Aug. 24, 1943. C. F. WARRICK 2,327,684

RELAY MECHANISM

Original Filed May 18, 1938

Fig. 1.

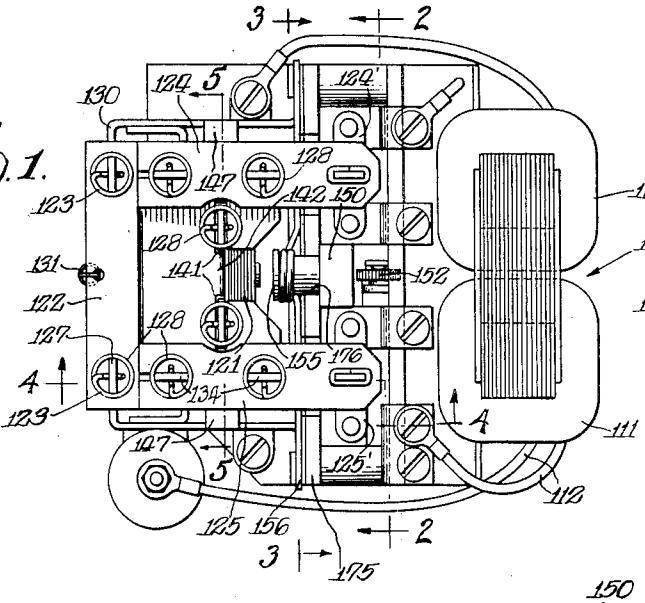


Fig. 6.

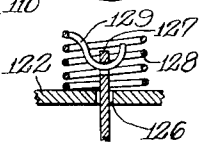


Fig. 2.

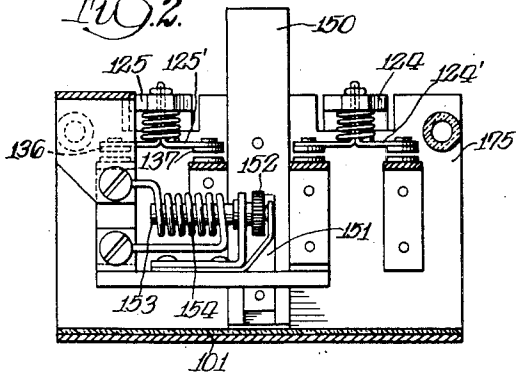


Fig. 3.

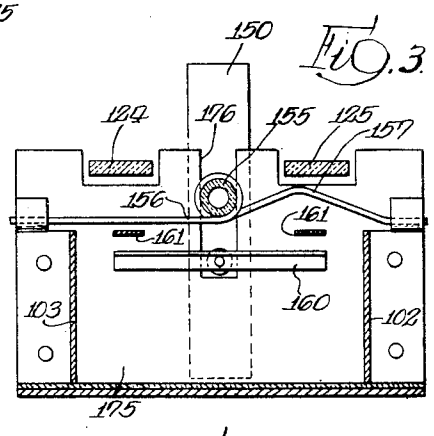


Fig. 4.

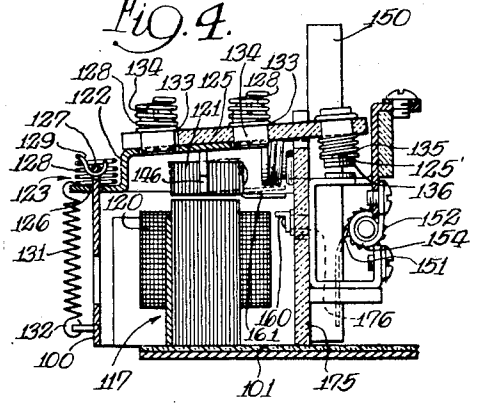
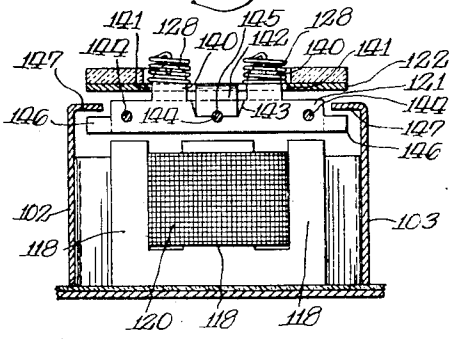


Fig. 5.



