June 7, 1955 V. R. HERTERICK 2,710,329

ELECTRICAL ASSEMBLY

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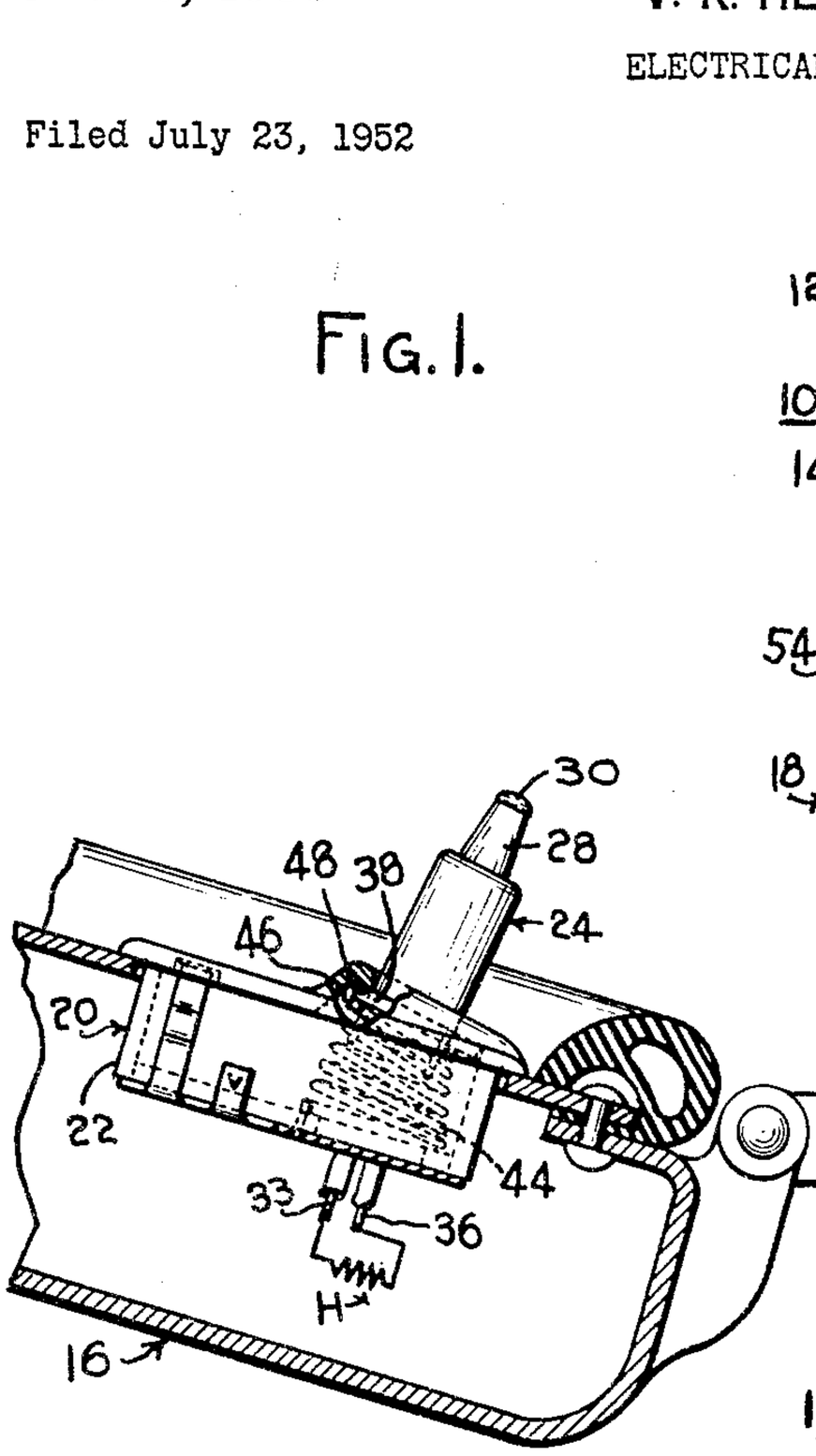
FIG. 1.



