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ELECTRICAL RELAY DEVICE

Filed Dec. 17, 1942

2 Sheets-Sheet 1

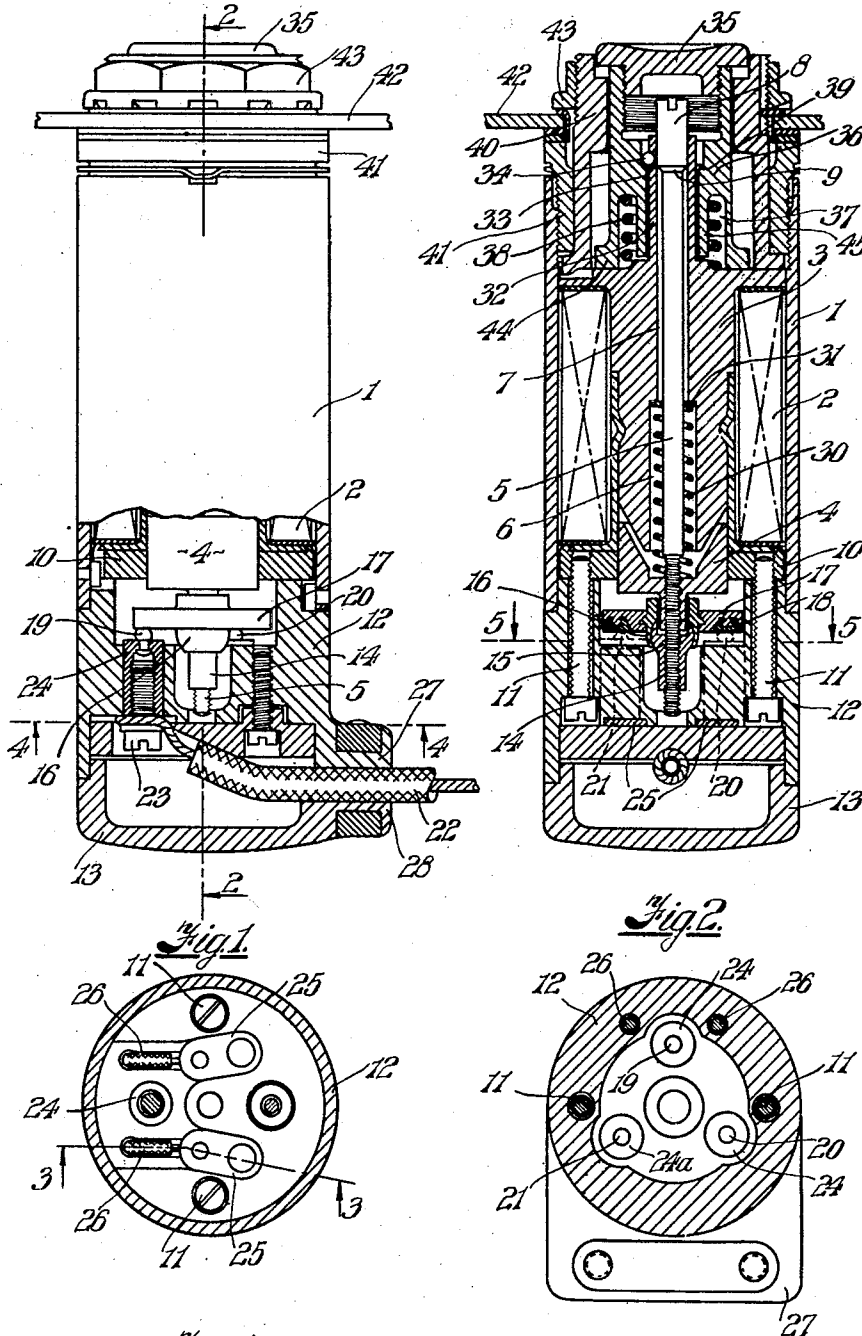


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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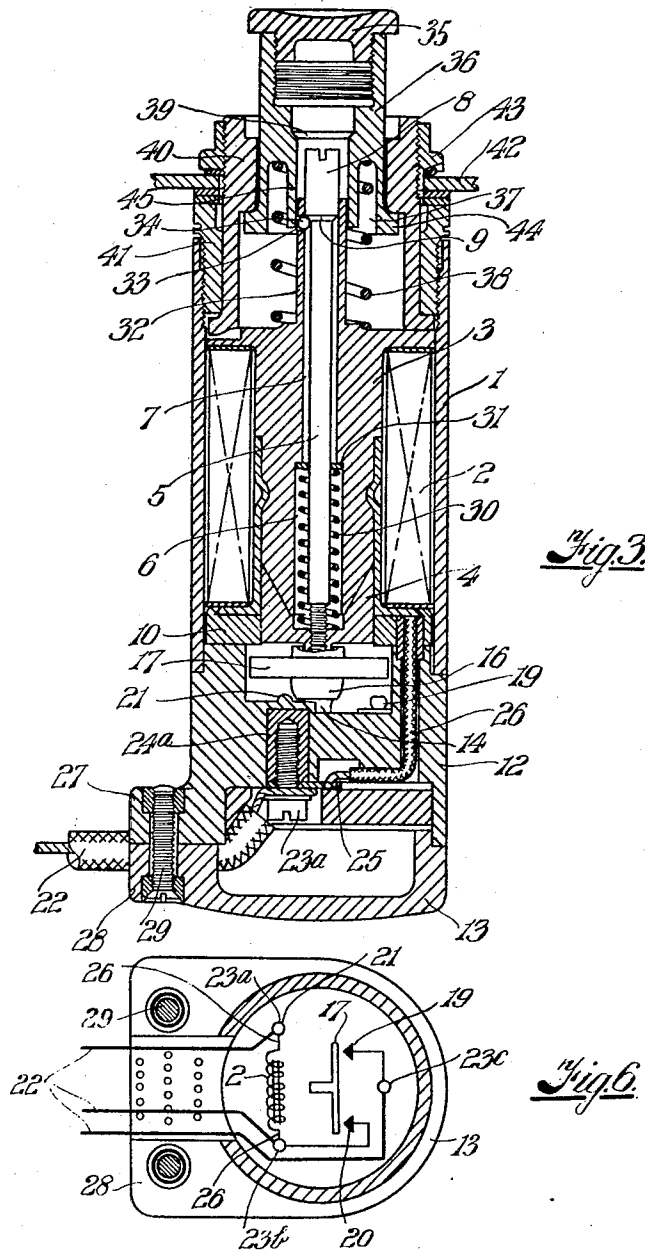
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UNITED STATES PATENT OFFICE

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ELECTRICAL RELAY DEVICE

William Frederick Forrest Martin-Hurst,
Sunbury-on-Thames, EnglandApplication December 17, 1942, Serial No. 469,328
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10 Claims. (Cl. 200—87)

This invention relates to electrical relay devices and has for its object to provide an improved construction or arrangement wherein a solenoid operated switch mechanism is provided with means for giving a visual indication of switch operation and means to prevent resetting of the switch until the conditions which caused the switch operation have changed.

According to the invention the improved electrical relay device comprises a solenoid operated switch arranged when operated to cause a visual indicator to be projected out of the relay housing such operation being utilised to lock the switch mechanism until the solenoid circuit is interrupted when the visual indicator can be depressed to re-set the switch.

Reference will now be made to the accompanying drawings which illustrate by way of example a relay constructed according to the invention and in which:

Fig. 1 is an elevation partly in section,

Fig. 2 is a sectional elevation taken on the line 2—2 of Fig. 1 showing the switch members closed,

Fig. 3 is a sectional elevation taken on the line 3—3 of Fig. 4 and showing the positions of the parts with the switch members open,

Fig. 4 is an inverted sectional plan taken on the line 4—4 of Fig. 1,

Fig. 5 is a sectional plan taken on the line 5—5 of Fig. 2 and

Fig. 6 is a diagrammatic sectional plan to show the electrical connections.

In the construction illustrated the improved electrical relay comprises a casing 1 within which is mounted a solenoid consisting of windings 2, core 3 and armature 4. This armature is fixed near one end of a spindle 5 which extends through passages 6 and 7 of differing diameters in the core 3 and is provided at one end with a head 8 between which and the spindle is formed a conical shoulder 9. The armature 4 is axially movable within an aperture formed in a plate 10 to which is fixed by screws 11 the insulating base 12 of the device which carries a removable cap 13 to permit access to be gained to terminals hereinafter described.

