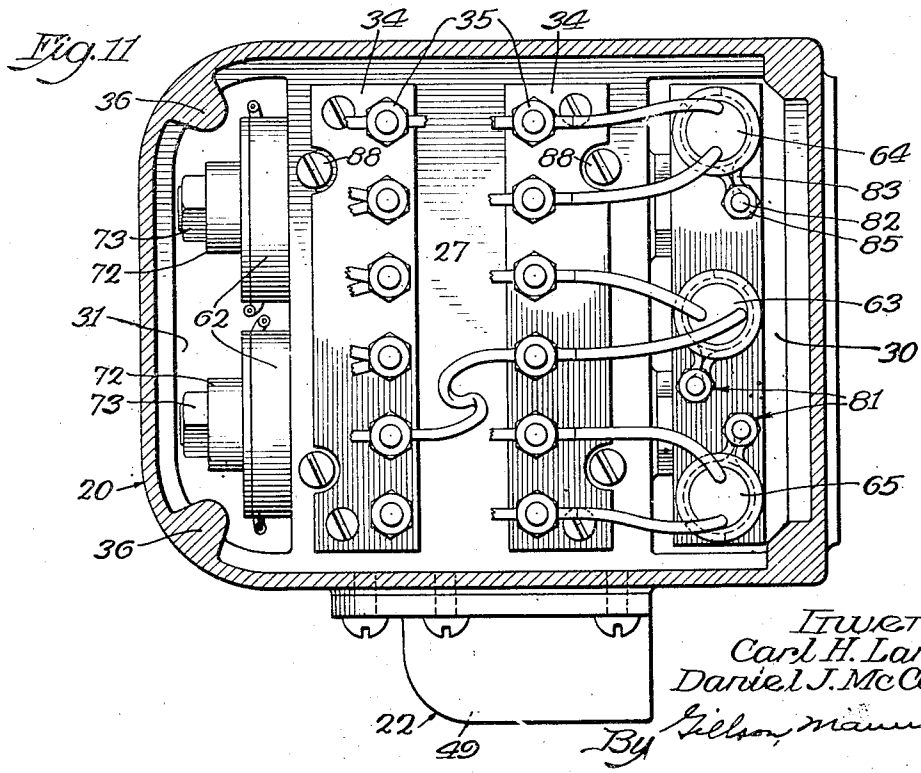


Fig. 11



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MERCURY SWITCH RELAY

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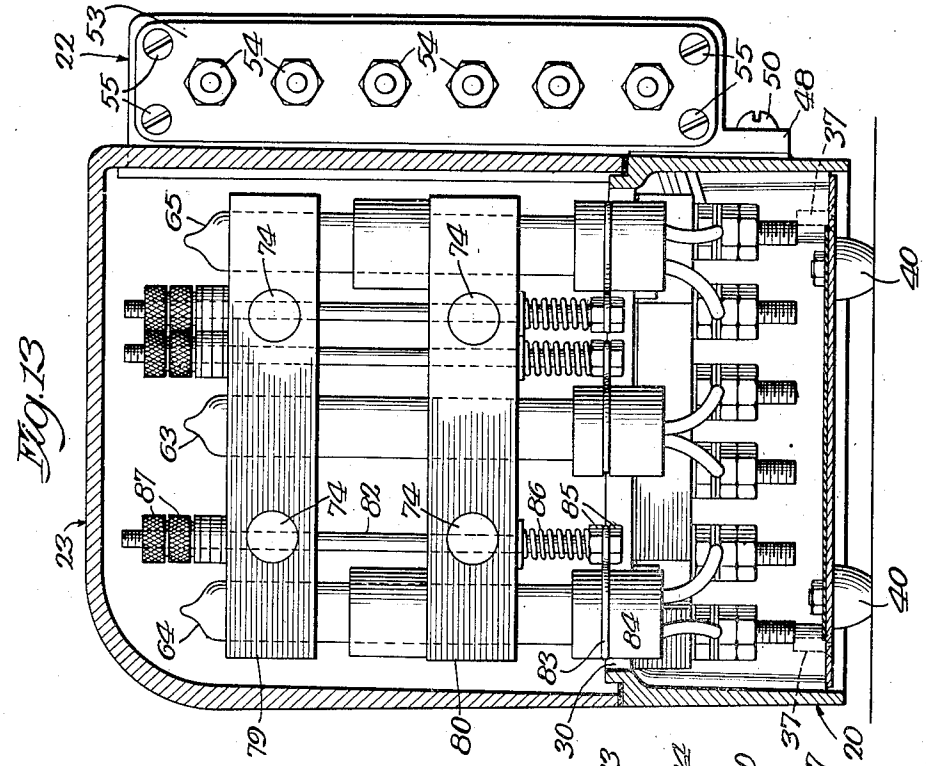