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UNITED STATES PATENT OFFICE

2,327,684

RELAY MECHANISM

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Original application May 18, 1938, Serial No. 208,728, now Patent No. 2,249,994, dated July 22, 1941. Divided and this application July 15, 1940, Serial No. 345,655

5 Claims. (Cl. 175—336)

My invention relates to electrical controls and particularly magnetic actuated controls suitable for use in a variety of installations. Among the objects of my invention is to provide a new and improved electric control which is positive acting and sufficiently powerful so that movable parts therein of rugged construction can be shifted by a simplified circuit arrangement.

Another object is the provision of an electro-magnetic relay mechanism provided with a new and improved overload release operating on the solder pot principle which is resiliently cushioned in such a manner that smooth operation is assured under all conditions.

Another object is embodied in the provision of a new and improved electro-magnetic relay provided with an overload release in which is incorporated an alarm which utilizes the magnetic attraction of a pole piece in the relay upon its armature.

Other objects include an electro-magnetic relay wherein the moving parts are resiliently and pivotally mounted one with respect to the other by means of spring connections of such a nature that each piece can tilt in any direction with respect to the piece to which it is connected regardless of the position to which either has been previously tilted during operation of the device. The universal tilting construction also has for its object the embodiment of a novel mounting of the armature upon the lever carrying it such that by use of the universally mounted springs the armature is always permitted to lie perfectly flat upon the pole pieces during normal operation.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained as hereinafter more fully set forth and pointed out in my claims and illustrated in the accompanying drawing in which:

Figure 1 is a top plan view of a commercial embodiment of my improved electric control device.

Figure 2 is a cross sectional elevation on the line 2—2 of Figure 1.

Figure 3 is a cross sectional elevation on the line 3—3 of Figure 1.

Figure 4 is a cross section of a portion of Figure 1 taken on the line 4—4 which is at right angles to Figures 2 and 3.

Figure 5 is a partial cross sectional elevation of the pole piece and armature portion taken on the line 5—5 of Figure 1.

Figure 6 is a detail view of the universal spring mounting.

In the construction of electric control devices which must be made of such a rugged construction that they are suitable for throwing heavy switches for actuating alarms and like activities, it is necessary to construct the actuating portions in such a manner that they can be supplied with a current strong enough to do the work desired without that current being so great as to jeopardize the safety of any person coming in contact therewith. By providing a positive acting relay of this character the construction can be kept extremely simple so that an electrician with no more than a fundamental grounding in his art is capable of making adjustments and repairs without it being necessary to send the entire instrument back to the factory. The extremely simple construction of my device also permits it to be built quickly and cheaply without sacrificing any fineness of adjustment in its operation and insures a product which can be sold to the public at a price commensurate with its usefulness.

My device in general consists of a transformer, or in some instances a condenser, having the primary side directly and permanently connected to a source of alternating current. The secondary side of the transformer includes a circuit necessarily insulated from the primary circuit and operable to actuate a magnetic relay, the armature of which is pivoted so that when actuated it is capable of throwing a heavy switch or of striking a bell or other similar functions requiring movement of an actuator arm with considerable force.

When such an electrical control device is used with an apparatus such for example as a pump, occasions arise when the pump might stall causing an overload and an excessive drain upon the line current causing temporary disruptions in the current conditions of the device. Accordingly, the control device has incorporated therein an overload release which is operable to disconnect the pump motor on such an occasion without disconnecting the circuit through the magnetic operative relay portion. To further insure against damage caused by an overloaded condition, the relay is constructed so that when the motor switch is tripped by the functioning of an overload release, the armature is tilted very slightly by means of lifting a resilient angle bracket at the side so that as the current con-

tinues to flow through the magnetic relay portion the armature produces a loud vibrant hum calling attention to the overloaded condition so that it may be readily corrected before a raise in the water level might reach such a point as to flood the entire mechanism.

