Nov. 16, 1954 H. H. KEEN 2,694,758

INTERLOCKING ELECTROMAGNETIC RELAY

Filed March 29, 1951

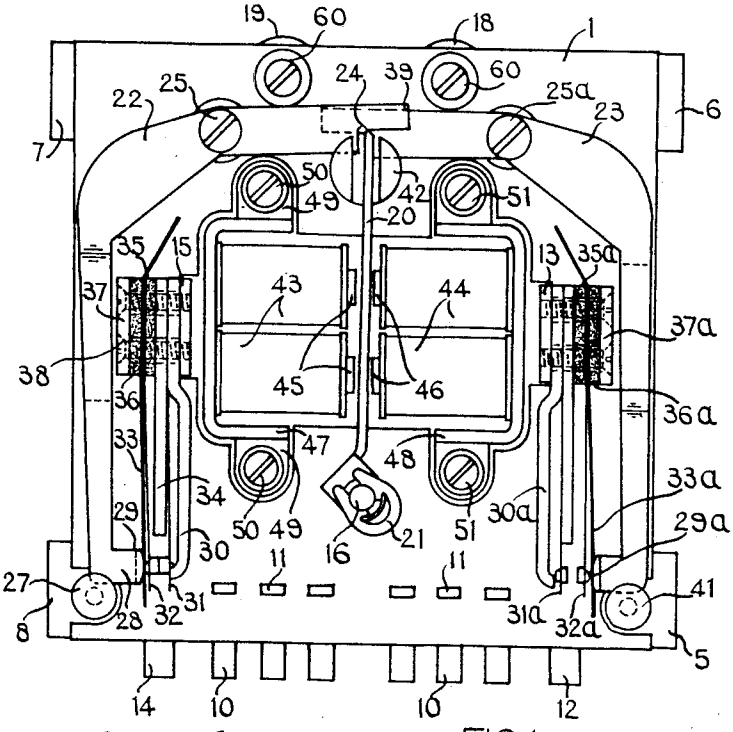


FIG. 1.

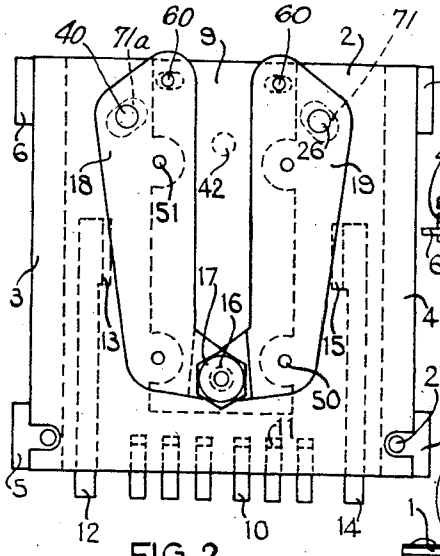


FIG. 2.

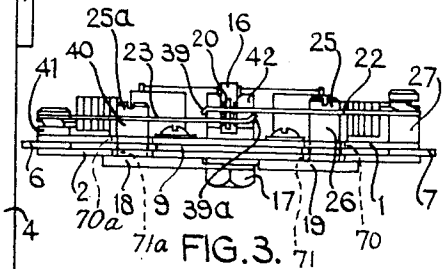


FIG. 3.

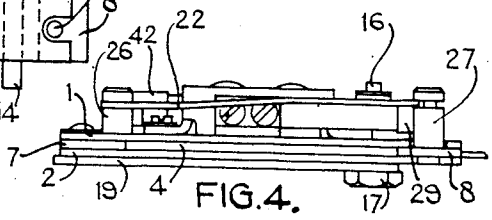


FIG. 4.

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INTERLOCKING ELECTROMAGNETIC RELAY

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8 Claims. (Cl. 200—98)

This invention relates to electromagnetic relays of the double acting type.

