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Sellerstam

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[45] **Apr. 1, 1975**

[54] **CONTROL FOR GAS-ELECTRIC REFRIGERATOR**

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[73] Assignee: **Aktiebolaget Electrolux**, Stockholm, Sweden

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[52] **U.S. Cl.** **219/279**, 62/236

[51] **Int. Cl.** **F27d 11/00**

[58] **Field of Search** 219/279; 62/236, 148, 497

[56] **References Cited**

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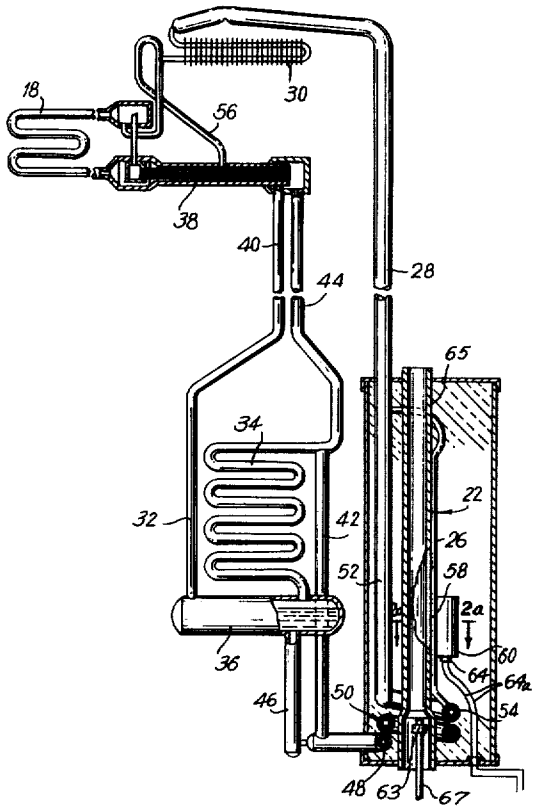
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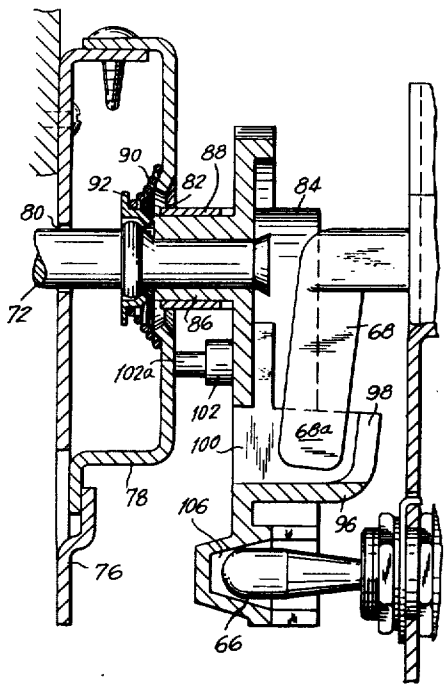
Primary Examiner—C. L. Albritton

[57] **ABSTRACT**

A manual control for a refrigerator which can be operated by either gas or electricity. The control unit can be either two-way or three-way. In the latter, means are provided for switching to any of the following modes: gas; 110 volt A.C.; and 12 volt D.C. The switching mechanism is selectively operative for the desired mode of refrigerator operation.