In order to supply smooth and efficient operation to a commercial embodiment of my invention, certain innovations in the construction of an electrical control device working upon the principle herein disclosed become highly advantageous. These advantages comprise among other things what might be termed a universal resilient mounting for the armature and its extension arm, together with the switch mounting carried thereby. In addition to this there is built into the control device an overload release and an alarm which utilizes the magnetic attraction of the armature as an audible warning of an overloaded condition.

This case is a division of my co-pending application, Serial No. 208,728, filed May 18, 1938, now Patent No. 2,249,994, issued July 22, 1941.

The commercial device as shown in Figures 1 through 6 comprises an outer casing having a rear wall 100, bottom wall 101 and side walls 102 and 103. A transformer 110 is shown in Figure 1 having a primary coil 111 and a secondary coil 113. Line wires 112 supply a permanent alternating current to the primary coil. A relay 117 is shown provided with pole pieces 118, the center one of which is wound with a relay coil 120. An armature 121 is carried by an extension 122 which is pivotally mounted by a special universal resilient mounting at the point 123 upon the rear wall 100 of the casing. The extension by means of a pair of insulated switch actuating arms 124 and 125 is adapted to carry respectively a switch bar 124' for controlling the relay circuit and a switch bar 125' for controlling the motor circuit, all the parts of which correspond in operation to the parts shown in the diagrammatic sketch of Figure 1 of my said co-pending application, Serial No. 208,728, filed May 18, 1938.

The parts shown in Figures 1 through 5 have been given the same characters above 100 as the corresponding parts in Figure 1 of my said co-pending application, as for example the transformer of Figure 1 of the said co-pending application indicated by the character 10 is indicated by the character 110, in Figure 1 herein, the armature 21 by the armature 121, etc., in order to tie the commercial embodiment in with the general construction shown in diagrammatic form. Inasmuch as the diagrammatic sketch in Figure 1 of my said co-pending application clearly illustrates the method of making the connections embodied in Figures 1 through 5 herein the electrical connections of Figures 1 through 5 will not be described in detail. Instead the mechanical means facilitating the electrical operations will be emphasized.

As shown in Figure 1 and more clearly by the sectional view in Figure 4, the extension 122 carrying the armature 121 is constructed of a somewhat Z shaped metal piece provided with apertures 126 and extending through each aperture is a projection 127 comprising a portion of the rear wall 100. The projection fits loosely in the aperture and a pair of these are supplied forming the universal resilient joints 123. A coil spring 128, details of which appear in Figure 6, rests upon the upper face of the extension 122 and surrounds the aperture 126 and projection 127. An extension 129 of the spring is hooked inward and downward through a perforation at the end of the projection 127 thereby tending to press the extension 122 downwardly into position upon a suitable shoulder 130. An elongated coil spring 131 secured to the outer rear end of the extension and a bracket 132 upon the rear wall tends to normally tilt the extension in an upward direction.

The switch arms 124 and 125 previously referred to are attached to the extension arm by resilient spring connections similar to that described for the pivot point 123. These connections 133 comprise relatively large apertures in the switch arm in which are inserted projections 134 of the extension to which are attached the novel coil springs 128 above described. By this manner of attachment the switch arm is enabled to tilt in any direction with respect to the extension 122. At the opposite free end of the switch arm 125 there is provided the switch bar 125' resiliently mounted by means of a coil spring 135 upon the insulated switch arm and bearing contact points 136 and 137 for closing the motor circuit. A similar construction applies to the switch arm 124 which actuates the relay switch for opening and closing the relay circuit.

In relay devices which are designed to operate at moderately high voltage, it is always the desire to have the armature set absolutely even upon the pole pieces and so that there will be no undesirable noice resulting from vibration by reason of having the armature tilted out of position. In the device disclosed herein, there is shown a novel and efficient mounting for the armature which permits it to adjust itself absolutely flat upon the pole pieces. This universal mounting comprises partly a universal spring arrangement such as has been above described featuring projections 140 forming a part of the laminated bar of the armature 121 which extend upward through slots 141 of the extension 122. Springs 128 engage the extension and the projections extending therethrough in the same manner as similar springs are used elsewhere throughout the pivoting portion of the armature. The springs by their action tend to draw the armature upward toward the extension 122.

