April 20, 1954 L. F. REYNOLDS 2,675,998

THERMAL CONDITIONING MEANS FOR ENCLOSURES

Filed June 10, 1950

3 Sheets-Sheet 1

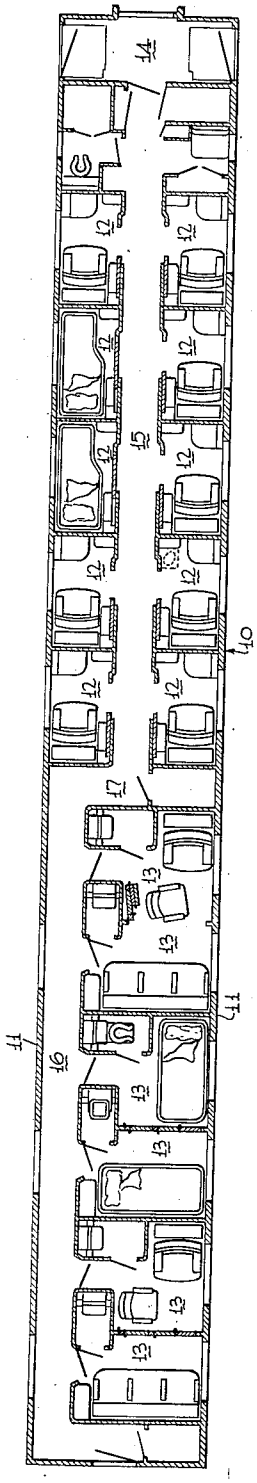


FIG. 1

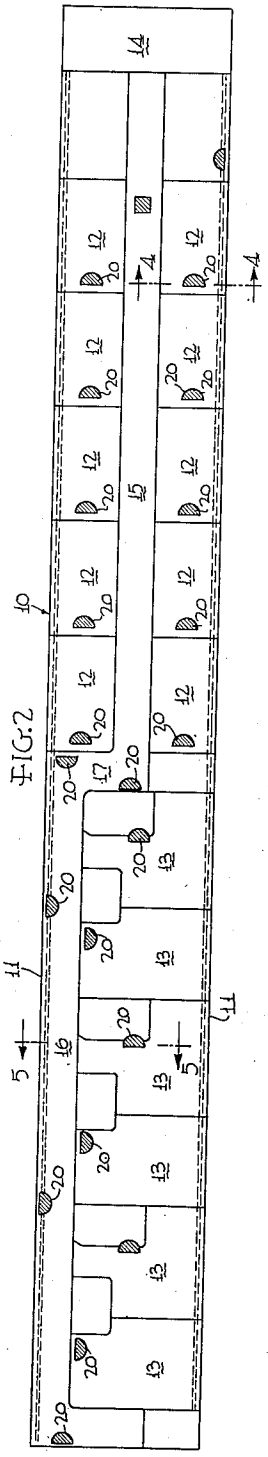


FIG. 2

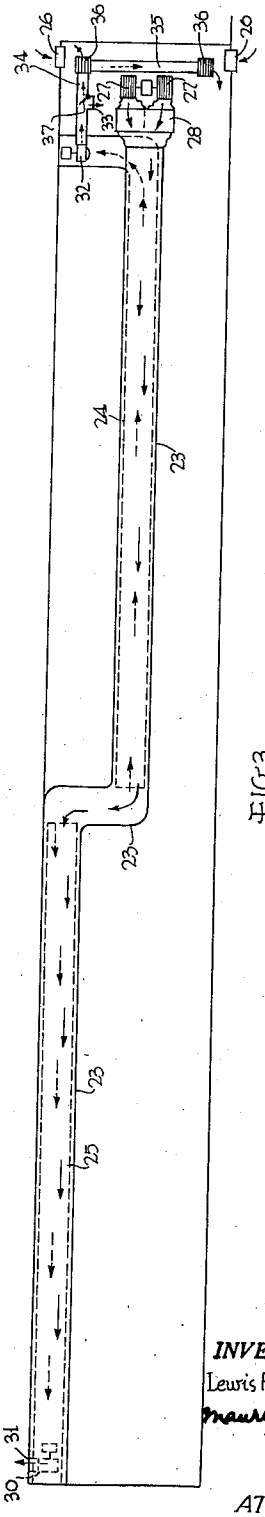


FIG. 3

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THERMAL CONDITIONING MEANS FOR ENCLOSURES

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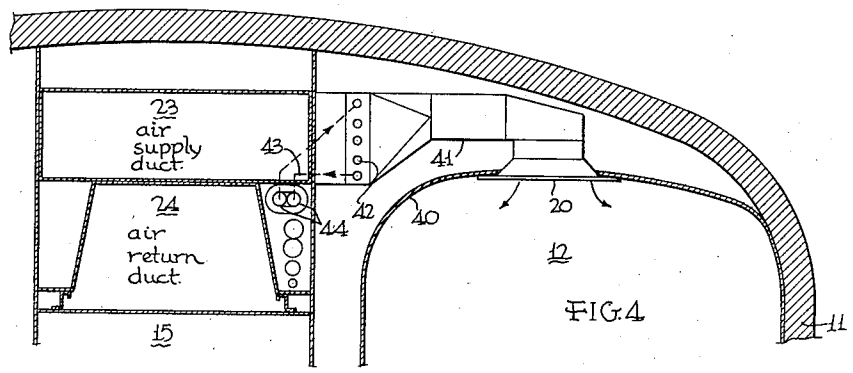


