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[54] A ROTARY CONTROL DEVICE FOR ACTUATING A SWITCH AND DIRECTING A FLUID PRESSURE FORCE

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[52] **U.S. Cl.** **200/61.86,** 137/625.48

[51] **Int. Cl.** **H01h 9/06**

[58] **Field of Search** 200/61.86

[56] **References Cited**

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Primary Examiner—Robert K. Schaefer

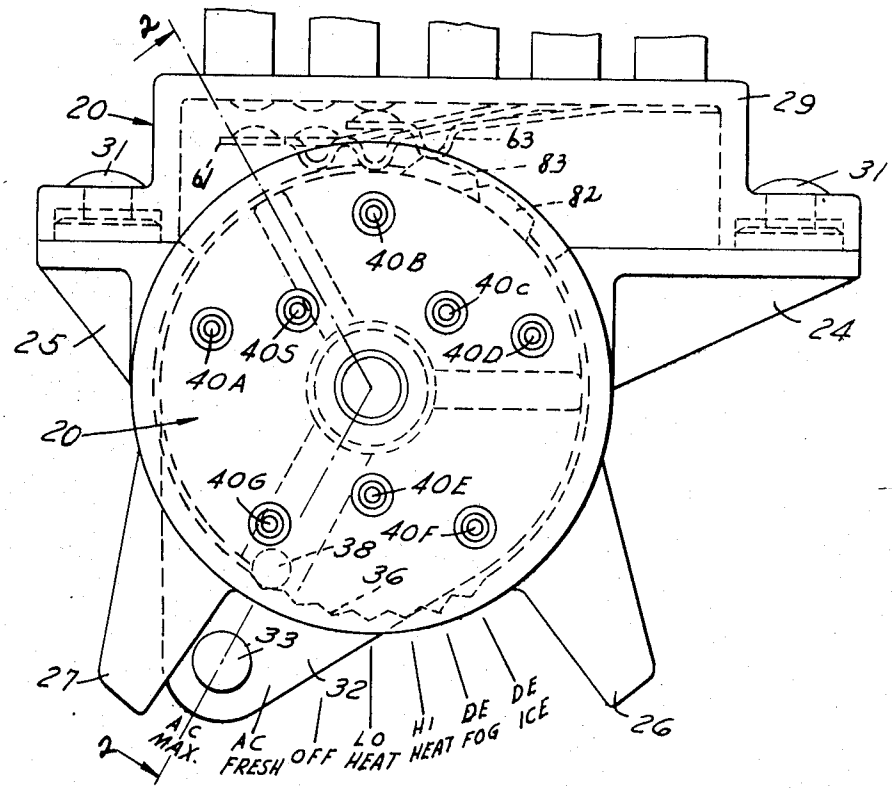
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[57] **ABSTRACT**

A control device having one moving body or portion for actuating application of both electro-motive force (EMF) and fluid-pressure-force (FPF) in a system such as vehicular heating, ventilating, and/or air-conditioning having a case with a first wall equipped with selectively positioned FPF supply ports and use ports located between supply and use in the system and a second wall equipped with EMF selectively positioned switch arms and contacts located between EMF supply and use in a system; an angularly movable body or portion having a first surface equipped with a grooved maze lying against the ported wall of the case forming a plurality of selective FPF channels relative to the FPF supply and use ports and having a second surface equipped with cam ramps for actuating the EMF switch arms selectively relative to the contacts; and means for selectively angularly moving the body relative to the case to change the maze channels relative to the ports and change the cams relative to the switch arms to selectively and simultaneously control the application of EMF and FPF in the system.