To counteract the tendency of the springs to draw the armature toward the extension there is provided a downwardly extending lip 142 near the center of the extension. In the armature is provided an elongated slot 143 having somewhat of a trapezoidal shape with a width at the bottom approximately equal to the length of the lip 142, and the slot being somewhat wider and longer than the lip permits it to shift slightly in any direction once it is inserted therein. Laminated portions of the armature are bound together by rivets 144 at the sides and in the center and since the slot 143 extends down to the center of the armature the central rivet 144 is partially exposed in the slot. To accommodate the rivet there is provided a recess 145 at the lower edge of the lip 142 which is adapted to rock upon the exposed portion of the rivet in the nature of a pivot. Lugs or ears 146 are provided at the ends of the armature cooperable with inward extending portions 147 at the sides of the casing to prevent the armature being tilted upward beyond a certain point.

When the armature is assembled upon the extension the springs tend to draw the armature upwards against the lower edge of the lip 142. This in turn permits the armature to tilt either endwise or crosswise or even in a diagonal direc-

tion so that although being held firmly in place it is so held by a universally acting resilient means which permits it to lie flat against the pole pieces regardless of any misadjustments or obstructions upon the same.

In case the motor should stall for some reason, there is provided in the electrical control device an overload release consisting of a plunger 150 of insulating material normally urged in an upward direction by spring means not shown but retained by a means of a pawl 151 attached to the plunger which engages a ratchet wheel 152. The ratchet wheel in turn is mounted upon a shaft journaled in a cylindrical solder pot 153 of more or less customary design. Around the solder pot there is wound a coil of resistant wire 154 which is connected in series with one of the wires leading to the motor. Normally the plunger is held in a downward position because the solder in the pot being solid prevents rotation of the ratchet wheel 152. If there is an excessive call for current in the motor circuit, raising the amperage, the coil 154 becomes hot enough to melt solder in the solder pot as soon as the flow of current reaches a certain amount. Solder of this kind is carefully calibrated so as to melt at a predetermined temperature. When the solder melts the ratchet wheel 152 is permitted to rotate thereby permitting the plunger 150 to be urged upwards.

A wall 175 of insulating material separates the transformer coil from the relay coil and serves as a vertical guide for the plunger 150. In the wall there is cut a slot 176 and extending through the slot is a projection 155 secured to the plunger around which is wound a spring 156 having one end bent up sharply at the point 157. Whenever the plunger is released by means of an overloaded condition it raises the spring 156 until the uppermost point 157 engages the switch arm 125 but since the opposite side of the spring 156 is not bent upwards no contact is made with the relay switch arm. Accordingly, when there is an overload the motor switch arm is raised breaking the motor circuit thereby cutting the motor and pump out of operation. Since the relay switch is unaffected the armature remains held in position and the remainder of the device continues in operation unaffected by said overload condition. It is significant that the overload release is of an extremely resilient character since both the spring 156 which lifts it is resilient as it also the support for the contact bridge 125^1.

Although the mechanism for disconnecting the motor under overload conditions is highly meritorious, an added precautionary measure is built into the relay consisting of an overload alarm. The principle of operation of the alarm is that of deliberately tilting the armature on the pole pieces so that vibration due to a relatively high alternating current may set up a distinct audible hum calling attention to the overloaded condition of the motor.

The overload alarm comprises primarily a bar 160 secured to the plunger 150 at a point slightly below the attachment of the spring 156. Attached to the armature at each end is a resilient bracket 161 which extends over the bar 160. This bar is positioned on the plunger at such a point that whenever it has been raised sufficiently to break the motor circuit as a result of overload, the bar 160 ascends into contact with the resilient brackets 161 tending to tilt them slightly. The tendency to tilt is a very small amount, only enough to cause the armature to vibrate as a result of the alternating current producing thereby a penetrating audible hum calling attention to the overload. If the warning given by the alarm is heeded there will be ample time to correct the condition in cases where the control might be used in connection with a sump pump and damage which might be caused by flooding of the system due to failure of the pump to operate may be avoided.