When it is required to maintain a set of relay contacts closed for a considerable period, it is frequently convenient to provide mechanical locking for the armature so that current is not required to maintain the relay operated, but only to effect setting. It is known for this purpose to employ a relay in which the armature is held in unoperated position directly by the spring pressure of the contacts. When the operating coil is energized, the armature is attracted, closing the contacts, and the armature is then held in this position by a mechanical latch, allowing the operating coil to be de-energized. The mechanical latch is released by energization of a second or unlatching coil.

This type of construction provides positive locking of the armature in only one position and the parts required for the operating coil and armature and the unlatching coil and armature are dissimilar.

An object of the present invention is to provide an improved electromagnetic relay of the double acting type, in which the armature is positively mechanically held in both operative positions by the action of two levers which also each operate a set of contacts.

A further object of the invention is to provide a double acting relay in which the two coils and their associated parts are of similar form.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a plan view of the top of the relay.

Figure 2 is a plan view of the underneath of the relay.

Figure 3 is a rear elevation of the relay with certain parts removed.

Figure 4 is a side elevation of the relay.

The relay is intended to be plugged in as opposed to being permanently wired in circuit, thus facilitating maintenance and replacement of the relay. To this end, the parts of the relay are mounted on a flat plate, which is provided with a set of connection strips.

The mounting plate is built up from two paxolin plates **1** and **2** (Figures 1, 2 and 3). Between the plates at either side are two brass strips **3** and **4**. These strips have portions **5**, **6**, **7** and **8** at either end, which project outside the paxolin to form guiding keys which locate the relay when it is inserted into a suitable mounting frame.

In between the plates in the central portion is a brass strip **9** (Figures 2 and 3). This strip is flush with the top edge of the plates **1** and **2** (Figure 2) but does not extend to the lower edge. In the gap between the bottom edge of plate **9** and the plates **1** and **2** are placed six connection strips **10**. One end of these project beyond the edges of the mounting plate sufficiently to engage contact members when the relay is inserted in its frame and the other ends are bent at right angles to project through holes in plate **1** to form soldering lugs **11** (Figure 1).

Also between the plates **1** and **2** are two further connection strips **12** and **14** (Figures 1 and 2). These extend at their outer ends to the same distance as the strips **10** and are located in the space between strips **3** and **9**, and **4** and **9** respectively (Figure 2). The inner ends of strips **12** and **14** are bent at right angles to form brackets **13** and **15** respectively, which each project through holes in plate **1** and form a support for a set of contact blades.

The two plates **1** and **2** and the various brass strips between them are bonded together to form an integral unit by means of a suitable adhesive applied under pressure. It would also be possible to produce the same integral unit by a moulding process.

A hole is provided through plates **1** and **2** and the lower part of plate **9**. In this hole is secured a post **16** carrying a shouldered nut **17** on the lower end (Figures 1 and 2). The shoulder on nut **17** forms a pivot for the lower ends, which are reduced in thickness, of two right angled levers **18** and **19** (Figures 2 and 3). The upper ends of these levers are secured by screws **60** near the upper edge of the plates **1** and **2**, the screws passing through slots in the plates and strip **9**.

The upper end of post **16** forms the mounting for an armature **20**, one end of which is formed into a U-section but at an angle to the main part of the armature. The post **16** passes through holes in the limbs of the U-section and the armature is retained in position by a spring washer **21** (Figure 1).

The other end of armature **20** is formed into a V shape, such that it engages with either of two notches formed in two levers **22**, **23** (Figures 1 and 3). Notch **24** in lever **22** is shown in Figure 1, the armature being engaged with the similar notch in lever **23**.

Lever **22** is bent at right-angles in the plane of plate **1** and is pivoted on a screw **25** secured in a rod **26** which is in turn secured to the lever **19** (Figures 1, 3 and 4). Clearance holes **70**, **71** are provided in plates **1** and **2** respectively to allow rod **26** a certain freedom of movement when plate **19** is adjusted, as will be described later.