FIG. 4

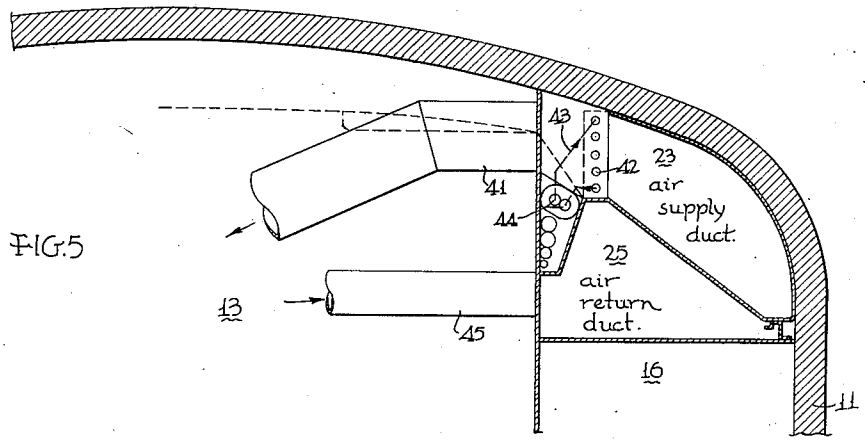


FIG. 5

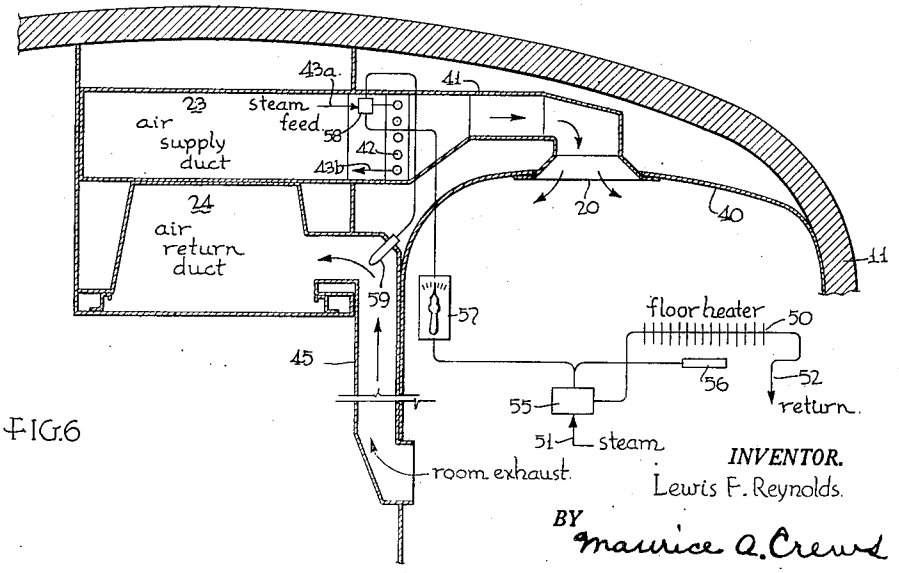


FIG. 6

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THERMAL