2 Claims, 7 Drawing Figures



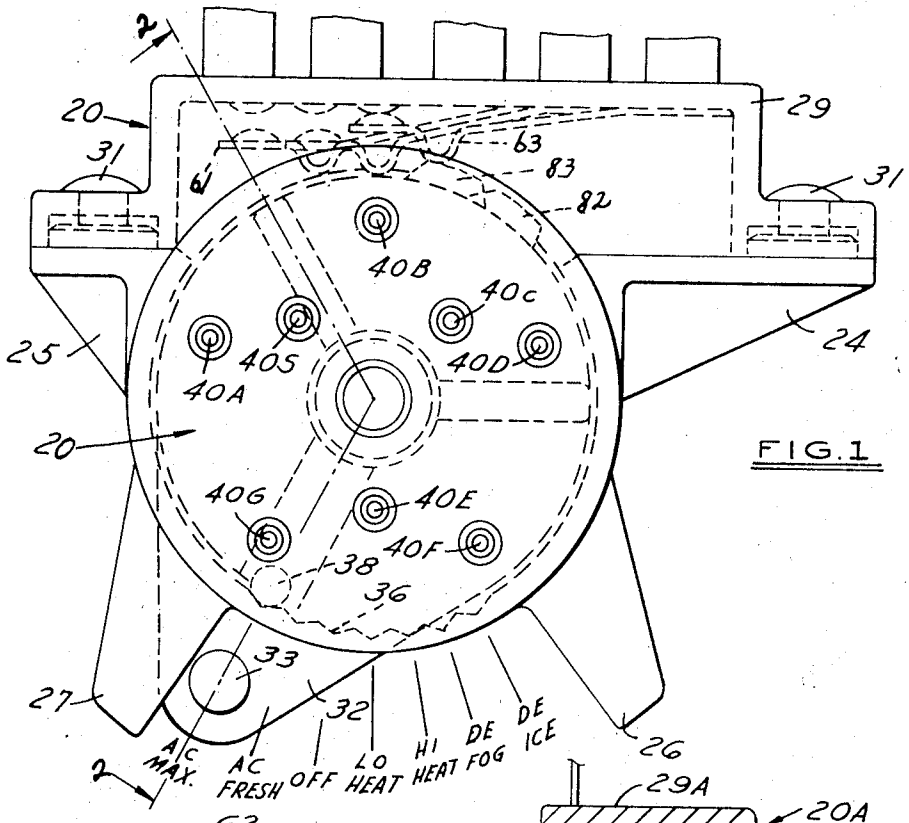


FIG. 1

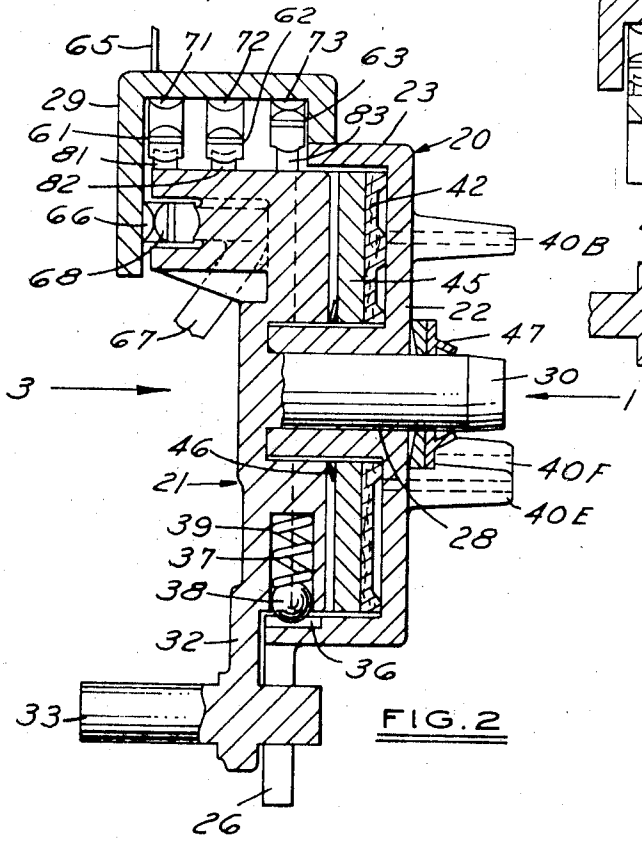


FIG. 2

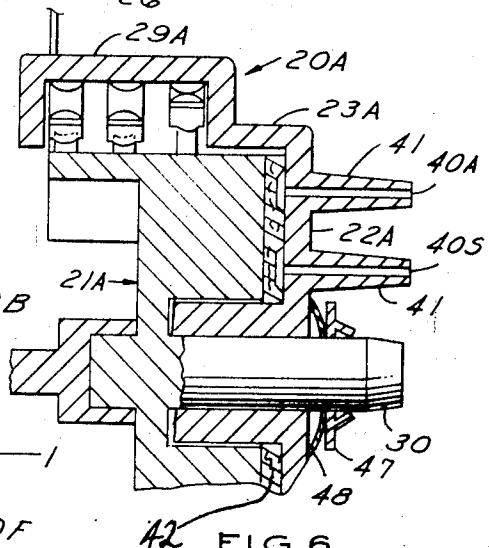