The arm of lever **22** remote from the armature **20**, and which overlies the left hand side of plate **1** (Figure 1) has two small angle bends in it (Figure 4), so that the end section is parallel to the part pivoted on rod **26**, but at a slightly greater distance from plate **1**. At the end of this section is a projection **28** (Figure 1), in the plane of plate **1**. The end of this projection is bent at right angles to the plane of plate **1** to form a stop **29** which engages the contact set secured to the bracket **15**.

The contact set comprises a rigid brass stop member **30**, a spring contact member **31**, a second rigid stop **34**, an insulating spacer **35**, a second spring contact **32**, a flexible insulating strip **33**, a second insulating spacer **36**, and a steel block **37** (Figure 1). The parts are assembled in this order and fixed to the bracket **13** by two screws **38**. The spring contact **31** is in contact with the stop **30**, which in turn is in contact with bracket **15**, hence this contact **31** is electrically connected to the connection strip **14** of which bracket **15** forms a part.

The spring contact **32** is insulated from bracket **15** by the spacers **35** and **36** and from the stop **29** on lever **22** by the flexible strip **33**. Contact **32** is connected by a wire (not shown) to a lug **11** of one of the connection strips **10**.

When the end of armature **20** engages notch **24** in lever **22**, the lever is allowed to move clockwise about the pivot screw **25** under the pressure of spring contact **32** on extension **29**, thus opening the contacts **31** and **32**. If the armature is now moved out of notch **24**, the end of the armature engaging the edge of lever **22** will force the lever to move anti-clockwise, so that extension **29** will contact **32** against the spring tension to close contacts **31** and **32**.

To guide the lever **22**, the edge of the projection **28** engages in a slot cut in rod **27** (Figures 1 and 4), which is secured to part **3** of the strip **4**. As a further guide, the end of lever **22** at **39** adjacent the armature **20** is bent downwards at an angle of approximately 45° so that it bears lightly on the upper surface of lever **23**.

The lever **23** is exactly the same in form as lever **22**, and is mounted and guided in a similar manner. The arm of lever **23** remote from the armature **20** overlies the right hand side of plate **1**, so that the lever is reversed compared with lever **22**, that is, the upper surface of one lever corresponds to the lower surface of the other. The height of rod **40** (Figure 3) which carries the pivot for lever **23** and guide rod **41** is such that the end of lever **23** adjacent the armature **20** lies underneath the corresponding end of lever **22**. Parts relating to lever **23** which

correspond with those relating to lever **22** are given similar reference numbers with the suffix *a*.

The ends of the levers **22** and **23** in contact with armature **20** are positioned by a cylindrical block **42** secured to the brass strip **9** (Figures 1, 2 and 3). This block is slotted vertically to provide clearance for the armature **20** and is slotted horizontally to provide locating surfaces for the two levers **22** and **23** (Figures 1 and 3).

Two electromagnets are mounted adjacent to the armature **20**, one electromagnet on either side of the armature. The left hand electromagnet (Figure 1) comprises two windings **43** mounted on two pole pieces **45**. These pole pieces are secured to the centre limb of a U-shaped yoke **47** which has a bracket **49** with slotted holes therein, on the two outer limbs so that the electromagnet assembly may be secured to the lever **19** by screws **50**. Clearance holes in the plate **1** and strip **9** allow the assembly to move when lever **19** is adjusted.

The right hand electromagnet is constructed similarly and comprises coils **44**, pole pieces **46** and yoke **48**, the assembly being secured by screws **51** to the lever **18**.

When the right hand electromagnet is energized, the armature **20** is moved clockwise about the pivot **16** (Figure 1), so that lever **23** is permitted to move anti-clockwise about the pivot screw **25***a* and the notch in lever **23** to drop onto the V-shaped end of armature **20**. Thus the extension **29***a* of lever **23** moves away from the fixed stop **30***a*, allowing the contacts **31***a* and **32***a* to open. At the same time, lever **22** is also moved anti-clockwise as the armature **20** comes off the notch **24** in the lever. This movement presses extension **29** of the lever against the insulating strip **33**, thereby closing the contacts **31** and **32**. The relay then assumes the position shown in Figure 1.