13 Claims, 10 Drawing Figures





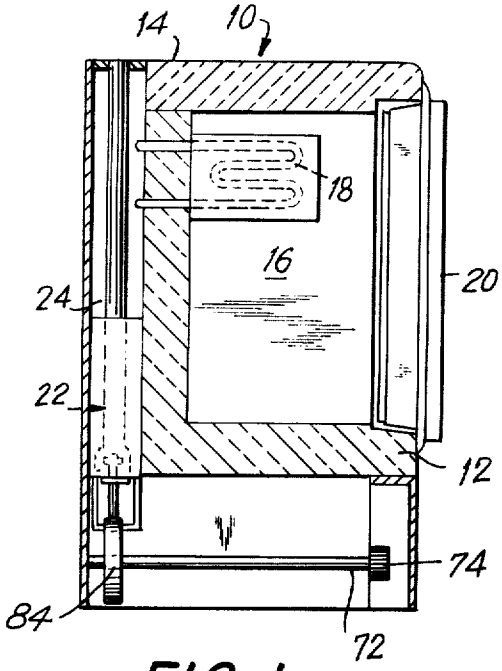


FIG. 1

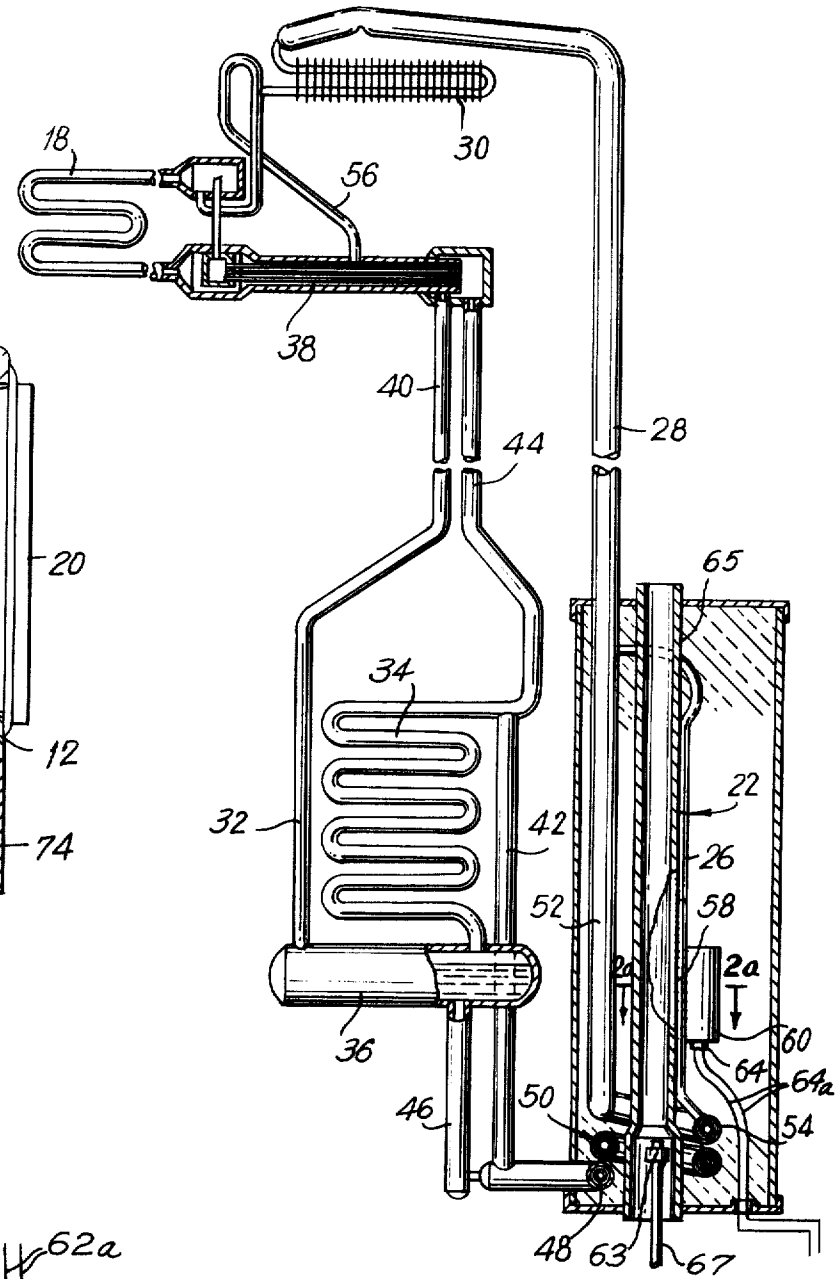


FIG. 2

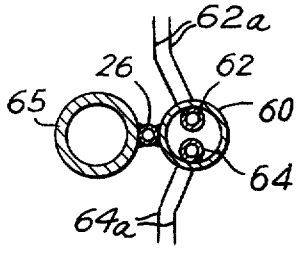


FIG. 2a

FIG. 3