Fig. 13

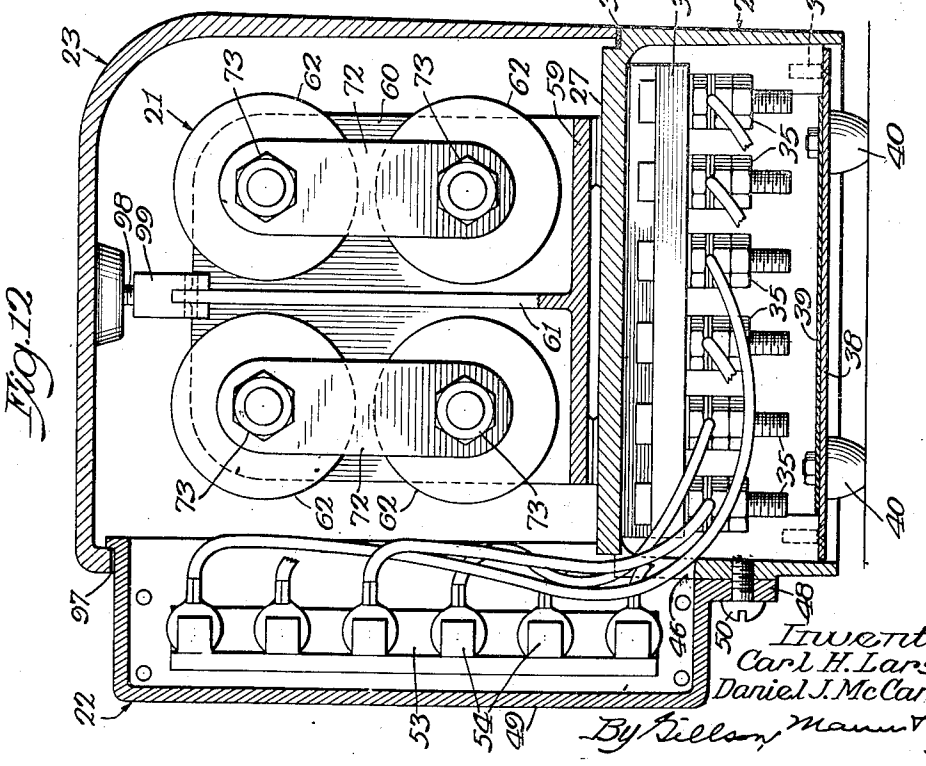


Fig. 12

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UNITED STATES PATENT OFFICE

2,046,272

MERCURY SWITCH RELAY

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Application September 7, 1935, Serial No. 39,608

10 Claims. (Cl. 200—112)

Electro-mechanical relays are large and cumbersome as compared with relays using mercury switches of the type disclosed in Larson Patent No. 1,967,247, issued July 24, 1934, as the contact making devices.

The primary object of this invention is to take advantage of the inherent qualities of mercury switches of this type and provide an arrangement of parts which holds to a minimum the size of the assembled relay; permits inspection of the switch parts at all times without opening the unit; facilitates installation, adjustment of parts, removal of switch elements, and the making of minor repairs; and holds manufacturing costs to a minimum.