FIG. 6

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FIG. 3

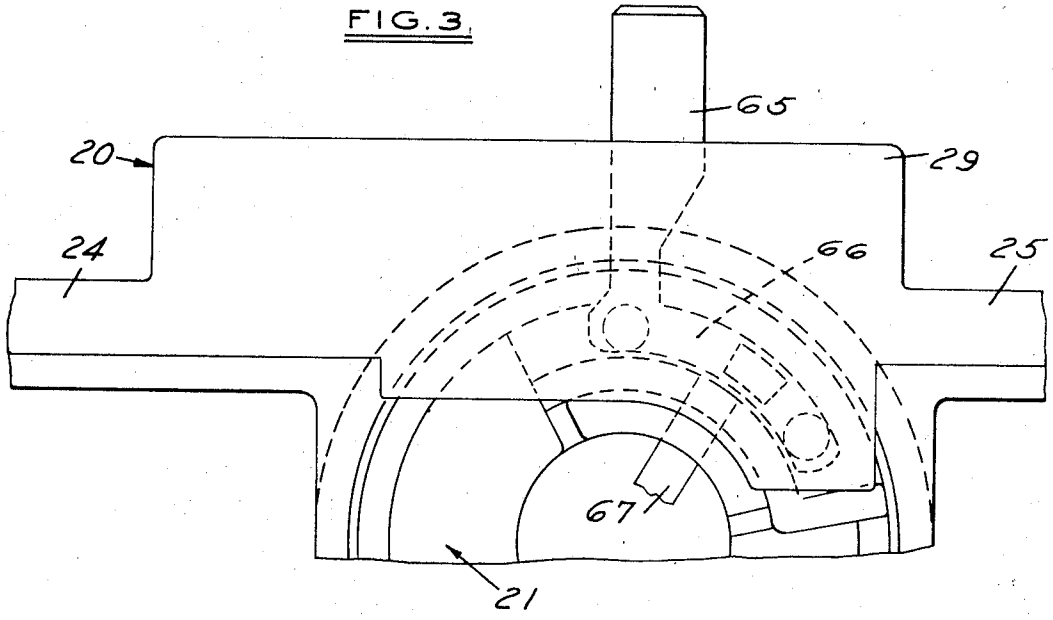


FIG. 4

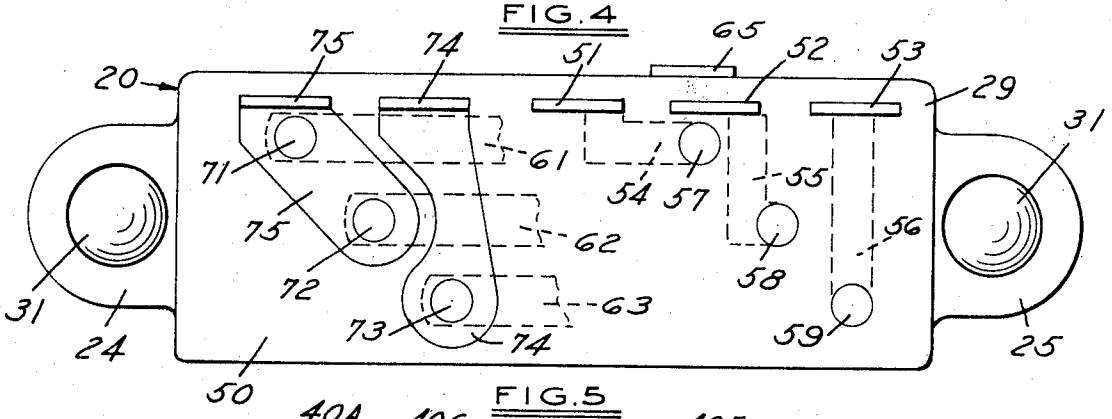