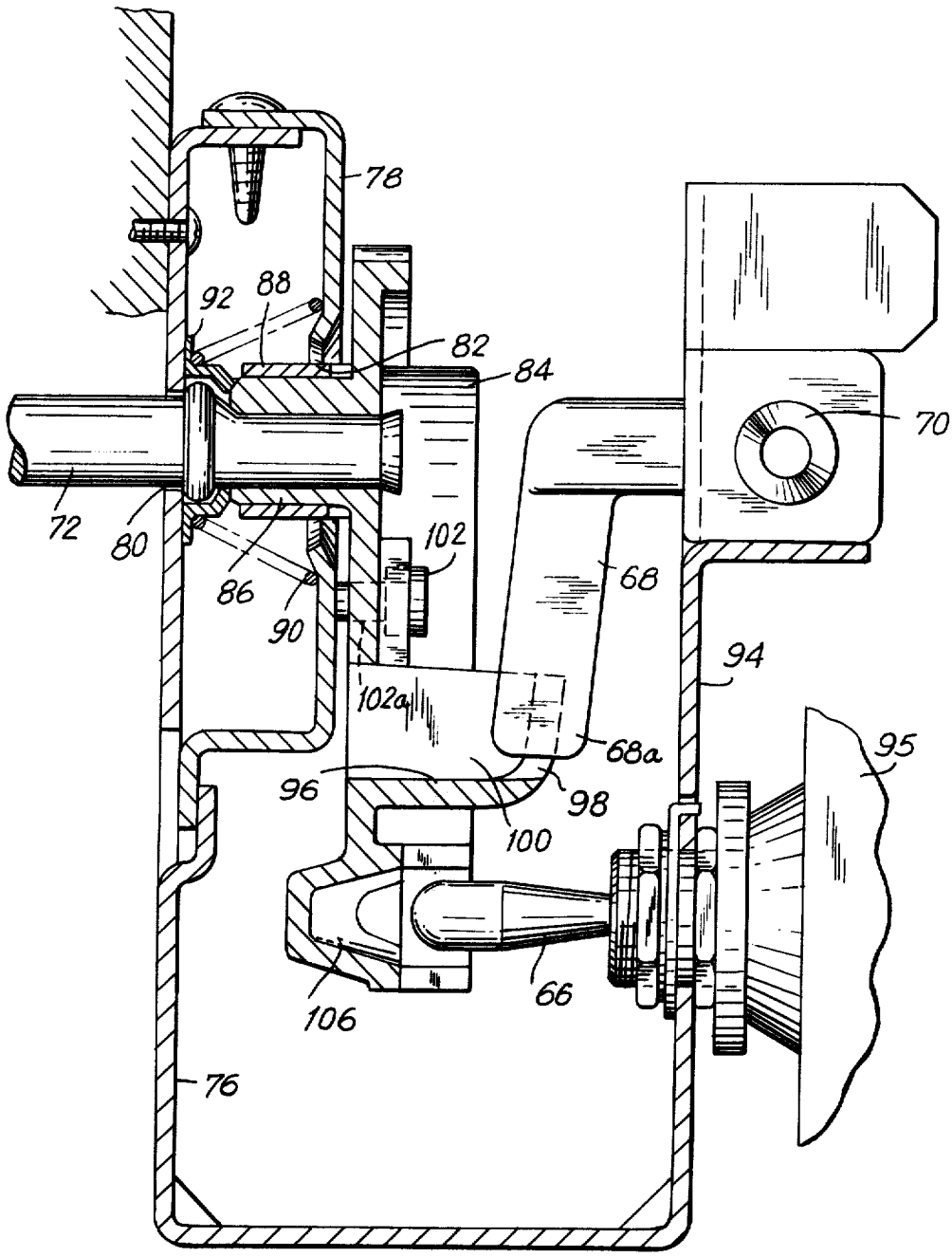

78
92
88
82
84
70
72
80
102
86
90
68
94
102a
68a
95
96
98
100
66
106
76

FIG. 5

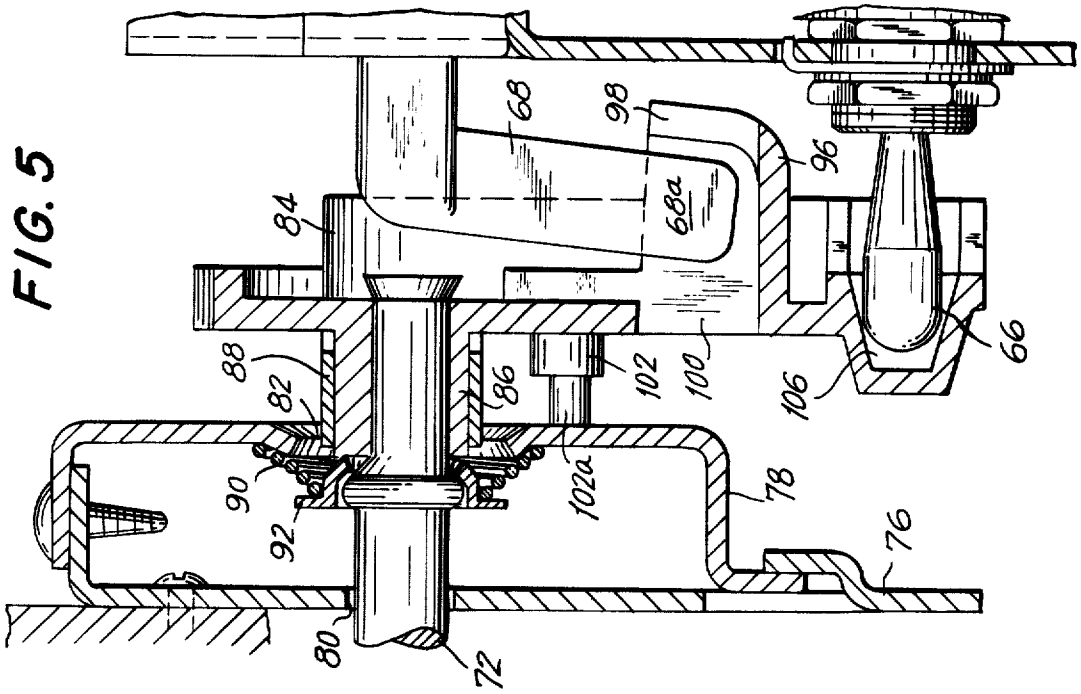

68
98
96
84
68a
66
88
82
86
102
100
106
90
92
102a
78
76
80