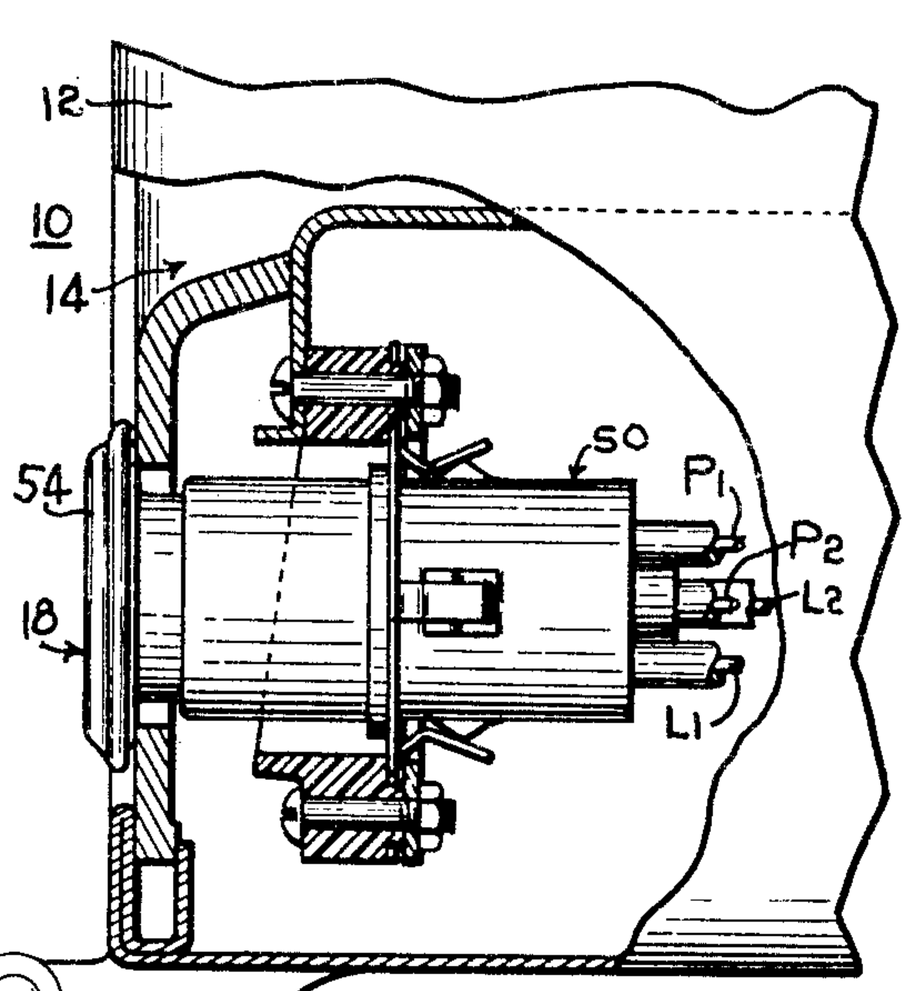


FIG. 2.

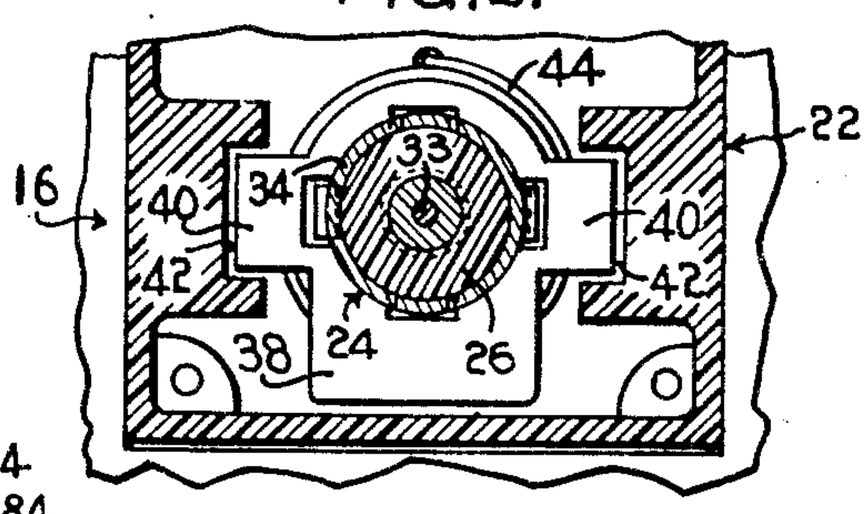


FIG. 3.