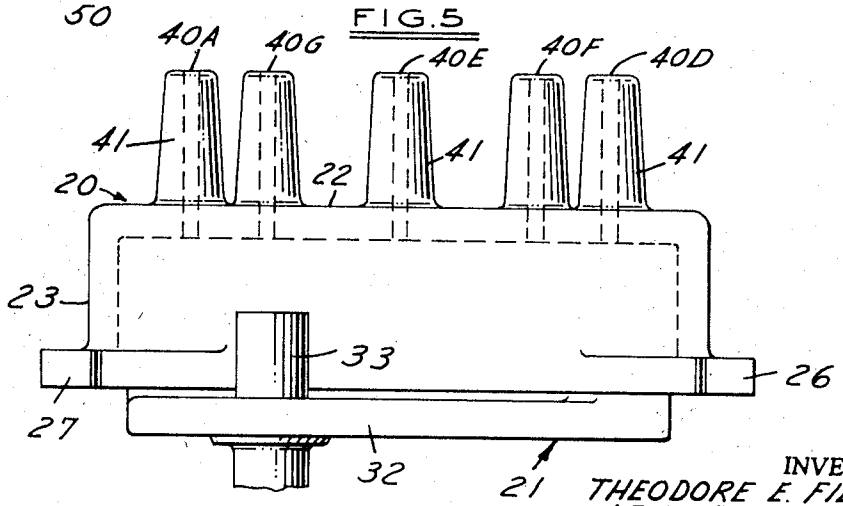


FIG. 5



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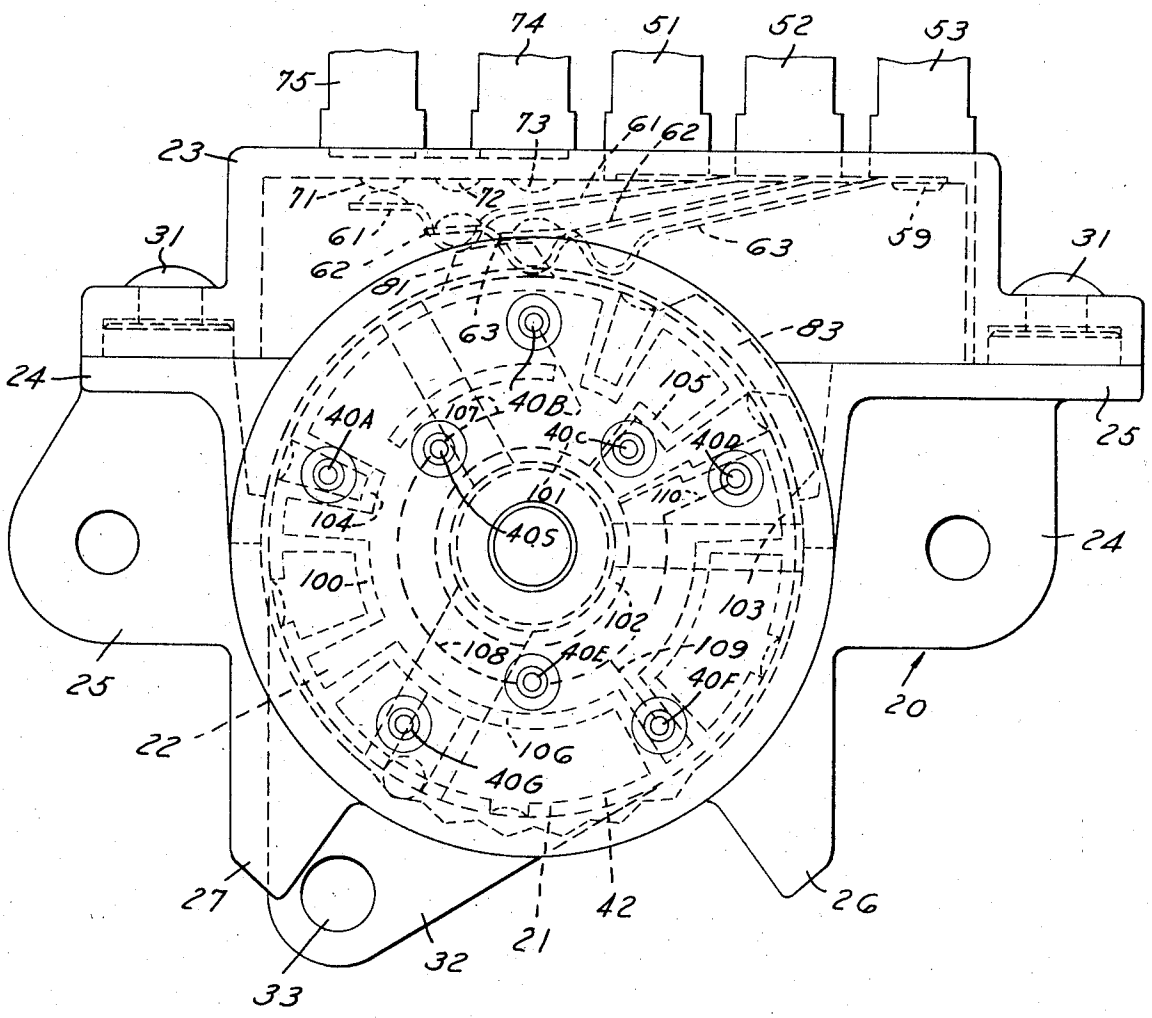