72

FIG. 4

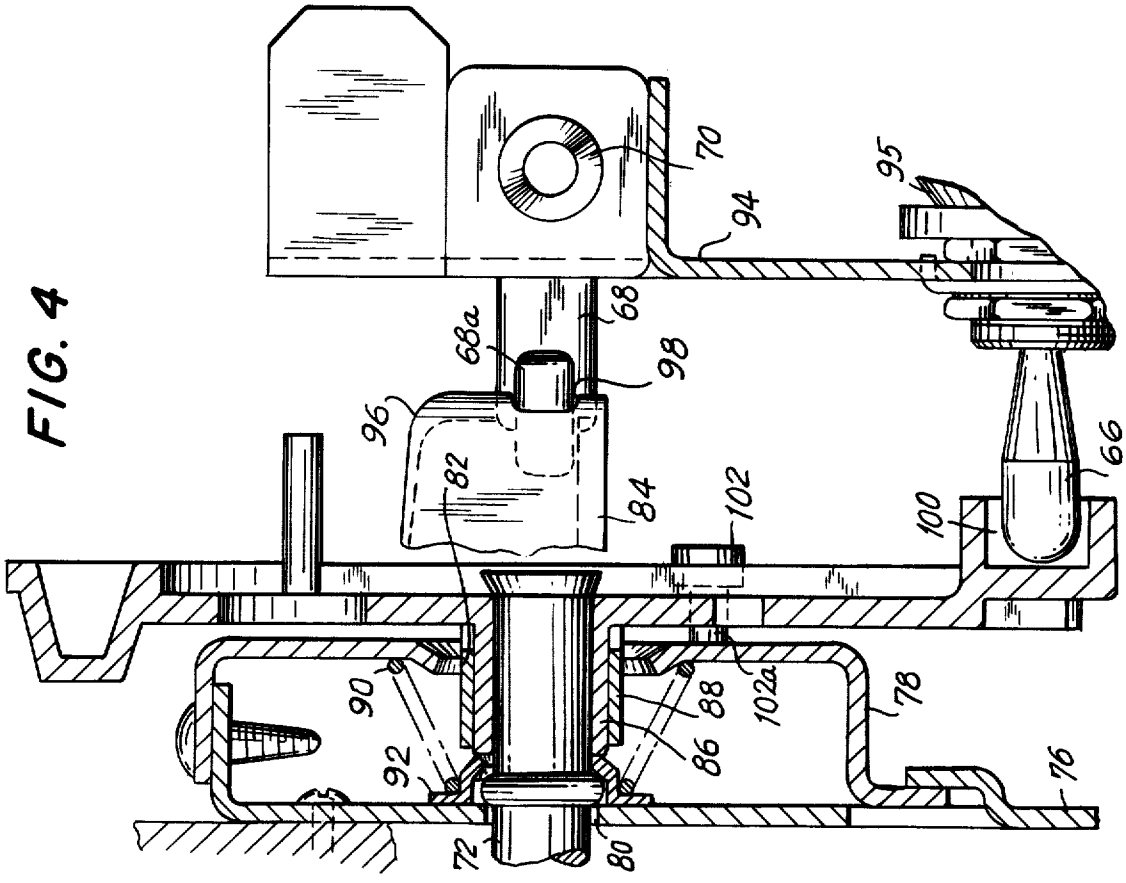

70
95
94
68
68a
98
96
66
82
84
102
100
90
88
102a
78
92
86
76
72
80

FIG. 7

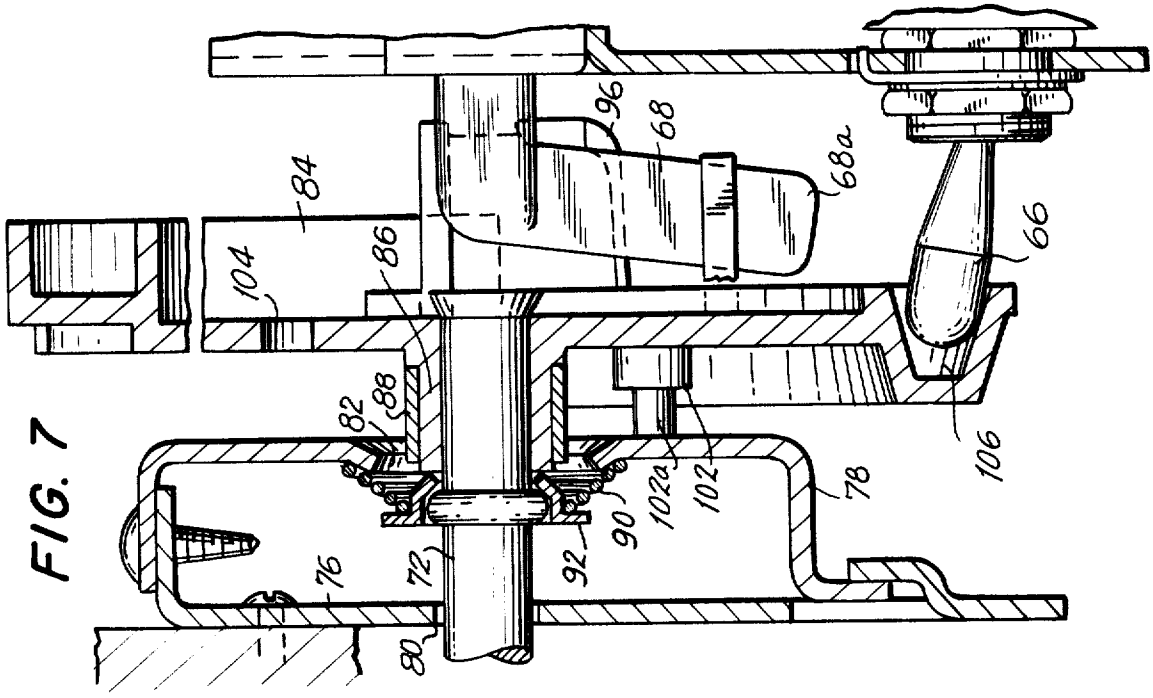
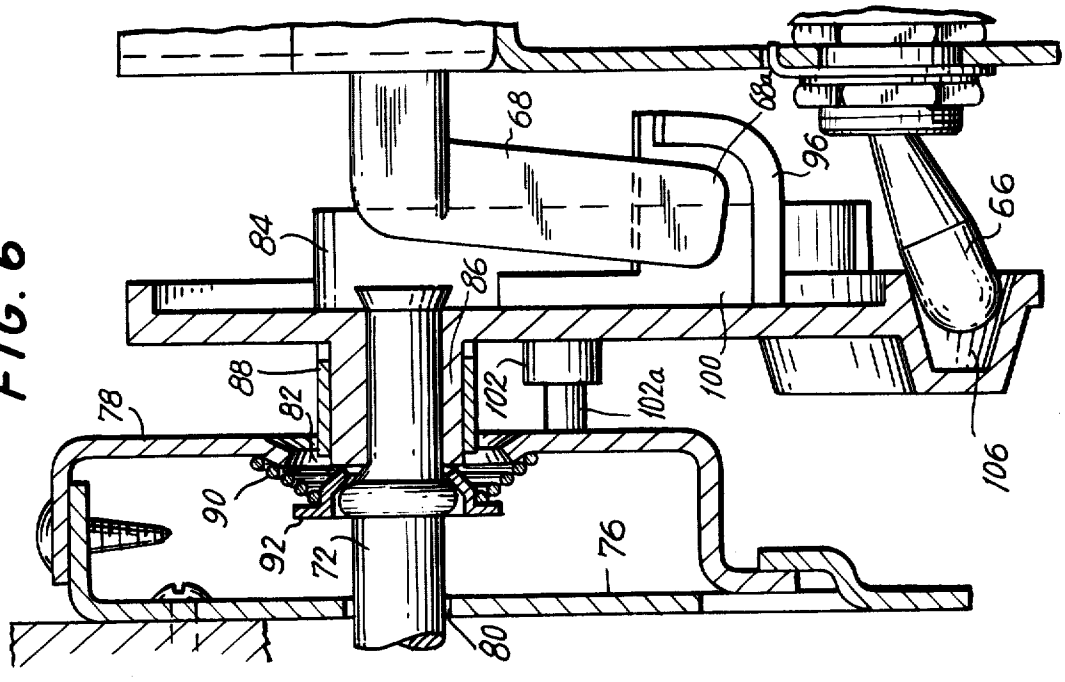