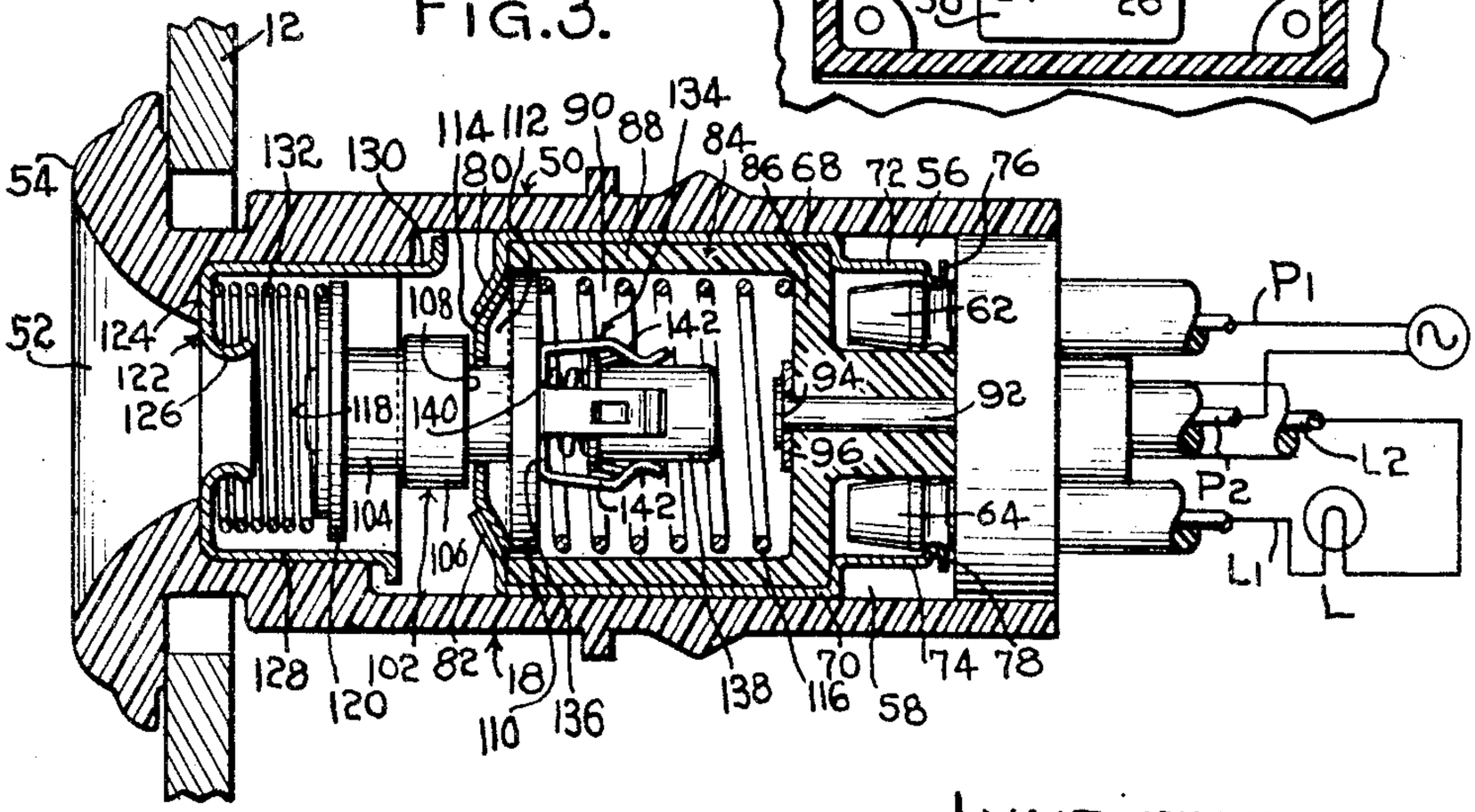


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FIG. 4.