When the left hand electromagnet is energized, the armature is moved anti-clockwise, so that the end of the armature is located in the slot in lever **22**. In consequence, the movement of the levers **22** and **23** is the reverse of that described above so that contacts **31** and **32** open and contacts **31***a* and **32***a* close.

In either position, the armature is mechanically locked by the engagement of the end of the armature with the notch in one or other of the levers **22** and **23**. The spring tension of the contacts **32** and **32***a* urges the lower ends of the levers **22** and **23** outwards, so that, pivoting on the screws **25** and **25***a*, the levers are always biassed in such a way as to maintain their other ends in contact with the armature **20**, ensuring that the armature is engaged with the notch in one lever or the other.

Connections (not shown) are made from the electromagnet coils **43**, **44** and from contacts **32**, **32***a* to the soldering lugs **11**.

The electromagnets and the levers **22** and **23** are secured to the levers **18** and **19** which pivot about the post **16**, which also forms the pivot for the armature **20**. This method of construction provides a simple method of adjusting the relay for optimum operation. Firstly, the armature **20** is centralised by inserting spacers between the armature and each side of the vertical slot in the block **42**.

The screws **50** and **51** securing the electromagnets are loosened and the electromagnets are moved away from the armature. They are temporarily locked in this position by tightening screws **50** and **51**, and screws **60** are loosened. This allows levers **18** and **19** to be pivoted about the post **16** and by gently pushing the upper ends of the levers **22** and **23**, the notches in both levers are engaged with the end of the armature. Thus the two sets of levers are centralised with respect to the armature. The screws **60** are then tightened to hold the levers **18** and **19** in this position.

The screws **50** and **51** are again loosened, the electromagnets are adjusted to provide a suitable gap between the armature and the respective pole pieces, and they are then locked in this position by screws **50** and **51**. Finally, screws **60** are loosened and levers **18** and **19** are adjusted until the position of levers **22** and **23** is such as to ensure correct operation of the contacts and the required travel of armature **20**. Screws **60** are then tightened to hold the parts in the correctly adjusted position.

What I claim is:

1. A double-acting electromagnetic relay comprising an armature freely pivotable between a first and a second extreme position, an electromagnet disposed on each side of said armature, two freely pivoted levers, each having a notch therein, the end of said armature being received in and positively held against accidental dislodgement by the notch of one said lever at one extreme position and by the notch of the other said lever at the other said extreme position, spring means for biasing said levers into engagement with said armature, each lever being pivoted against its bias on movement of said armature out of the notch in that lever and into the notch of the other lever on energisation of said electromagnets and a set of contacts for each said arm operatively engaged by the associated lever but electrically insulated therefrom, each set of contacts being mutually engaged and disengaged on opposite pivotal movements of the associated lever.

2. A double-acting electromagnetic relay comprising an armature freely pivotable between a first and a second extreme position, an electromagnet disposed on each side of said armature, two levers freely pivoted intermediate the ends thereof, each lever having a notch therein near one end thereof, the end of said armature being received in and positively held against accidental dislodgement by the notch of one said lever at one extreme position and by the notch of the other said lever at the other said extreme position, spring means for biasing said levers into engagement with said armature, each said lever being pivoted against its bias on movement of said armature out of the notch in that lever and into the notch of the other lever on energisation of said electromagnets and a set of contacts for each said lever operatively engaged by but electrically insulated from the other end of the associated lever, each set of contacts being mutually engaged and disengaged on oppositive pivotal movements of the associated lever.