96
68
68a
84
66
104
86
88
82
106
102a
102
78
90
92
76
72
80

FIG. 6


68
68a
96
84
66
86
88
102
102a
100
78
82
106
90
92
72
76
80

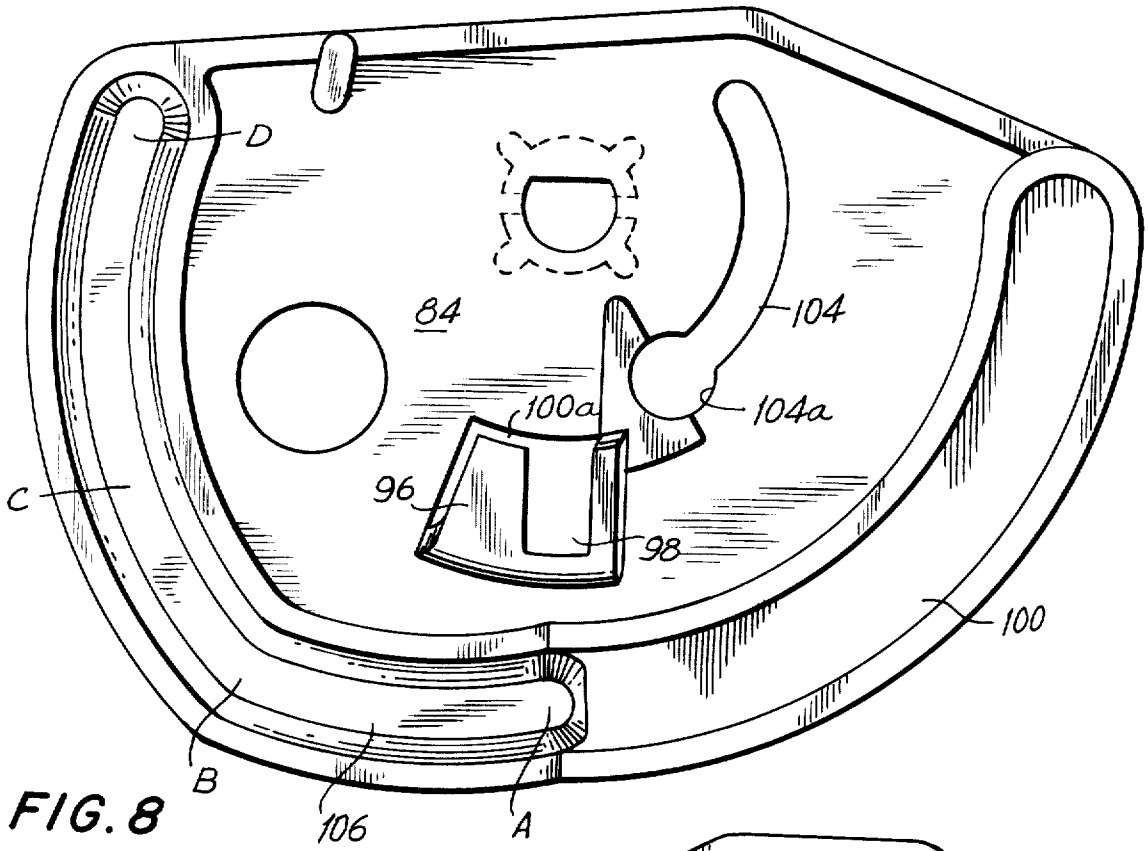

D
84
104
100a
104a
96
C
98
100
B
106
A

FIG. 8

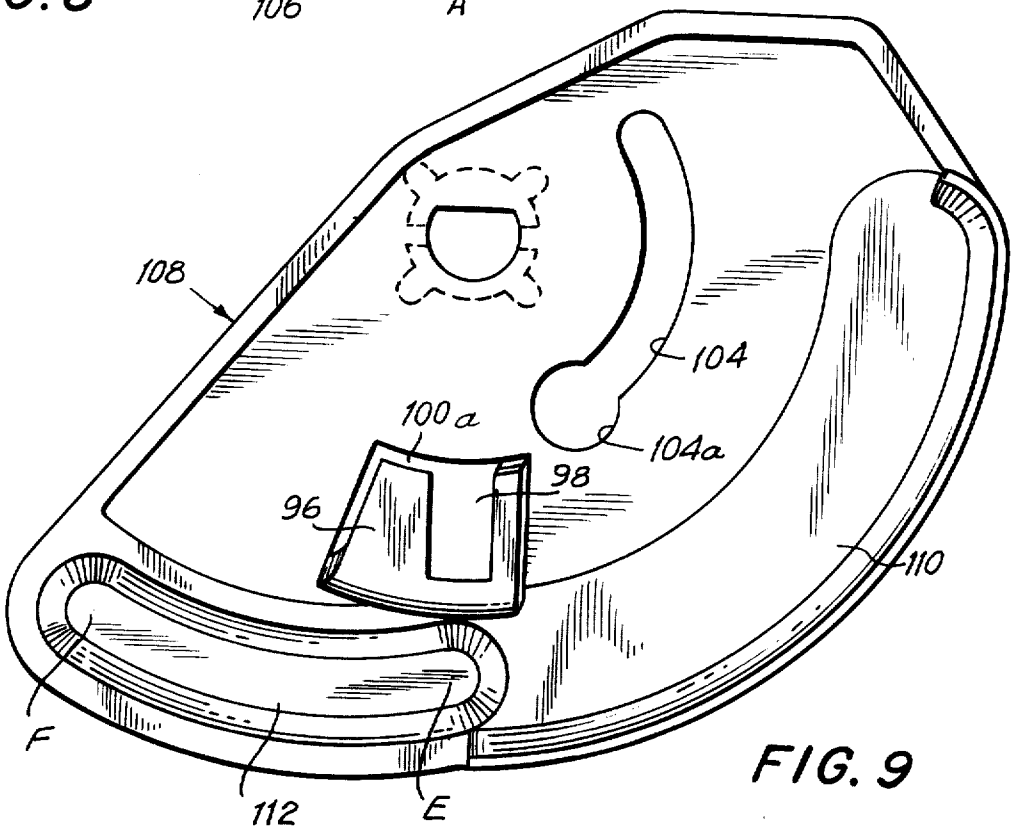

108
104
100a
104a
98
96
110
F
112
E

FIG. 9

CONTROL FOR GAS-ELECTRIC REFRIGERATOR

House trailers or other mobile living accomodations require a refrigerating system which preferably can be operated alternatively from different power sources. When the trailer is mobile, the refrigerator can be operated by a gas supply or a 12 volt D.C. battery. However, when the trailer is parked in a location where a source of alternating current is available, the refrigerator may be connected to the convenient A.C. source.

It is particularly desirable to provide a single manual control for selectively activating and de-activating the various power sources which overcomes the drawbacks of known multiple control arrangements for operating and disconnecting various power supplies.

It is an object of the present invention to provide a two or three-way control unit for selecting various power supply modes for a portable refrigerator, such as gas; 110 volt A.C., or 12 volt D.C. electricity.

Another object of the present invention is to provide a rotatable operating cam body which is also capable of axial movement, and that is selectively coupled to a gas valve handle or to an electric switch lever.

A further object of the present invention is to provide an interlock arrangement between the gas valve and the electric switches to prevent the application of power from a source other than the selected power source.

Another object of the present invention is to provide a control device for a refrigerator in a mobile home or trailer which has a single knob and operates simply and efficiently.

The invention will now be more fully described with reference to the accompanying drawings in which:

FIG. **1** is a diagrammatic vertical section of a heat operated mobile refrigerator having a manual control device for gas-electric operation constructed according to the teachings of the present invention;

FIG. **2** illustrates more or less diagrammatically the heat operated refrigeration apparatus suitable for use in the refrigerator shown in FIG. **1**;

FIG. **2***a* is a sectional view taken along the lines **2***a*—**2***a* of FIG. **2**, showing certain details of construction with respect to the electrical heating elements of the invention;

FIG. **3** is a side elevation view, partly in cross-section, of the control device with the operating shaft in the off position and the gas valve being closed;

FIG. **4** is a side elevation view, partly in section, of the control device with the operating shaft in the gas position and the gas valve rotated to an open position;