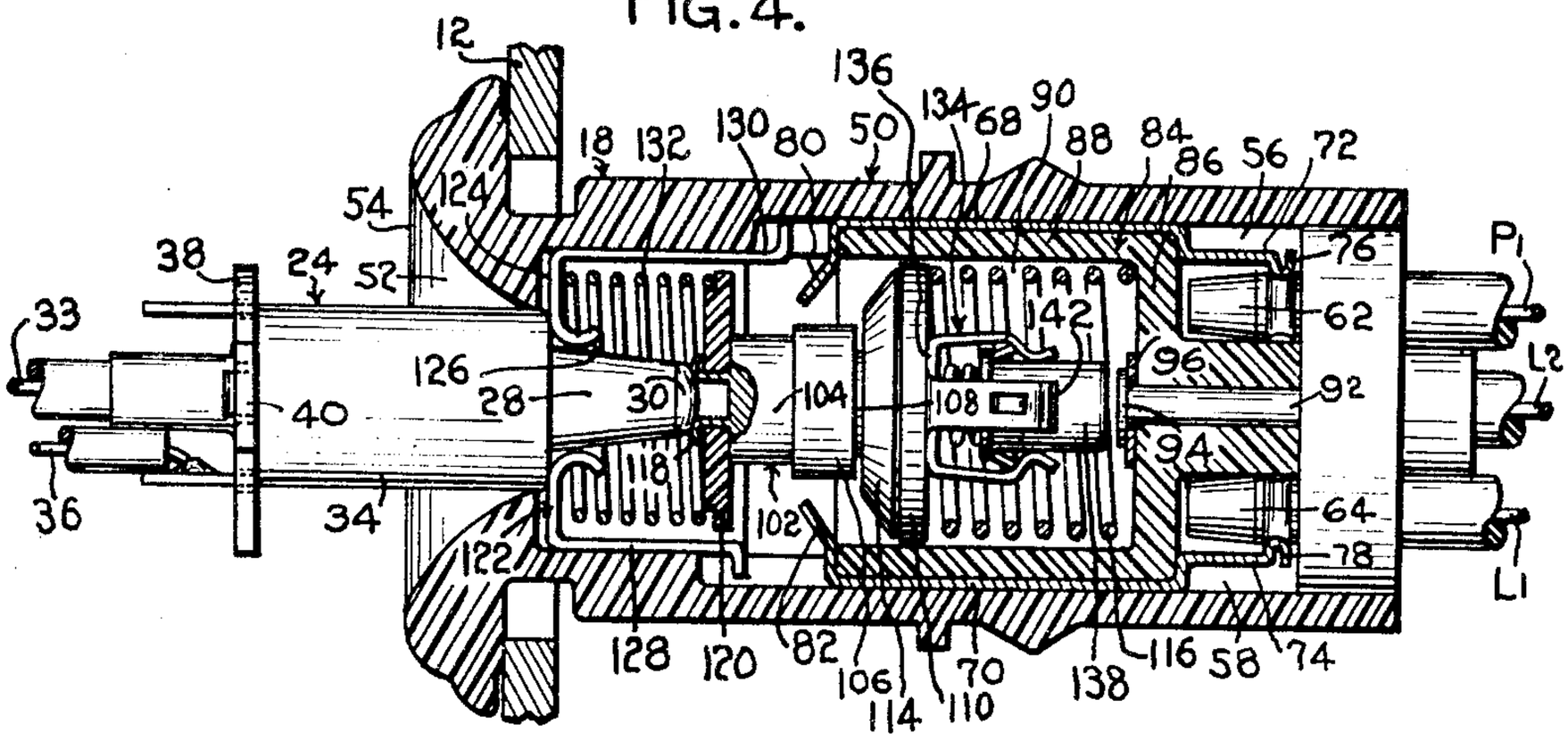


FIG. 5.

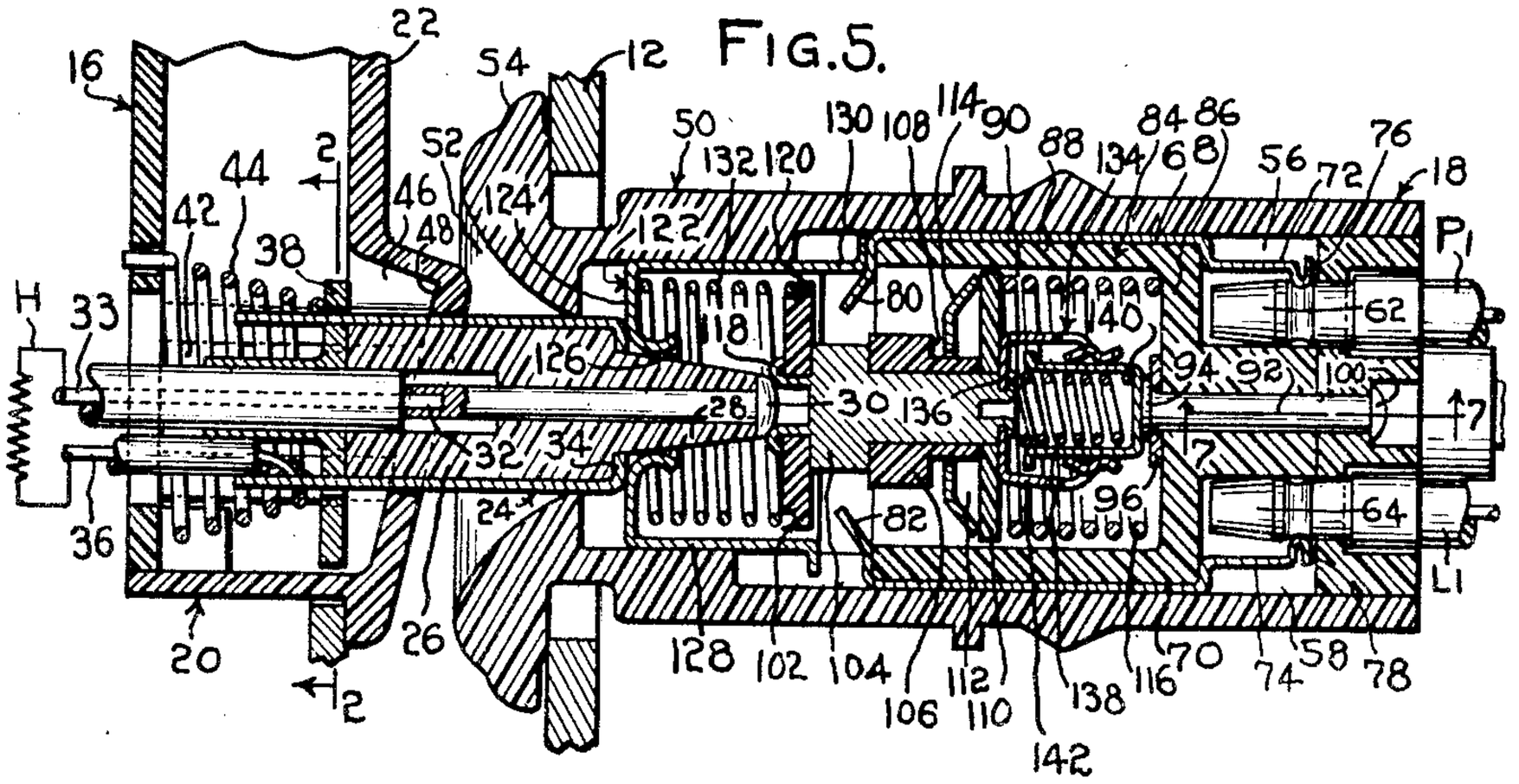


FIG. 6.