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

Fig. 1 is a front elevational view of a relay made in accordance with this invention;

Fig. 2 is a side elevational view of the relay;

Fig. 3 is a perspective view of the bell cover;

Fig. 4 is a perspective view of the sub-unit which includes the relay coil and the mercury switches;

Fig. 5 is a perspective view of the hollow base, a portion being broken away to expose the interior;

Fig. 6 is a perspective view of the side terminal block;

Fig. 7 is a vertical sectional view taken on the line 7—7 of Fig. 1;

Fig. 8 is a vertical sectional view taken on the line 8—8 of Fig. 4;

Fig. 9 is a schematic diagram of the electrical circuit;

Figs. 10 and 11 are horizontal sectional views taken on the lines 10—10 and 11—11 respectively of Fig. 7; and

Figs. 12 and 13 are vertical sectional views taken on the lines 12—12 and 13—13 respectively of Fig. 7.

A disclosure of the preferred form of the invention is made for the purpose of complying with section 4888 of the revised statutes, but it will be understood that the claims are to be construed as broadly as the prior art will permit.

The relay which has been chosen for illustration and specific description is one which is intended for use in controlling the operation of highway crossing signals. It is subjected to all kinds of weather conditions, and, in order that the railroad whose right of way is crossed by the highway may be certain that the relay is in good order, it is frequently inspected and adjustments are made when necessary.

This use to which the relay is put demands that it must be compact; the parts should be protected from the weather as far as possible; the switching elements should be capable of being seen from the outside of the casing for inspection purposes; ready access must be afforded to the switching elements; and of course these results must all be obtained with structures that conform to the demands of good manufacturing practice.

In the chosen embodiment of the invention, the relay comprises a hollow base generally designated 20, a sub-unit generally designated 21 which is separable as a unit from the base, an upstanding terminal block generally designated 22 which rises from one side of the base, and a bell cover generally designated 23 which encloses the sub-unit 21 but excludes the terminal block 22.

The base consists of a casting, preferably of aluminum, which has two of its side walls 25 and 26 connected by a bridge or top wall 27 spaced from the two other side walls 28 and 29 by openings 30 and 31, respectively. The base is provided with a marginal seat 32 upon which the bell cover 23 is adapted to rest, a gasket 33 (see Fig. 7) being ordinarily interposed between the cover and the base in order to provide a good seal.

L-shaped terminal blocks 34 of insulating material, such as bakelite, are secured to the underside of the bridge 27 by screws 24 and the blocks support a plurality of binding posts 35. At the four corners of the base casting are enlargements 36 which serve as bosses to receive screws 37 (see Fig. 12) which hold a bottom cover plate 38 in place. The plate is readily removable for access to the binding posts 35.

The cover plate 38 is preferably made of sheet metal and is covered with a fiber sheet 39 to prevent any possibility of the plate 38 coming in contact with one of the conductors within the base. A plurality of rubber feet 40 are secured to the plate 38 for supporting the relay.

The side terminal block 22 is mounted on the wall 26 of the base, as best shown in Figs. 2, 5, 10 and 13. The wall 26 of the base is notched out, as indicated at 46, and has a marginal raised portion 47 to which the flange 48 of the terminal block casing 49 is secured by screws 50. The casing 49 is preferably cast aluminum and has a lip 51 which extends around the inside edge of the casting.

An elongated vertical slot 52 in the front face

of the casing 49 receives the side terminal block 53, preferably made of bakelite and equipped with a plurality of binding posts 54. The block 53 is secured to the front face of the casing 49 by screws 55, as best shown in Figs. 1, 6 and 13. The side terminal block having its binding posts in vertical alignment has the advantage that the relay cannot be accidentally short-circuited by some person who carelessly leaves a screw driver or other metallic tool on the casing. This could happen if the exposed binding posts were arranged in a horizontal plane.

All of the working parts of the relay are contained in the sub-unit 21, which is a distinct advantage, since these parts may be made, assembled and tested prior to the mounting of the sub-unit on the base.

The sub-unit comprises a cast aluminum bracket, generally designated 58, having a horizontal web 59, an upstanding wall 60 integral with the web and a vertical gusset 61 integral with both the web 59 and the wall 60.