FIG. **5** is a side elevation view, partly in section, of the control device in the off position similar to what is shown in FIG. **3**, but with the operating shaft and associated cam body pushed inwardly;

FIG. **6** is a side elevation view, partly in section, of the control device with the operating shaft rotated to the D.C. battery position;

FIG. **7** is a side elevational view, partly in section, of the control device with the operating shaft further rotated to the A.C. position;

FIG. **8** is a front elevational view of the cam body of the control device suitable for three-way operation; and

FIG. **9** is a front elevational view of another embodiment of the invention illustrating a two-way cam body of the control device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, the invention is shown diagrammatically as installed in a mobile refrigerator of the type used in house trailers or mobile homes. The refrigerator referred to generally by the numeral **10** is constituted of a cabinet **12** having thermally insulated walls **14** defining a refrigerated storage compartment **16**. In the latter is arranged a cooling element or evaporator **18** of a suitable heat operated refrigeration apparatus. Access to the storage compartment **16** may be gained by means of a door **20** at the front of the cabinet **12**. The heat operated refrigeration apparatus is preferably but not limited to the well known uniform pressure absorption type. In a refrigerator of this type, the cooling element **18** is connected to other parts of the apparatus including a generator **22** which is mounted in a space **24** at the rear of the cabinet **12**.

In heat operated refrigerators of the present type, and as seen in FIGS. **2** and **2***a*, a refrigerant vapor is expelled from absorption liquid in a vapor lift pipe **26** of the generator **22**. The refrigerant vapor thus expelled passes through a conduit **28** to a condenser **30**. The refrigerant vapor is then liquefied in the condenser **30** and flows into evaporator unit **18**. In the evaporator, the refrigerant diffuses into an inert gas to thereby produce a refrigeration effect. The resultant gas mixture of refrigerant and inert gas flows from the evaporator **18** to an absorber **34** which may be of the air-cooled type and includes a coil and an absorption vessel. The gas mixture enters the absorption vessel **36** through a heat exchanger **38** and a conduit **40**. In the absorber **34**, the refrigerant is absorbed from the gas mixture into absorption liquid, which is conducted into the absorber **34** by means of a conduit **42**. The absorption liquid enriched in refrigerant then passes into the absorber vessel **36**. Thereafter, the inert gas is returned from the absorber **34** to the evaporator **18** by means of a conduit **44** and heat exchanger **38**; and the enriched absorption liquid is conducted through a conduit **46** and inner pipe **48** of heat exchanger **50** to the generator **22**.