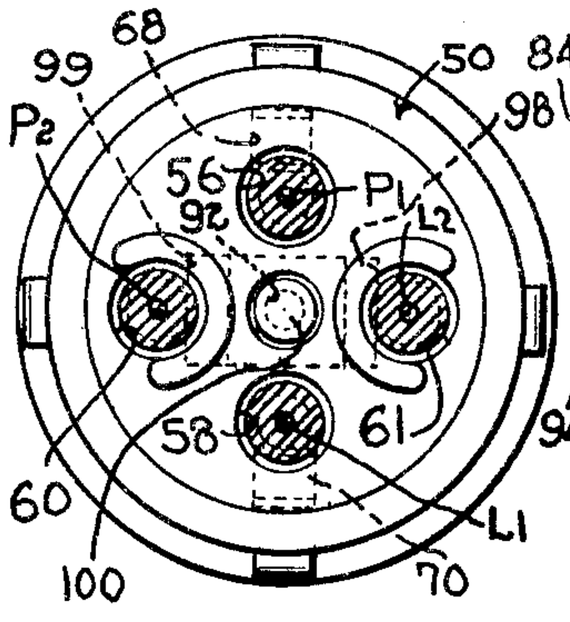
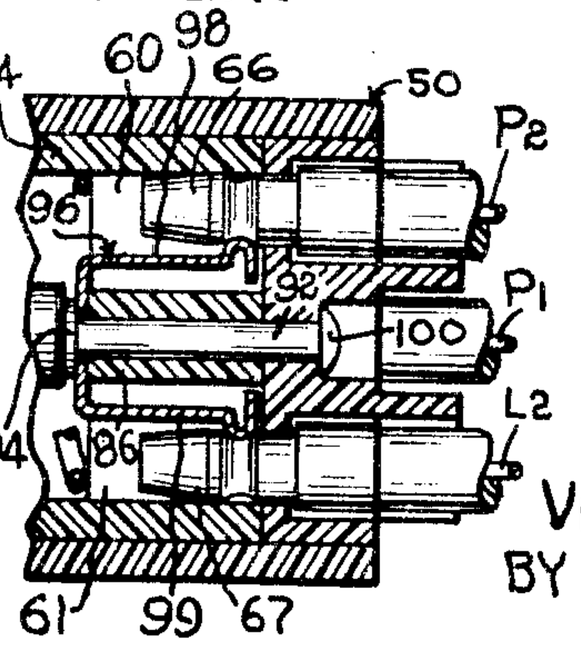


FIG. 7.



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ELECTRICAL ASSEMBLY

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7 Claims. (Cl. 219—20)

This invention relates generally to refrigerator assemblies, and has particular reference to an improved form of switch mechanism for use therein.

In many types of refrigerators, a housing forming a compartment to be refrigerated is provided with means for illuminating the interior thereof which is operated by opening and closing the door of the compartment. An auxiliary storage compartment is frequently provided in the door, and in many cases this auxiliary compartment is utilized for the storage of certain types of food that do not require the degree of refrigeration of the foods stored in the main storage compartment. For this reason, heating means is provided in the door storage compartment which is thermostatically controlled to maintain the door storage compartment at a predetermined higher temperature than the main storage compartment.

The provision of such heating means requires that power be transferred in some manner from the housing to the door. It has been found undesirable to transfer the power to the heating means by direct wiring, since such wires must necessarily flex during opening and closing of the door, and the wires are exposed when the door is open, so that they can be accidentally broken. Hence, such construction creates a shock hazard which makes it undesirable for home installations.

Since a switch for energizing the illumination means is ordinarily provided in the housing so as to be operated by opening the door, it would be desirable to incorporate in this switch means for energizing the heating means, said means to be operated by closing the door.

The object of the invention is to provide a refrigerator assembly in which a switch mechanism is provided in the housing to energize illumination means in the housing when the housing door is open and to energize heating means in the door when the door is closed.

A further object of the invention is to provide a switch mechanism operable by a plunger to be inserted therein in which said switch is provided with contact means for completing an electric circuit to the plunger, and said switch has means responsive to the insertion of the plunger to break a separate electric circuit.

Another object of the invention is to provide a switch mechanism for completing a circuit to a plunger having contacts thereon in which said switch is provided with terminal contact means for supplying power to the circuit and intermediate contact means adapted to be moved into contact with said terminal contacts by the insertion of the plunger into the switch after said intermediate contacts have made contact with the plunger contacts.

In the drawing:

Fig. 1 is a view in elevation of a portion of a refrigerator assembly embodying the features of the invention;

Fig. 2 is a view in section on line 2—2 of Fig. 5;

Fig. 3 is a view in elevation, partly in section, of a switch assembly for use in the refrigerator assembly of Fig. 1;

Fig. 4 is a view similar to Fig. 2 in which the plunger has started into the plunger-receiving aperture of the

switch, illustrating the action of the switch when the door is being closed;

Fig. 5 is a view similar to Fig. 3 in which the plunger and switch are in the position corresponding to their position when the refrigerator door is closed.