CONDITIONING MEANS FOR ENCLOSURES

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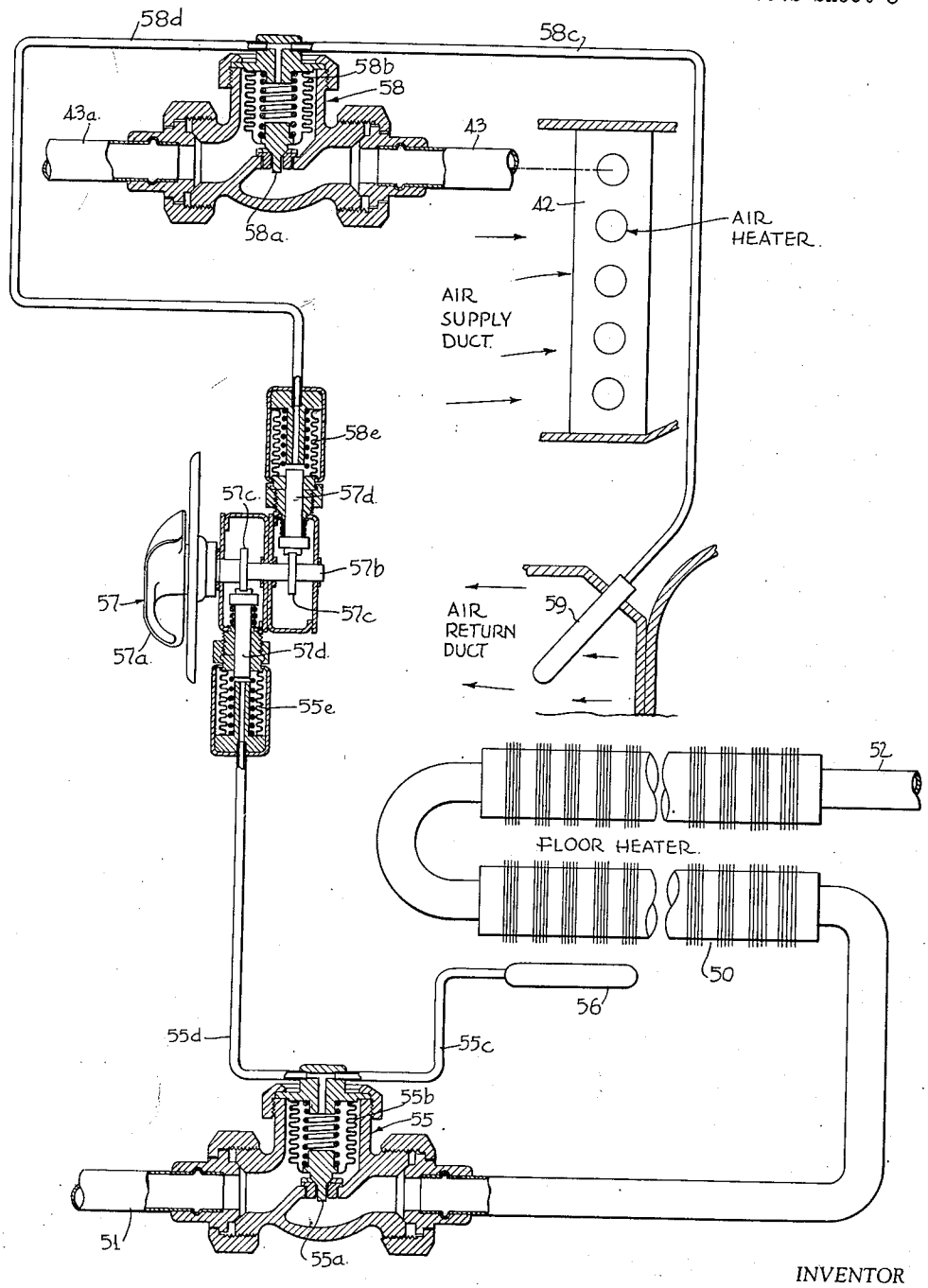