FIG 7

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A ROTARY CONTROL DEVICE FOR ACTUATING A SWITCH AND DIRECTING A FLUID PRESSURE FORCE

This application is a continuation-in-part of copending application Ser. No. 94,283, filed Dec. 2, 1970.

This invention relates to a control device having one angularly moving body or portion for actuating application of both electro-motive-force (EMF) and fluid-pressure-force (FPF) in a system such as vehicular heating, ventilating and/or air-conditioning.

Control devices of the prior art employed heretofore have a plurality of moving bodies, are complicated in design and construction, expensive to manufacture, difficult to operate, use, and repair, and cumbersome to place, mount and connect.

With the foregoing in view, it is a primary object of the invention to provide a control device which has a single angularly moving body or portion, is simple in design and construction, inexpensive to manufacture, easy to operate, use, and repair, and facile to place, mount and connect.

A further object of the invention is to provide a case equipped with FPF connections and valve ports and equipped with EMF terminals, contacts, and switch arms,

A further object of the invention is to provide a single angularly moving body or portion in the case having a plural channel maze side relative to the FPF ports and a plural cam ramp side relative to the EMF switch arms so that angular movement of the body relative to the case selectively actuates the desired coordinated application of both EMF and FPF in a system.

These and other objects of the invention will become apparent by reference to the following description of a control device embodying the invention taken in connection with the accompanying drawings, in which:

FIG. 1 is a face elevational view of a control device embodying the invention showing the case and the FPF connection nipples in end elevation; showing the EMF contacts and switch arms in the case in dotted lines; and showing the actuator lever for moving a rotational portion relative to the case.

FIG. 2 is a cross-sectional view of the device seen in FIG. 1, taken on the line 2—2 thereof, showing the actuator lever handle partly in cross section, showing the switch arms and contacts for transferring EMF, and a ball detent for locating and holding the angular position of the rotational portion relative to the case.

FIG. 3 is an enlarged side elevational view of the top portion of the device as seen in the direction of arrow 3 of FIG. 2, showing a switch contact and an arcuate contact strip in broken lines.

FIG. 4 is a top plan view of the body as seen in FIG. 2, showing the arrangement of the electrical contacts and terminal strips and showing a portion of the switch arms in the broken lines.

FIG. 5 is a bottom plan view of the device as seen in FIG. 1, showing the FPF nipple arrangement at the ports.

FIG. 6 is a view similar to FIG. 2, with the lower half broken away to conserve space, showing a modified device of the invention; and

FIG. 7 is a view similar to FIG. 1 showing the channel maze in broken lines in an exemplary arrangement for changing communication between the ports at the nipples which are shown in full lines.