Fig. 6 is a view in section taken on line 6—6 of Fig. 4;

Fig. 7 is a view in section taken on line 7—7 of Fig. 5.

Referring to Fig. 1 of the drawing, there is illustrated a portion of a refrigerator assembly 10 which comprises a housing 12 having an access opening 14 closable by a door 16. The refrigerator assembly 10 is of the type which has illumination means (illustrated schematically at L) disposed in the housing to be energized when the door is open and heating means (illustrated schematically at H) disposed in the housing to be energized when the door is closed, to maintain the auxiliary storage compartment at a predetermined temperature higher than that of the main storage compartment.

To provide means controlling the energizing of the illumination means and the heating means when the door is opened and closed, a switch mechanism 18 is provided in the housing and a plunger mechanism 20 is provided in the door which is adapted to actuate the switch mechanism in a manner to appear hereinafter.

The plunger mechanism 20 comprises generally a housing 22 adapted for assembly into the refrigerator housing in any convenient manner and a plunger 24 assembled into the housing and protruding therefrom. As illustrated in section in the plunger portion of Fig. 5, the plunger 24 is provided with an insulating body 26 having a tapered nose portion 28, with a center conductor 30 extending from the nose longitudinally through the body and having a connector portion 32 for receiving a lead wire 33 to carry current to the heating means in the door. A second conductor 34 is provided in the form of a shell about the body 26 in spaced relation to the nose and extends rearwardly therefrom into the housing 22, with a second lead wire 36 being joined thereto by soldering or the like, to complete the circuit from the conductors to the heating means.

To enable the plunger to adjust itself to the angle of the door in relation to the refrigerator housing during opening and closing of the door, the plunger 24 is mounted in the plunger housing 22 so as to be tiltable therein, by means of a plunger retainer 38 which is assembled onto the plunger and is provided with a pair of ears 40 extending laterally therefrom (see Fig. 2). To receive the ears 40, a pair of elongated grooves 42 are provided inside the housing, so that in addition to being tiltable in the housing, the plunger is also movable into and out of the housing a predetermined distance for a purpose to be hereinafter described. A spring 44 is provided in the housing behind the retainer 38 to urge the plunger into an extended position when the door is open; and to properly align the plunger for entry into the socket as the door is being closed, the plunger housing is provided with an internal recess 46 having an inclined surface 48 disposed for contact with the retainer when the plunger is in the extended position, so that the plunger assumes a position perpendicular to the inclined portion (see Fig. 1).

As illustrated in Figs. 3, 4 and 5, the switch mechanism 18 comprises an outer insulating housing 50, which may be assembled into the refrigerator housing so as to be laterally shiftable a predetermined amount in relation thereto and has a plunger-receiving opening 52 in the front or exposed end 54 and apertures 56, 58, 60 and 61 in the rear end to receive shouldered lead wire connectors 62, 64, 66 and 67. A pair of conductor bars 68 and 70 are assembled in the housing and extend longitudinally therein, having terminal end portions 72 and 74 disposed in the apertures 56 and 58 with shoulder portions 76 and

78 disposed thereon to receive the shouldered connectors 62 and 64 in snapping engagement. The other end of the conductor bars 68 and 70 are provided with inwardly extending contacts 80 and 82. The conductor bars are retained in place by an inner housing 84, having a base 86 and a peripheral wall 88 disposed on the base and extending toward the front of the outer switch housing 50 forming a cavity 90. A center conductor bar 92 is centrally disposed in the base 86 of the inner housing and has a headed portion 94, which retains a connector 96 in assembly therewith (see Fig. 7). The connector 96 is provided with shouldered spring arms 98 and 99 which extend forwardly into the apertures 60 and 61 to receive the shouldered lead wire connectors 66 and 67 in snapping engagement. The other end of the conductor bar 92 is provided with a headed portion 100 disposed on the rear side of the base 86 to retain the connector and conductor bar 92 in assembly.

To provide means in the socket for completing an electric circuit between the contacts 80 and 82, a movable member 102 is disposed in the housing 50 and as illustrated in section in Fig. 5, comprises a center conductor 104 having an insulating member 106 disposed thereon. The insulating member 106 has a shoulder 108, and an insulating washer 110 is assembled onto the rear end thereof, forming a peripheral recess 112. A shorting member 114 is assembled about the insulating member 106 in the recess 112 so as to be movable thereon a predetermined distance longitudinally for a purpose to appear hereinafter. To urge the movable member 102 toward the front of the housing, a spring 116 is disposed in the cavity 90 of the inner housing 84 between the base 86 thereof and the washer 110 on the movable member.

To provide means in the socket for making electrical contact with the center conductor 30 of the plunger, the center conductor 104 of the movable member is provided with a rivet-like connector 118 disposed on the front end thereof, which holds an insulating washer 120 in assembly on said end.