The absorption liquid, elevated in vapor lift pipe **26** and from which refrigerant vapor has been expelled, flows by gravity from a stand pipe **52** through the outer pipe **54** of liquid heat exchanger **50** and conduit **42** into the upper part of absorber coil **34**.

The vent conduit **56** connects the lower end of the condenser **30** to the heat exchanger **30** through which the gas mixture flows from the evaporator. Thus, the absorption solution, enriched in refrigerant, flows from the absorber vessel **36** through the liquid heat exchanger **50** into the lower end of the vapor lift pipe **26** which is in thermal exchange relationship at location **58** with a heating tube **60**.

As seen in FIG. **2**, the heating tube **60** is embedded in insulation and is heated by either an A.C. heating element **62** having electrical leads **62***a* or alternatively by a D.C. heating element **64** provided with electrical leads **64***a*, both of which are mounted within the heating tube. A heating flue **65** is shown in heat exchange relationship with the vapor lift pipe **26**. A fluid fuel burner **63** is arranged in the bottom part of the flue **65** and is coupled to gaseous source through pipe **67** connected to the gas valve **70**. Thus, the generator **22** can be operated by independent sources of heat, such as gas, A.C., or D.C. electric, each of which can selec-

tively supply heat at a proper rate and at sufficiently elevated temperature to the vapor lift pipe **26.**

The heating of the tube **60** causes the vapor generated in the contiguous vapor lift pipe **26** to raise the liquid therein by vapor lift action, so that the vapor flows from the upper end of pipe **26** through the upper part of the standpipe **52** into the conduit **28** and then into the condenser **30,** as explained hereinabove.

Referring to FIGS. **3–9,** the refrigerator control device which embodies my invention is operatively connected to a multiple position electric toggle switch **66** as well as gas valve handle **68** of the gas valve **70.** The control device is provided with a D-shaped control shaft **72** having a knob **74** mounted in the cabinet **12** under the refrigerator storage compartment **16.** The knob **74** has indicia thereon for the angular positions of the control shaft **72,** such as "OFF", "ELECTRIC", "BATTERY", and "GAS". A U-shaped bracket **76** is secured to the rear of the cabinet **12** and is provided with a plate **78** removably held thereto. The bracket **76** and plate **78** are provided with aligned holes **80** and **82,** respectively.

A control body referred to generally by the number **84** is shown in front elevation in FIG. **8** as well as in various operative positions illustrated in FIGS. **3–7.** The control body **84** has a neck portion **86** provided with a ring **88.** A compression spring **90** is positioned at one end against the plate **78,** and surrounding the ring **88,** and the control shaft **72** is provided with a flange **92** against which the other end of the spring **90** is located. The spring maintains the control body **84** in the normal situs of the control body.

Mounted on the side **94** of the U-shaped bracket **76** is the gas valve **70** as well as the electric switching device **95.**

The gas valve **70** is shown in FIG. **3** in closed position, with the handle **68** directed downwardly. The control body **84** has a rearwardly extending L-shaped lip **96** provided with a slot **98** formed between the upstanding portion of the lip **96** and a side wall **100***a*. As seen in FIG. **3,** the end **68***a* of the handle **68** is positioned in the upstanding slot **98** in the normal rest position of the control body. In this position, the gas valve **70** is in the closed position. If it is desired to open the gas valve **70,** the knob **74** is rotated counter-clockwise to the gas position in which the control shaft **72** and the control body **84** are all rotated in a counter-clockwise direction which, at the same time, rotates the gas valve handle **68** to a substantially horizontal position inasmuch as the end **68***a* is captured in the slot **98** of the lip **96,** as seen in FIG. **4.** Thus, the gas valve **70** is opened only when the handle is rotated in a counter-clockwise direction. It will be noted that when the gas valve handle is turned in a counter-clockwise direction the knob **74** cannot be pushed inwardly, since the end of the toggle switch **66** projects in channel **100** of the control body **84** (FIGS. **4** and **8**) and substantially no axial movement of the control body **84** is permitted. The restricted movement of the control body results since the plate **78** is provided with a headed pin **102** projecting outwardly therefrom and accommodated in a through slot **104** having an enlarged end **104***a* in the control body **84.** Thus, the shank **102***a* of the headed pin **102** travels in the slot **104** during the movement of the gas valve handle **68** toward the open position of the gas valve **70** and axial movement of the control body **84** is prevented. However, when the gas valve handle **68** is turned to the vertical position shown in FIG. **3,** the headed pin **102** is in the enlarged end **104***a* of the slot **104,** and the toggle switch **66** is at the position A in the contiguous channel **106** in the control body **84.** In this position, the control body can be moved axially and pushed inwardly so that the slot **98** moves away from the end **68***a* of the gas valve handle **68,** as seen in FIG. **5,** and the deep channel **106** can accommodate the switch **66** upon axial movement of the control body **84.** Simultaneously, the enlarged end **104***a* of the slot **104** is removed from the headed pin **102** and the knob **74** for the control body **84** is free to move in a clockwise direction to assume positions of the control body as seen in FIGS. **6** and **7.** The position B of FIG. **8** is particularly shown in FIG. **6** in which the toggle switch **66** is illustrated in a down condition whereby the 12-volt D.C. electrical power supply is connected to the control device. When the knob **74** is rotated further clockwise to the position C of FIG. **8,** the switch **66** is turned to the off position and when the knob **74** is continued to be rotated in a clockwise direction, the switch **66** is moved to its upward condition D of FIG. **8** and particularly shown in FIG. **7.** In this position, a 110-volt A.C. power source is supplied to the control device.