Referring now to the drawings wherein like numerals refer to like and corresponding parts throughout the several views, the control device disclosed therein to illustrate the invention comprises, a case 20, and a body 21, FIGS. 1 and 2. The case 20 has an annular end wall 22, a circumferential outer wall 23 on the wall 22, side brackets 24 and 25 adjacent to top of the case 20, stop legs 26 and 27 adjacent the bottom of the case 20, and an axial aperture 28. The walls 22 and 23 define a hollow interior chamber and house the body 21 therein. The case 20 may be split as shown wherein the case 20 has a separable top housing 29 secured to the side brackets 24 and 25 by fasteners 31. The housing 29A and case 20A also may be formed integral as shown in FIG. 6. The body 21 has an axle 30 lying in the axial aperture 28 of the case 20. The body 21 rotates relative to the case 20 on the axle 30. The body 21 has a radial arm 32 and a handle 33 for rotating the body 21 relative to the case 20. The case 20, outer wall 23 has a series of spaced depressions 36. A spring 37 and a ball detent 38 lie in a socket 39 of the body 21. The ball 38 bears against one of the depressions 36. By swinging the handle 33, the body 21 is caused to rotate relative to the case 20 and the ball detent 38 to move across the depressions 36 in the outer wall 23 giving the operator "Position Feel" and also locating and holding the body 21 at the adjusted angular position relative to the case 20.

Ports 40, such as 40S and 40A, B, C, D, E, F, and G, are formed in the case end wall 22. Nipples 41 surmount the ports 40 for connecting the ports 40 to tubular lines. A channel maze member 42 is mounted on a disc 45 which is keyed on the axle 30 and has at least two channels formed on its surface which faces the wall 22 of the case 20.

The channel maze member 42 bears against the end wall 22 and coacts with the ports 40 selectively at various angular positions of the body 21 as desired and integrated in the engineering of the ports 40 and the design of the channel maze surface of the member 42. The channel maze member 42 also may be mounted on the body 21A as seen in FIG. 6. By swinging the handle 33 the channel maze member 42 is moved angularly relative to the ports 40 to change channeling between the ports 40.

Referring to FIG. 6, the case 20A is shown as a one-piece molded part including the housing 29A as integral, and the body 21A is shown with the channel maze member 42 mounted directly thereon. A light spring washer 46, FIG. 2, lies between the discular member 45 and body 21 resiliently urging the channel maze member 42 on the discular member 45 against the ported wall 22 of the case 20. The body 21 is held axially relative to the case 20 by the jam nut 47 gripping the axle 30 and abutting the case 20. In the embodiment of FIG. 6, a light spring washer 48 lies between the jam nut 47 and the case resiliently urging the nut 47, axle 30, and body 21A axially to the right to resiliently urge the channel maze member 42 against the wall 22A of the case 20A. The spring washers 46 and 48 may be deleted in an accurately moulded device when lower than atmospheric pressure is used as the force of outside high pressure to press the channel maze member 42 into sealing contact with the walls 22 and 22A of the case 20 and 20A.

Electrical terminal strips 51, 52 and 53 for connection to use are mounted and have internal leads 54, 55, and 56 respectively running to connections 57, 58, and 59 respectively, FIGS. 2 and 4. Switch arms 61, 62, and 63 are mounted on the connections 57, 58, and 59 respectively and thus are individually connected to the terminal strips 51, 52, and 53. Contacts 71, 72, and 73 are mounted on the case wall 50 for coaction with the switch arms 61, 62, and 63 respectively. A terminal strip 74 leads from supply to the contact 73 and a terminal strip 75 leads from supply to both contacts 71 and 72. The body 21 has cams or ramps 81, 82, and 83, which act against the switch arms 61, 62, and 63 respectively to make and break circuits at the contacts 71, 72, and 73 respectively. The separate terminal strips 74 and 75 from supply thus provide two independent supply circuits, however one or more supply terminals may be incorporated as desired or needed. The foregoing electrical components are radially of the body 21.

A terminal strip 65 from supply leads to an arcuate strip portion 66 located axially. A terminal strip 67 in the body 21 has an axial contact 68 which bears against the arcuate portion 66. The contact 68 moves angularly with the body 21 relative to the strip portion 66. The arcuate strip portion 66 may have a plurality of contact points to be equipped with a relieved noncontracting portion to break a circuit at an angular position of the body 21.