FIG. 7

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UNITED STATES PATENT OFFICE

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THERMAL CONDITIONING MEANS FOR ENCLOSURES

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6 Claims. (Cl. 257—3)

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This invention relates to thermal conditioning means for enclosures, particularly for railway cars, and has for an object the provision of improvements in this art.

One of the particular objects is to provide simple and effective controls for the thermal conditioning means for a compartment, the controls being such that a single manual control and associated automatic controls will regulate the entire thermal conditioning means of the compartment.

Another object is to provide combination radiator heating and hot air heating which avoids overheating locally by the radiator and which gives the occupant individual control of the heat supplied by the air, also control of the cooling.

Another object is to provide a constant supply of air to a compartment at a given temperature and to provide means at each compartment or air outlet for changing the temperature as delivered.

Another object is to provide automatic control means for a plurality of different types of heating means which is responsive to the resultant temperature of the air leaving the compartment.

The invention also provides improved means for circulating fresh, exhaust and mixed air and for pressurizing the vestibule by exhaust air.

The above and other objects and advantages of the invention will be apparent from the following description of an exemplary embodiment, reference being made to the accompanying drawings, wherein:

Fig. 1 is a plan view showing a railway sleeping car with which the present invention may be usefully employed;

Fig. 2 is a diagrammatic plan view of the same car showing the air supply scheme for the compartments;

Fig. 3 is a diagrammatic plan view of the same car showing the main air supply and exhaust ducts;

Fig. 4 is a partial enlarged vertical transverse section taken on the line 4—4 of Fig. 2 and showing the aisle ducts and air supply arrangement for one of the smaller compartments or roomettes of the car;

Fig. 5 is a view similar to Fig. 4 but taken on the line 5—5 of Fig. 2 and showing the air supply arrangement for one of the larger compartments or bedrooms of the car;

Fig. 6 is a diagram, partly in vertical section, showing the controls for a compartment like that of Fig. 4 and

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Fig. 7 is a diagram, similar in general to that of Fig. 1 but showing details of the apparatus.

Fig. 1 shows in plan a railway sleeping car 10 having side walls 11, a plurality of small compartments or roomettes 12, a plurality of large compartments or double bedrooms 13, an end vestibule 14, a center aisle 15, a side aisle 16, and a connecting aisle portion 17. This car is described in detail in the patent to Murphy 2,462,027, February 15, 1949, and need not be described in detail here.

Fig. 2 shows the same plan view as Fig. 1 but with the furnishings, such as berths, seats, basins, toilets, and the like omitted and the air distributors, such as anemostats 20, shown in their relative positions in the ceilings of the compartments and aisles. The compartment passengers have control over the air distributors and the car porter or other train attendants have similar control over the aisle distributors.

In Fig. 3 the same car plan is shown at a higher elevation with an air supply duct 23 indicated in solid lines and exhaust ducts 24 and 25 indicated in dotted lines. Circulation of air in the supply duct is shown by arrows in full lines and in the exhaust ducts by arrows in broken lines. Fresh air is taken in at the end grills or louvers 26 and enters a plenum space where it mixes with return air from the car (if so returned) where it is blown by fans 27 over heating or cooling (heat exchange) means 28 and thence into the supply duct 23. Separate coils in 28 may be used for heating in cool weather and cooling in hot weather. Air flows from the duct 23 to the distributors 20.