3. A double-acting electromagnetic relay comprising an armature freely pivotable between a first and a second extreme position, an electromagnet disposed on each side of said armature, two freely pivoted levers, each lever having a notch therein, the end of said armature being received in and positively held against accidental dislodgement by the notch of one said lever at one extreme position and by the notch of the other said lever at the other said extreme position, and a set of spring contacts for each said lever operatively engaging against and electrically insulated from the associated lever and biasing said lever into engagement with said armature, each said lever being pivoted against its bias on movement of said armature out of said notch therein and into the notch of the other lever by energisation of said electromagnets and each said set of contacts being mutually engaged and disengaged on opposite movements of the associated lever.

4. A double-acting electromagnetic relay comprising an armature having a V-shaped end and freely pivotable between a first and a second extreme position, an electromagnet disposed on either side of said armature, two freely pivoted levers, each said lever having a notch therein, said V-shaped end being received in and positively held against accidental dislodgement by the notch of one said lever at one extreme position and by the notch of the other said lever at the other said extreme position, spring means for biasing each said lever into engagement with said V-shaped end of said armature, each said lever being pivoted against its bias on movement of said armature out of said notch therein and into the notch of the other said lever, and a set of contacts for each said lever operatively engaging against and electrically insulated from said lever, the distance between the pivot axis of each said lever and the notch therein being less than the distance between said pivot axis and the point of engagement of said contacts with said lever.

5. A double-acting electromagnetic relay comprising an armature having a V-shaped end and freely pivotable between a first and a second extreme position, an electromagnet disposed on either side of said armature, two levers freely pivoted intermediate the ends thereof each said lever having a notch near one end thereof, said V-shaped end of said armature being received in and positively held against accidental dislodgement by the notch of one said lever at one extreme position and by the notch of the other said lever at the other said extreme position, and a set of spring contacts for each said lever operatively engaging but electrically insulated from the other end of the associated lever and biasing said

lever into engagement with said V-shaped end of said lever, each said lever being pivoted against its bias to bring the contacts of the associated set into mutual engagement on movement of said armature out of the notch therein and into the notch of the other said lever on energisation of one of said electromagnets and the distance between the pivot axis of said lever and the notch therein being less than the distance between said pivot axis and the point of engagement of said contacts with said lever.

6. A double-acting electromagnetic relay comprising an armature pivoted near one end about a pivot axis and having the other end V-shaped, two carrying members, each pivoted about said pivot axis, two electromagnets disposed one at each side of said armature and adjustably mounted separately on said members, two levers freely pivoted one on each of said members, each said lever having a notch therein, said V-shaped end of said armature being received in and positively held against accidental dislodgement by the notch of one said lever, in one extreme pivotal position of said armature and by the notch in the other said lever in another extreme pivotal position of said armature, and a set of spring contacts for each said lever operatively engaging but electrically insulated from the associated lever and biasing said lever into engagement with said V-shaped end of said lever, each said lever being pivoted against its bias to bring the contacts of the associated set out of mutual engagement on movement of said armature out of the notch therein and into the notch of the other said lever on energisation of one of said electromagnets.

7. A double-acting electromagnetic relay comprising two spaced and opposed electromagnetic means, a single armature means disposed freely pivotal between said two electromagnetic means, two levers mounted freely pivotal, each of said levers being notched at its end situated adjacent to one end of the armature means, the said end of the armature means being V-shaped and engageable with said lever notches, and two sets of spring contacts, the other end of each of said levers having means coacting with the respective one of said sets of spring contacts, the said spring contacts biasing the levers into coaction with the armature means, engagement of the said V-shaped end of the armature means with either one of said lever notches retaining the armature means in the respective one of two positions solely under the bias of the respective set of spring contacts, and energization of one of said electromagnetic means moving the armature means into engagement with the notch of the respective lever whereby the armature means is movable from one position into the other upon energization of the respective electromagnetic means.

8. A relay as defined in claim 7, in combination with a pair of members each supporting one of the electromagnetic means and the lever coacting therewith, the said members being pivotal about the same center as the armature means.

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