The lower end of the spindle 5 carries, below the armature 4, a sleeve 14 which has a spherical portion 15 over which is mounted a similarly formed bearing 16 carrying a plate 17 which has a metallic rim 18 forming the movable component of a switch. The stationary switch components comprise two studs 19 and 20, a third stud 21 being formed as a dummy contact integral with

the insulating base 12 and serving to ensure that the plate 17 is not tilted when operative and that its rim 18 makes complete engagement with the studs 19 and 20 (see Figs. 1, 2 and 3). The studs 19 and 20 are carried in the ends of metal sleeves 24 mounted in the base 12 and are internally screw-threaded to receive terminal screws 23. A third terminal screw 23a is adapted to enter and engage within a sleeve 24a disposed immediately below the dummy contact stud 21. Electrical conductors 22 are connected to the lower end of one of the sleeves 24 and to the sleeve 24a by means of the screws 23 and 23a which also serve to secure in position metal plates 25 (see Fig. 4) to which are attached conductors 26 leading to the solenoid windings. The connections thus established will be understood by reference to the diagrammatic sectional plan, Fig. 6 wherein the various components and connections are indicated by the reference numerals used in the other figures. In Fig. 6, two of the main cables 22 are shown as connected at points 23a and 23b from which connections 26 pass to the solenoid windings 2. The point 23a coincides with the position of the dummy contact 21 while point 23b is also connected to the contact stud 20. The third main cable is connected to the point 23c which in turn is connected to contact stud 19 the gap between which and contact stud 20 is adapted to be closed by the movable plate 17. The fixed switch contact members carried by the sleeves 24 are spaced 120 degrees apart as shown in Fig. 5 and the mounting of the plate 17 over the spherical bearing 15 enables it to accommodate itself under pressure of spring 30 to make certain engagement with the stationary contacts 19 and 20 with the assistance, as already described, of the dummy contact 21. The base 12 and the cap 13 are formed with laterally projecting cooperating portions 27 and 28 through which the conductors 22 are admitted and the two components are held together by screws 29 removal of which enables the cap 13 to be detached to gain access to the terminals.

Within the passage 6 of greater diameter in the core 3 is disposed a spring 30 (Figs. 2 and 3) which surrounds the spindle 5 and bears at its upper end on a shoulder 31 formed by the difference in diameters between passages 6 and 7 and at its lower end the spring bears against armature 4, the tendency of the spring being thereby to hold the armature in its lower position in which the switch contacts are closed.

Surrounding the upper portion of the spindle 5 and its head 8 is a sleeve 32 formed integral

with the core 3 and having a number of apertures 33 in which are seated steel balls 34. Preferably three of these balls are employed spaced 120 degrees apart. Surrounding the sleeve 32 and enclosing the head 8 of the spindle 5 is a push button member comprising a cap 35 fixed into a sleeve 36 whose lower end is formed with an annular recess 37 in which is housed a spring 38 bearing at its upper end against the end of the recess 37 and at its lower end upon the upper end of the core 3. The inner wall of the sleeve 36 is formed with a coned shoulder 39 against which the balls 34 normally bear, as shown in Fig. 2 and prevent the push button as a whole from being projected outwardly by the spring 38. The push button is guided within the sleeve 40 which is fixed by means of a further sleeve 41 within the upper end of the casing 1, and the relay as a whole is adapted to be fixed behind or below a panel 42 by means of a nut 43 which engages the upper end of the sleeve 40.

The operation of the relay device above described is as follows:

In the position shown in Figs. 1 and 2 the solenoid is inoperative and the spring 30 holds the armature 4 in its lowermost position to maintain the switch contacts closed. The push button is locked by the balls 34 engaging the shoulder 39 and cannot move or be moved in either direction. When the solenoid 2 is energised the armature 4, contact plate 17 and spindle 5 are all raised to the positions shown in Fig. 3. This movement brings the shoulder 9 on the spindle 5 to a position above the balls 34 so that the pressure exerted by spring 38 can force the push button outwards to the position shown in Fig. 3, the inner wall of the sleeve 36 forcing the balls 34 inwardly to engage below the shoulder 9 and thereby lock the spindle 5 in its upper position and maintain the movable switch contact plate 17 inoperative. The balls cannot be released from the position shown in Fig. 3 by manipulation of the push button as a flange 44 at the lower end of sleeve 36 engages a shoulder in sleeve 40, as shown in Fig. 3, in a position wherein the inner portion 45 of sleeve 36 is still covering the balls. In this position, however, the push button can be depressed by hand but as its inner wall 45 will merely slide idly past the balls 34 its movement cannot be utilised to reset the switch.

When the solenoid is de-energised and it no longer exerts an attraction on the armature 4, the spring 30 will tend to move the spindle 5 and armature 4 downwardly to close the switch but is prevented from so doing by the engagement of the balls 34 beneath the shoulder 9. When, thereafter, the push button is depressed, its internal coned shoulder 39 will return to the position shown in Fig. 2 so that the pressure of the spring acting through shoulder 9 will force the balls outward into the positions to lock the push button and allow the spring to restore the spindle to the switch closing position wherein the movable contacts 18 again engage the contacts 19 and 20.