Some changes may be made in the construction and arrangement of my device without departing from the real spirit and purpose of my invention and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. In a magnetic actuated electric relay including a casing member and a pole piece therein, the combination of an armature actuated mechanism comprising a lever member, a universal spring connection member suspending one end of the lever relative to the casing, an actuator member having its axis extending from the spring connection toward the pole piece and universal spring connections along the axis urging said actuator against the lever member, an armature member having an axis extending across the axis of the actuator intermediate the spring connections and a universal spring connection attaching said armature member to said lever member and holding the armature away from the pole piece, said connection comprising in each case an aperture means on one member and a projection on the other extending loosely therethrough and a coiled spring seated on the apertured member surrounding the projection on the other having an extension hooked into said projection to permit relative tilting of the members so connected in any direction.

2. In a magnetic actuated electric control device including a casing and a pole piece therein having separate spaced poles and having a portion bearing a coil, the combination of an armature actuated mechanism comprising a lever member pivoted to the casing and an elongated armature member extending over said poles, a plurality of universal connections spaced along the armature member attaching the armature member to said lever member, and connections including a plurality of aperture means in one member and a plurality of corresponding projections in the other member extending loosely through the aperture means, coiled springs positioned on one member about the respective projections on the other having extensions engaged in the projections adapted to resiliently urge the members in one direction at said respective spring locations, and a universally pivoted connection between said members adapted to limit movement of said members in the opposite direction and provide thereby a balanced universal connection therebetween.

3. In a magnetic actuated electric control device including a casing and a pole piece therein having spaced poles and having a portion bearing a coil, the combination of an armature mechanism comprising a lever member pivoted to the casing and suspended above the poles, an elongated armature member extending over said poles having a universal connection with said lever member, said connection including a pair of aperture means in one member and a pair of

projections in the other member extending loosely through the aperture means, coiled springs positioned on one member about the respective projections on the other having extensions engaged in the projections adapted to resiliently urge the members in one direction, one of said members having a second elongated aperture means running parallel to the long dimension of the armature and having a rounded element extending thereinto and a corresponding elongated projection on said other member extending into said elongated aperture, said last projection having a recessed portion complementary to and engageable with said rounded element to limit movement of said members in the opposite direction and provide a balanced universal connection therebetween.

4. In a magnetic actuated electric control device including a casing and spaced electric wound pole elements therein having flat exposed ends, the combination of a laminated armature positioning mechanism comprising an elongated armature member having a flat face normally extending over the ends of both poles and adapted on operation to be moved into face-to-face contact therewith, a lever member resiliently suspended above the armature member having a supporting portion extending laterally relative to the armature, universally movable resilient supports attached independently to said armature member and said lever member on opposite sides of a point midway between the ends of the armature member urging said members toward each other and holding the armature away from the poles, said armature member having a relatively narrow recess between the laminations adjacent the midportion thereof including a rounded element in the recess and a lip on the other member extending loosely within the narrow recess having a hollow portion engaging said rounded element forming a pivot between said members having limited lateral and longitudinal movement and opposing the force of said universal resilient supports tending to urge said members toward each other.

5. In a magnetic actuated electric control device including a casing and spaced electric wound pole elements therein, the combination of an armature positioning mechanism comprising an elongated armature member extending over the ends of both poles, a lever member resiliently suspended adjacent the armature member, universally movable resilient supports attached independently to said armature member and to said lever member at points spaced one from another on opposite sides of a point midway between the ends of the armature member and having independent operation with respect thereto in a direction adapted to urge said members toward each other and to urge the armature away from the poles, one of said members having a relatively narrow recess adjacent the midportion thereof and a lip on the other member extending loosely within the narrow recess forming a pivot between said members remote from the points of attachment of said resilient supports, said pivot having limited lateral and longitudinal movement and opposing the force of said universal resilient supports.

CHARLES FREDRICKS WARRICK.