A plurality of relay coils 62 are horizontally mounted on one side of the wall 60 and on the other side are the contact-making devices consisting of mercury switches 63, 64 and 65. The mercury switches are of the type disclosed in Larson Patent No. 1,967,247, issued July 24, 1934, and comprise briefly (Fig. 7) a switch envelope 66 having electrodes 67 and 68 sealed through the base of the envelope, the former being insulated for a portion of its length by a glass sleeve so that when the displacer 69 (which is made of magnetic material) is in the position shown in Fig. 7, the mercury level is sufficiently high to bridge the electrodes 67 and 68, but, when the displacer is raised by energization of the relay coils, the mercury level falls below the top of the insulating sleeve around the electrode 67 and breaks the circuit between the two electrodes.

The details of the particular switches used in the flasher relay of this invention and the circuit associated with the switches may be found in the co-pending application of Carl H. Larson, Serial No. 759,634, filed December 29, 1934, and the wiring diagram of Fig. 9 follows substantially the disclosure of that application.

The relay coils 62 are arranged in pairs, one on each side of the gusset 61. An iron circuit is associated with each pair and comprises cores 70 and 71 of high grade electrical iron, such as Svea metal or Permalloy, connected at their outer ends by a bar or link 72 of similar material. The outer ends of the cores are reduced in diameter, as best shown in Fig. 8, to receive the link 72, and nuts 73 screw onto threads provided on the reduced portion of the cores to hold the link 72 in place.

The other ends of the cores are also reduced, as indicated at 74, and project through reinforced openings 75 in the wall 60 of the bracket 58. The cores are supported from the wall by brass bushings 76 which are clamped to the wall 60 by nuts 77 which screw onto the threaded ends of the bushings. Cork washers 78 are preferably used between the coils and the nuts 77.

The reduced portions 74 of the cores 70 and 71 project beyond the bushings 76 and are press-fitted into suitable holes in pole blocks 79 and 80 (Figs. 4 and 8), the blocks being made of high grade electrical iron (Svea metal or Permalloy) and having a plurality of aligned apertures adapted to receive the switches 63, 64 and 65.

The poles 79 and 80 are also drilled to receive adjusting devices, generally designated 81, each consisting of an adjusting rod 82, a tube clip 83 which engages the insulating base 84 of the switch, nuts 85 which hold the tube clip on the rod 82, a spring 86 interposed between the lower pole block 80 and the top nut 85, and thumb nuts 87 which screw onto the threaded upper end of the adjusting rod and fix the position of the switch tube with respect to the magnetic circuit.

It will be understood that the magnetic flux set up by the coils 62 is directed by the cores 70 and 71, links 72, and pole blocks 79 and 80 through the armatures 69 of the switches, and the armatures respond by rising to a position of magnetic equilibrium, thus bringing about a change in the mercury levels in the switches and effecting the desired circuit opening or circuit closing actions in the relay circuit.

All of the components of the sub-unit 21 may be fabricated, assembled and tested before the unit is mounted on the base, and assembled with the other parts of the completed relay. The sub-unit may also be easily removed from the base, for it is held in place by only four screws, as indicated at 88.

The bell cover 24 may be an aluminum casting and has a window opening 94 to expose the front portion of the sub-unit 21 to view, without the necessity of removing the cover. The opening is closed by a glass window 95 held in place by a retainer 96 screwed to the inside of the cover.

On the side of the cover is an elongated vertical cutaway portion 97 which permits the interior of the side terminal block casing 49 to communicate with the interior of the relay. The lip 51 of the casing 49 lies within the bell cover when the latter is in place, as best shown in Fig. 10.

The cover is held in place by a screw 98 which passes through the top of the cover and engages a drilled and tapped lug 99 pivoted at 100 to the vertical gusset 61 of the sub-unit 21. Preferably a sealing compound 101 is used to fill the recess 102, as shown in Fig. 7, in order to prevent unauthorized access to the interior of the relay.

The wiring diagram of Fig. 9 indicates that two leads from each switch are connected to the binding posts 35 of one of the terminal blocks 34; that conductors 103 connect the switch 65 with terminals C and D of the side terminal block 22, which in turn are connected across one of the lamps of the crossing signal; the conductors 104 connect the switch 64 to binding posts E and F of the side terminal block 22, which in turn are connected across the other lamp of the crossing signal; and that conductors 105 connect the control switch 63 to binding posts A and B of the side terminal block 22, which in turn are connected to a suitable source of power, the switch 63, however, being in series with the four relay coils so that their state of energization is dependent upon the condition of the circuit in the control tube 63.