In the normal use of the relay, the push button 35 which may be distinctly coloured, is projected sharply to give a visual indication whenever the circuit completed by the movable switch member 17 is interrupted and the switch cannot be reset while the energising circuit of the solenoid is maintained.

I claim:

1. An electrical relay device comprising a solenoid, a movable switch member connected to and

adapted to be operated by the armature of the solenoid, fixed switch members adapted to cooperate with said movable switch member, an indicating device, and movable locking elements normally restraining said indicating device but adapted to move into position to lock said movable switch member when the solenoid is energised to enable the said indicating device to be moved into its indicating position.

2. An electrical relay device comprising a casing, a solenoid fixed within said casing, a spindle extending through said solenoid, an armature and a movable switch member carried by said spindle, fixed switch members disposed in said casing, a push button acting as a visual indicator and as a switch resetting member disposed movably in one end of said casing, locking elements adapted to restrain said push button from movement but adapted to change position and lock the spindle against movement and hold the switch members open when the solenoid is energised and thereafter until the push button is depressed.

3. An electrical relay device according to claim 2, including a spindle extending freely through said solenoid and carrying the solenoid armature and said movable switch member, and wherein said locking elements comprise a series of metal balls engageable by said spindle and engageable with said indicating device to restrain the latter from movement when said movable switch member is in closed position.

4. An electrical relay device according to claim 2, including a housing within which said solenoid is mounted, and a spindle extending freely through the solenoid and carrying the solenoid armature and said movable switch member, and wherein said indicating device comprises a push button movably mounted in one end of said housing, and said locking elements comprise a coned shoulder on the said push button, a coned shoulder on said spindle, and a series of metal balls engageable with the coned shoulder on the push button when said movable switch member is in closed position and engageable with the coned shoulder on the spindle when said movable switch member is in open position.

5. An electrical relay device according to claim 2, including a spindle extending freely through said solenoid and carrying the solenoid armature and said movable switch member, and wherein said locking elements comprise a sleeve superimposed upon the core of said solenoid and having apertures therein, a series of balls housed in the apertures in said sleeve, a shoulder on said indicating device engageable by said balls to define one position of said movable switch member, and a shoulder on said spindle engageable by said balls to define a second position of said movable switch member.

6. An electrical relay device according to claim 2, including a spindle extending freely through the solenoid and carrying the solenoid armature and said movable switch member, and a spring tending to move said movable switch member into closed position, and wherein said movable switch member comprises a self-adjusting plate, and said locking elements comprise an enlarged head on said spindle, locking devices engageable with said head, and means on the indicating device also engageable by said locking devices.

7. An electrical relay device comprising a casing, a solenoid fixed within said casing, a spindle extending through said solenoid, an armature and a movable switch member carried by said

spindle, fixed switch members disposed in said casing, an indicating and switch re-setting member disposed movably in one end of said casing and having a shoulder thereon, a shoulder on said spindle, and a number of balls engageable with one or the other of said shoulders to lock the indicating and switch resetting member when the switch members are in closed relation and to lock the spindle against movement and hold the switch members in open relation when the solenoid is energized and thereafter until the indicating and switch-resetting member is depressed.

8. An electrical relay device comprising a casing, a solenoid fixed within said casing, fixed and movable switch components mounted within said casing, a push button device movably mounted in one end of said casing and having an internal shoulder thereon, a spring tending to project said push button device from the casing to act as a visual indicator, a movable spindle in said casing carrying the movable switch component and having a shoulder thereon, and a series of balls adapted to make locking engagement with the shoulder on the push button device or the shoulder on the spindle according to the positions of the movable switch component.

9. An electrical relay device according to claim 8, wherein said locking balls permit inoperative movement of said push button device while said balls hold the movable switch component in open position and the solenoid remains energized.

10. An electrical relay device comprising a casing, a solenoid fixed within said casing, a spindle extending through said solenoid, an armature and a movable switch member carried by said spindle, fixed switch members disposed in said casing, a push button acting as a visual indicator and as a switch resetting member disposed movably in one end of said casing, a spring tending to project said push button from said casing, a sleeve superimposed upon the armature core and having apertures therein, a series of balls housed in the apertures in said sleeve, an internal coned shoulder on said push button engageable by said balls, an enlarged head on said spindle, a coned shoulder on said spindle adjacent said head also engageable by said balls, and a spring tending to relatively move the switch members into closed relation.

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