To provide means in the socket for making electrical contact with the outer conductor 34 of the plunger, a cup-shaped member 122 is disposed in the housing 50 between the plunger-receiving opening 52 and the front washer 120 on the movable member, and comprises a base 124 having a central opening 126, and a peripheral wall 128 disposed about the base. To make and break electrical contact between the cup-shaped member and the conductor bar 68, a contact arm 130 extends rearwardly from the peripheral wall 128. A spring memebr 132 is provided between the base 124 of the cup-shaped member and the front washer 120 on the movable member to urge the cup-shaped member toward the front of the housing 50.

To provide means for making and breaking electrical contact between the center conductor 104 of the movable member and the center conductor bar 92 in the rear of the housing, a contact assembly 134 is assembled onto the rear of the movable member, and comprises a fixed contact member 136 and an inner sliding shell 138 assembled into the rear end of the outer shell so as to be movable into and out of the fixed contact member. A spring 140 is disposed between the contact member 136 and the inner shell 138 to urge the inner shell to the extended position, and the fixed contact member is provided with wiping contact arms 142 to maintain electrical contact between the shells during relative movement therebetween. The rear end of the inner shell is positioned for contact with the center conductor bar 92 during operation of the switch in a manner to appear hereinafter.

When the switch is assembled into the refrigerator, the plunger lead wires 33 and 36 are connected to the heating means H. As illustrated in Fig. 3, the lead wire connectors 62 and 66 are disposed on the end of power supply leads P_1 and P_2 respectively, and are snapped into openings 56 and 60 to apply a voltage between the conductor

bar 68 and the center conductor bar 92. Lead wire connectors 64 and 67 are disposed on the end of leads L_1 and L_2, which are connected to the illumination means L, and are snapped into engagement in apertures 58 and 61, so that in effect, one terminal of the illumination means is electrically connected to the power supply lead P_2.

The normal position of the switch mechanism, that is, the position assumed by the various parts when the plunger is not inserted into the plunger-receiving opening, is illustrated in Fig. 3. The spring 116 urges the movable member 102 toward the front of the housing so that the shorting member 114 bears against the contacts 80 and 82 to complete an electric circuit therebetween. When the switch is in this position, an electric circuit is completed from the power supply lead P_1 and connector 62 through the conductor bar 68, the shorting member 114, the conductor bar 70, the lead wire L_1, and through the illumination means to the lead wire L_2 and hence through the connector 96 to the power supply lead P_2. It will also be noted that in the position shown in Fig. 2, the cup-shaped member 122 and the center conductor 104 of the movable member are disconnected from electrical contact with any voltage-carrying contacts, as will be more clearly described hereinafter.

As the plunger enters the plunger-receiving opening during closing of the door (see Fig. 4), the contact 30 on the end of the plunger nose contacts the center contact 118 of the movable member, and further movement of the plunger into the housing causes the movable member 102 to move rearwardly in the housing, carrying with it the shorting member 114, thereby breaking the electric circuit to the illumination means. At substantially the same time, the outer conductor 34 of the plunger contacts the cup-shaped member 122 and also forces it rearwardly in the housing. After the circuit to the illumination means has been broken, further movement of the plunger into the housing carries the movable member and the cup-shaped member rearwardly, until the inner shell 138 of the contact assembly 134 makes electrical contact with the headed portion 94 of the center conductor bar 92, and the contact arm 130 of the cup-shaped member makes electrical contact with the conductor bar 68. An electric circuit is thereby completed from the power supply lead P_1 through the conductor bar 68, the cup-shaped member 122, the outer conductor of the plunger 34, the plunger lead wire 36, through the heating means H, and back through the plunger lead wire 33 to the center conductor of the plunger, through the center conductor 104 of the movable member, through the contact assembly 134 on the rear of the movable member, to the connector 96 of the power supply lead P_2.

Hence, when the plunger is inserted into the housing, as illustrated in Fig. 5, corresponding to the position when the refrigerator door is closed, an electric circuit is completed to the heating means in the door. When the door is open, with the switch mechanism in the position shown in Fig. 3, the circuit to the heating means is broken and a circuit is completed to the illumination means.

When the door is opened, the sequence of events is, of course, the reverse of that described above, so that as the plunger backs out of the switch housing, the circuit to the heater is broken as the movable member and the cup-shaped member move toward the front of the housing. Thereafter, the movable member and the cup-shaped member are isolated from any voltage carrying portions of the switch, so that after the plunger is completely out of the housing, there is no shock hazard due to the exposed contacts in the front of the switch. Any arcing that might result from breaking the heater circuit occurs inside the switch housing, so that no discoloration of the exposed contacts results from prolonged use, which would impair the appearance of the visible portion of the switch.

Although the switch is particularly adapted for use with refrigerators, its use is not limited thereto, but may

be used in any device where it is desired to break one circuit and complete another by opening and closing a door or the like, in such a manner as to transfer power to some device in the door when it is closed.