The leads from the switches 63, 64 and 65 are connected directly to the binding posts 35 of the right terminal block 34 (Fig. 7), and the conductors from the coils 62 pass through the opening 31 in the base and are connected to the binding posts on the left terminal block 34 (Fig. 7).

We claim as our invention:

1. In a mercury switch relay, a hollow base, a terminal block within the base, a vertical wall rising from the base, a plurality of horizontally arranged coils supported on one face of the wall, a mercury switch supported on the other face of the wall, an iron circuit associated with the coils and switch, a terminal block projecting upwardly from one side of the base, and a bell

cover enclosing the coils and switch but excluding the last-named terminal block.

2. In a mercury switch relay, a hollow base, a terminal block within the base, a vertical wall rising from the base, a plurality of horizontally arranged coils supported on one face of the wall, a mercury switch supported on the other face of the wall, an iron circuit associated with the coils and switch, a terminal block projecting upwardly from one side of the base, and a bell cover enclosing the coils and switch but excluding the last-named terminal block, said bell cover having a window in one of its side walls exposing the switch to view.

3. In a mercury switch relay, a hollow base, a terminal block within the base, a vertical wall rising from the base, a plurality of horizontally arranged coils supported on one face of the wall, a plurality of mercury switches of the type including a magnetic armature within a sealed envelope mounted on the other face of the wall, an iron circuit associated with each switch, a terminal block projecting upwardly from one side of the base, and a bell cover enclosing the coils and switches but excluding the last-named terminal block.

4. In a mercury switch relay, a hollow base having a top wall provided with an aperture, a bracket secured to the top wall of the base having an upstanding wall, means for mounting relay coils on one side of the upstanding wall and a mercury switch on the other side of said wall, an iron circuit associated with the switch and coils, a terminal block within the base, said switch projecting downwardly through the aperture in the top wall of the base and having at least one lead connected to said terminal block.

5. In a mercury switch relay, a hollow base having two of its side walls connected by a bridge flanked on each side by an opening communicating with the interior of the base, a bracket secured to the bridge having an upstanding wall extending longitudinally of the bridge, means for mounting relay coils on one side of the upstanding wall and a mercury switch on the other side of said wall, an iron circuit associated with the switch and coils, a terminal block within the base, said switch being mounted over one of the openings in the base and having at least one lead connected to the terminal block, and conductors connecting the coils with the terminal block, said conductors passing through the other opening in the base.

6. A bracket for use with a mercury switch relay of the class described comprising a horizontal web, a vertical wall rising from the web having a plurality of reinforced apertures, and a vertical gusset between the horizontal web and the vertical wall.

7. In a mercury switch relay, a base, a vertical terminal block rising from one side of the base, a relay unit mounted on the base including a mercury switch and a relay coil, and a bell cover on the base enclosing the relay unit but excluding the terminal block.

8. In a mercury switch relay, a base, a vertical terminal block rising from one side of the base, a relay unit mounted on the base including a bracket, a mercury switch and a relay coil, a bell cover on the base enclosing the relay unit but excluding the terminal block, and means for securing the cover to the bracket.

9. In a mercury switch relay, a box-like base having two of its sides connected by a bridge with openings between the bridge and the other two sides, a relay unit mounted on the bridge and including a vertical wall extending longitudinally of the bridge, a plurality of coils supported in a horizontal position on one side of the wall, and a mercury switch of the type including a magnetic armature enclosed in a vertical switch envelope mounted on the other face of the wall, a terminal block within the base, and leads connecting the coils with the terminal block, said leads passing through one of the openings flanking the bridge.

10. A sub-unit for a relay of the class described comprising a bracket having a horizontal web and an upstanding wall, a plurality of coils mounted in a horizontal position on one side of the wall, an iron circuit associated with the coils having its ends projecting through the wall, pole pieces on the other side of the wall associated with the ends of the iron circuit and having a plurality of vertically aligned apertures, and mercury switches of the displacer type mounted within the apertures.

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