It should be noted, as seen in FIGS. **6** and **7,** that during the movement of the control body **84** from positions B, C, and D, the headed pin **102** engages the rear surface of the control body **84** and slides therealong.

FIG. **9** shows another embodiment of the control body referred to generally by the numeral **108** in which identical parts of the control body **84** shown in FIG. **8** bear the same reference numerals therein. The body **108** has a channel **110** and a contiguous channel **112.** The latter channel has a different configuration from the channel **106** of the control body **84** shown in FIG. **8,** so that the toggle switch **66** can move from an off position E to a downward on position F in which the 110-volt A.C. power source is supplied to the control device. This arrangement provided for only a two-way control device but has the same interlock feature of the previously described control device.

The present control device for a refrigerator of the mobile type features a single control member in which there is an interlock between the gas valve and the electric switch for both 12-volt D.C. and 110-volt A.C. operation. The control device is selectively and independently coupled to either the gas valve handle or the electric toggle switch.

What is claimed is:

1. In a combination with a refrigerating system of the type alternatively employing gas or electricity as power sources in which cooling is effected by means of a refrigeration unit having a heat receiving part provided with a gas heat supply means and a heating element, an A.C. electric heat supply means and a D.C. electric heat supply means, each having a separate heating element, a single control mechanism for selectively and independently switching to a selected one of said heat supply means while the other heat supply means are disconnected, said control mechanism being movable in one direction to connect the gas heat supply means to its respective heating element, and to disconnect the electric heat supply means, and said control mechanism being movable in the reverse of said one direction to selectively connect at least one of the D.C. and A.C. electric heat supply means to its respective heating ele-

ment while said gas heat supply means remains disconnected.

2. The combination claimed in claim 1 wherein said gas heat supply means is provided with a valve and a valve operator, said control mechanism including a rotatable control body adapted to selectively engage and move said gas valve operator only when the control mechanism is rotated in one direction.

3. The combination claimed in claim 2 wherein said control body is provided with at least one shaped channel, said electric heat supply means being provided with a switch and a switch actuator, the control body in one predetermined position thereof being adapted to be moved axially whereby said switch actuator enters said shaped channel and upon the further rotational movement of said control body said switch actuator is moved to selectively connect at least one of the D.C. electric heat supply means and the A.C. electric heat supply means to its respective heating element.

4. The combination as claimed in claim 2 wherein said control body is provided with an outward extending lip having a slot, said valve operator being positioned in said slot and moved by said control body when the control mechanism is rotated to a position connecting said gas heat supply means to its respective heating element.

5. The combination as claimed in claim 1 wherein said control mechanism is provided with a control body having a thorough slot, said slot being provided with an enlarged end, a fixed headed stud projecting through said enlarged end of the slot in one position of the control body whereby said control body can move axially forward so that the head of the stud is situated in a plane behind said slot and the control body may be rotated to selectively connect one of the electric heat supply means to its respective heating element while the head of the stud remains behind the rear surface of the control body.

6. The combination as claimed in claim 5 wherein when the control body is rotated in a direction to connect said gas heat supply means to its respective heating element the shank of said headed stud is in the slot and the head is in a plane in front of said slot thereby preventing the forward axial movement of said control body.

7. The combination as claimed in claim 3 wherein said shaped channel is substantially arcuate, and said switch actuator is a toggle element that rides in said channel and is moved to various positions as the control body is rotated.

8. The combination as claimed in claim 1 wherein said D.C. electric heat supply means is a 12-volt system.

9. The combination as claimed in claim 1 wherein said control mechanism includes a control body, the latter being provided with a shaped channel, said electric heat supply means having a switch and a switch actuator, said switch actuator being in said shaped channel when said control body is rotated in the direction to connect said electric heat supply means to its respective heat element to thereby operate said switch actuator which in turn operates said switch.

10. The combination as claimed in claim 2 wherein said control body has a projecting part that engages and moves said valve operator when the control mechanism is rotated in one direction to connect the gas heat supply means to its heating element; but does not engage or move said valve operator when the control mechanism is rotated in the opposite direction to connect a selected electric heat supply means to its respective heating element.

11. The combination as claimed in claim 3 wherein said control body is rotatable and is provided with a control shaft, a spring surrounding said shaft at the end adjacent to the control body whereby said shaft is capable of rotatable movement and limited axial movement, and said control body being rotatable with said switch actuator in said shaped channel only after said control shaft has been first moved axially and then rotated in a predetermined direction.

12. In a combination with a refrigerating system of the type alternatively employing gas or electricity as power sources in which cooling is effected by means of a refrigeration unit having a heat receiving part provided with a gas heat supply means and with heating elements connected to two electric heat supply means for heat from different kinds of electric energy sources, a single control mechanism for selectively and independently switching to a selected one of said heat supply means, and said control mechanism being movable in said one direction and further in the same direction to selectively connect at least one of the electric heat supply means to its respective heating element, while said gas heat supply means remains disconnected.

13. In a combination with a refrigerating system of the type alternatively employing gas or electricity as power sources in which cooling is effected by means of a refrigeration unit having a heat receiving part provided with a gas heat supply means and with two electric heat supply means for heat supply from different kinds of electric energy sources, a single control mechanism for selectively and independently switching to a selected one of said heat supply means while the other heat supply means are disconnected, said control mechanism being movable in one direction from an off position to connect the gas heat supply means and to disconnect the electric heat supply means, and said control means being movable from the off position in the opposite of said one direction only after having been pushed axially to selectively connect at least one of the electric heat supply means to its respective heating element while said gas heat supply means remains disconnected.

* * * * *