Since certain obvious changes may be made in the device without departing from the scope of the invention, it is intended that all matter contained herein be interpreted in an illustrative and not in a limiting sense.

I claim:

1. In a refrigerator assembly which comprises a housing forming a main compartment to be refrigerated and having an access opening closable by a door, means to be energized when the door is open for illuminating the interior of the housing, a storage compartment in the door, and heating means associated therewith to be energized when the door is closed to maintain the door storage compartment at a predetermined temperature higher than the normal temperature of the main compartment; the improvement comprising a switch mechanism mounted in the housing and a plunger mounted in the door for operating the switch mechanism during opening and closing of the door, said plunger having contact means connected to the heating means of the door, said switch mechanism having contact means for completing an electric circuit to the plunger contacts when the door is closed, said switch having other contact means thereon completing an electric circuit to the illumination means when the door is open, said other contact means being responsive to entry of the plunger into the housing during closing of the door to break the circuit to said illumination means.

2. In a refrigerator assembly as set forth in claim 1, a switch mechanism as set forth therein in which said contact means for completing an electric circuit to the plunger contacts are normally isolated from a pair of terminal contacts for suplying power to said circuit, said contact means being responsive to insertion of the plunger into the switch mechanism to make contact with said terminal contacts after said contact means has made contact with the plunger contacts.

3. In a refrigerator assembly, which comprises a housing forming a main compartment to be refrigerated and having an access opening closable by a door, means to be energized when the door is open for illuminating the interior of the housing, a storage compartment in the door, and heating means associated therewith to be energized when the door is closed to maintain the storage compartment at a predetermined temperature higher than the normal temperature of the main compartment; the improvement comprising a switch mechanism mounted in the housing and a plunger mounted in the door for operating the switch mechanism during opening and closing of the door, said plunger having contact means disposed thereon connected to the heating means, said switch mechanism being recessed in the housing and having a first pair of contact members for completing an electric circuit to the illumination means, and a movable member disposed in the housing, said movable member carrying a shorting member for making and breaking contact between the illumination means contact members, a second pair of contact members disposed in the housing for completing an electric circuit to the contact members on the plunger when the door is closed, one of said second pair of contact members being disposed on and movable with the movable member, whereby insertion of the plunger into the housing during closing the door completes a circuit to said plunger and moves said movable member so as to move the shorting member out of contact with said illumination contact members.

4. In a refrigerator assembly as set forth in claim 3, a switch mechanism as set forth therein in which said second pair of contact members in the housing is normally isolated from a pair of terminal contacts for supplying power to said heating circuit, and said second pair of contact members being responsive to insertion of the plunger so as to be moved into contact with said terminal contacts only after said other contact means are in contact with said plunger contacts.

5. In a refrigerator assembly which comprises a housing forming a main compartment to be refrigerated having an access opening closable by a door, means to be energized when the door is open for illuminating the interior of the housing, a storage compartment in the door, and heating means associated therewith to be energized when the door is closed to maintain the door storage compartment at a predetermined temperature higher than the normal temperature of the main compartment, the improvement comprising a switch mechanism mounted in the housing and a plunger member mounted on the door, said switch mechanism having a plunger-receiving aperture and means therein responsive to insertion of the plunger to break the circuit to the illumination means in the housing, said plunger having contacts disposed thereon connected to the heating means, said switch having means therein completing an electric circuit to the plunger contacts when the plunger enters the switch aperture, said plunger being capable of a predetermined amount of tilting in relation to the switch.

6. A switch assembly for operation by a plunger having a pair of contact members, said switch comprising a housing having a plunger-receiving aperture, a pair of intermediate contact members in the housing in position for contact with the contacts of an inserted plunger, said intermediate contact members being movable in the housing away from the aperture by the insertion of the plunger, a pair of terminal contacts in the housing in position to contact the intermediate contact members when they are moved away from the aperture by the inserted plunger, a second pair of terminal contacts in the housing, and shorting means movable in the housing to make and break contact between said second pair of terminal contact members, said shorting means being responsive to movement of one of said intermediate contacts during insertion of the plunger to break the contact between said second pair of terminal contacts.

7. A switch for operation by a plunger having a first contact disposed on the end and a second contact disposed in spaced relation to the end, said switch comprising a housing having an aperture for receiving the plunger, a first intermediate contact disposed in the housing in alignment with the opening for contact with the contact on the end of the plunger, and a second intermediate contact disposed between the first intermediate contact and the aperture, each of said intermediate contacts being movable away from the aperture by the insertion of the plunger, spring means urging said intermediate contacts toward the aperture, a first pair of terminal contacts disposed in the housing for contact with the intermediate contacts when they are moved away from the aperture by the plunger, a second pair of terminal contacts disposed in the housing, shorting means in the housing for completing an electric circuit therebetween, said shorting means being movable with said first intermediate contact member so that movement of said first intermediate contact member away from the opening during insertion of the plunger breaks the circuit between said second pair of terminal contacts.

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