Referring now to FIG. 7, the channel maze 42 is shown in broken lines behind the wall 22 of the case 20. The ports 40 and nipples 41 are shown on the case wall 22. The channel

maze 42 is comprised of beads or ribs 100 raised above the surface 101. A radially inner circular rib 102 and a radially outer circular rib 103 seal peripherally against the inside of the wall 22 through which the ports 40 communicate to the channel maze 42. The port 40S is the FPF supply port and communicates the low or high pressure to the face of the surface 101. In the angular position shown, port 40A is shut off by the box rib 104, port 40C is shut off by the box rib 105, and port 40G is shut off by the box rib 106. Also in the position shown, FPF from the supply port 40S is communicated to the port 40B as indicated by the dotted line 107 and to the ports 40E, 40F and 40D by the dotted arcuate line 108 and radial dotted lines 109 and 110. It will be understood that by moving the body 21 angularly that position of the radial ribs and boxes will change relative to the ports 40 to switch FPF in the system as engineered in the construction and design of the channel maze 42 and the location of the ports 40. It will be understood that for each angular position of the body 21 relative to the case 20 that a different channeling of FPF obtains to operate a system as desired and as engineered.

FPF supply is connected to one or more ports 40 by tubular lines on at least one nipple 41. FPF tubular lines to use are connected also on the nipples 41 and lead to items which are powered thereby. EMF wires are connected to the terminal strips 51–53, 65, 67, 74, 75 in circuits between supply and use and connected to items which are powered thereby when the switch arms 61–63 and 68 are actuated.

It will be understood that the channel maze 42 surface may be grooved as desired to connect and/or block use ports 40 relative to the supply port 40S at the various angular positions of the body 21 as desired and the cam ramps 81–83 may be located selectively to actuate switch arms 61–63 at the various angular positions of the body 21 as desired. Also one or more supply ports 40 may be used.

The number of switch arms, contacts, terminals and ramps, the number of ports and channels, and the number of various positions are designed and engineered in the device to suit the needs of desired control and/or to provide a device with a large plurality of EMF and FPF actuation positions so that less than all control positions may be selectively used. While the movement of the body 21 has been shown and described as lever actuated, the body 21 and case 20 relative movement may be actuated by cams, cables, etc.

In an exemplary installation of the control device of the invention in a vehicle heating, ventilating, and/or air conditioning system, the FPF circuits are connected to the pressure powered servomechanisms, and/or motors and the EMF circuits are connected to the electrically powered servomechanisms, and/or motors. In the control of the system, the FPF and EMF powered elements are coordinated for operating sequences and nonoperating sequences. The interaction of the ports 40 and channel maze surface 42 is coordinated with the interaction of the cam ramps 81, 82, and 83, and the switch arms 61, 62, and 63 to control singly and in combination, the operating sequences and the nonoperating sequences of the powered items to control the system. The coordinated interaction may be engineered and designed in the device to suit the needs of any particular system or the system may be engineered to suit the operation of any control device or various models of control devices.

The scope of the invention is defined in the appended claims.

I claim:

1. A control device having one angularly movable portion controlling the application of both EMF and FPF in a system, comprising,

a case having at least a first wall and a second wall,

a body mounted in said case for relative angular movement therebetween; said body having at least a first surface and a second surface;

said body surfaces lying adjacent said case walls;

means for moving one said body and said case angularly relative to one another to locate said body relative to said case in at least two angular positions;

said case having at least one FPF supply port and one FPF use port in said first wall surmounted by nipples for making connections to FPF supply and use;

said body first surface slidably sealing against said first ported wall of said case;

said body first surface having a grooved maze constituting at least two separate channels between said FPF supply and use ports with each said channel selectively communicating between FPF supply and use ports at one said position of said body relative to said case to effect desired application of FPF in a system,

said case having at least two sets of EMF switch arms and contacts on said second wall,

EMF terminals on said case leading to and from said switch arms and contacts for connections to EMF supply and use;

said body second surface having at least two cams with each said cam selectively actuating one said EMF switch arm and contact at one said angular position of said body relative to said case to effect desired application of EMF in system;

the cam arm EMF control and the channel port FPF control both being coordinated in operating a system by the angular position of said body relative to said case.

2. In a device as set forth in claim 1,

a spring on one said body and case bearing against the other urging said body channel maze surface in sealed relationship against said case first ported wall.

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