It is normally not desired to re-use more than half the air so an exhaust fan 30 may be employed to draw the vitiated air from the return duct 25 for one end of the car and blow it out at 31. From the duct 24 at the other end the used air is taken by fan 32 and either blown out of the exhaust duct at 33 into the plenum chamber or blown through ducts 34 and 35 to overhead registers 36 in the vestibule 14. The direction and relative amounts of air blown through the outlet 33 or to the registers 36 is controlled by a valve 37. The air blown out at 36 will pressurize the vestibule and minimize the entry of smoke, cinders and dust. It will also heat the vestibule to a comfortable temperature. From the vestibule the air escapes through numerous small openings to the outside atmosphere. Although the valve 37 may cause all the air at this end to be blown out at 33 for re-circulation it is preferred to have some air always blown into

the vestibule to pressurize it. Except in extremes of hot or cold weather, when the heating or cooling facilities might be overloaded, it is preferred to discharge all the vitiated air from the car. The air discharged into the separately enclosed vestibule not only serves to pressurize it to keep dust, soot, cold air and the like from entering but maintains the temperature of the vestibule at a point closely approximating that of the main car enclosure because the exhaust air directed into the vestibule still carries the thermal content which it had when withdrawn from the main car enclosure.

In Fig. 4 there is shown a roomette 12 with an air supply distributor 20 in the ceiling 40 taking fresh heated (or cooled) air from the supply duct 23. Air from the compartment is returned to the exhaust duct 24. Preferably the air is taken out near the floor to induce a downward circulation in the compartment.

The lateral supply duct 41 between the main duct 23 and the distributor 20 is provided with a supplemental heat exchanger 42 (heater or cooler as season demands) provided with connecting lines 43 from mains 44. The mains may be electrical cables, steam lines or refrigerant lines, as may be convenient. If pipes are used they may carry either heating or cooling fluid as may be needed.

In Fig. 5 the comparable arrangement for a bedroom 13 is shown and the same reference characters are used as far as applicable. Here a return lateral duct 45 for vitiated air from the compartment is shown.

In Fig. 6 the arrangement and controls for a roomette are shown. Here the fresh air distributor is shown at the end of the lateral 41 from the supply duct 23. There is also shown a return duct 45 leading vitiated air from near the floor to the return duct 24. A sidewall floor heater, such as a finned steam radiator 50, is shown schematically. The steam inlet is indicated at 51 and the outlet at 52. For the supply air heat exchanger 42 a supply pipe is indicated at 43*a* and an outlet at 43*b*.

The supply to heater 50 by pipe 51 is regulated by a throttling valve 55 under the joint control of a floor thermostat 56 which may be disposed near the radiator 50 and a hand control 57 on the wall. This may be referred to as the incoming air temperature control system.

The supply to 43*a* is regulated by a throttling valve 58 under the joint control of the hand control 57 and a temperature responsive control 59 which may be placed in any suitable location, as near the distributor 20 in the air inlet or, as shown, preferably in the air outlet 45 where it will be influenced by the temperature of the outflowing air which has been subject to the influence of the overhead air heat, the sidewall heat, the human body heat, and such other thermal influencing means as may be effective in the compartment. This may be referred to as the separate compartment temperature control system.

The lines between the control 57 and the valves 55 and 58 may be filled with fluid under pressure or may be mechanical push-pull wire-tube connections, these connections, as such being well known. The lines between the thermostats 56 and 59 and the valves 55 and 58 respectively may be fluid-filled or electrical according to known and much used systems.

In Fig. 7 the valve 55 which controls the supply of energy, here steam, to the sidewall or floor heater 50 is shown to have its plug 55*a* operated by a bellows 55*b* filled with a fluid, such as the liquid "Froen," the fluid within the bellows extending out into a bendable tube 55*c* to the thermostat 56 on the one side and out into a bendable tube 55*d* to the hand control device 57 on the other side. Similarly, the plug 58*a* of valve 58 for the air heater 42 is operated by a bellows 58*b* filled with fluid which communicates by tube 58*c* with the ethermostat 59 and by the tube 58*d* with the hand control device 57. Also, as shown in Fig. 7, the hand control device 57 may comprise the handle 57*a* for turning a shaft 57*b* which carries spaced eccentrics or cams 57*c* which operate plungers 57*d* entering the fluid-filled spaces of bellows 55*e* and 58*e* connected respectively to fluid lines 55*d* and 58*d*. The specific details of the spaced eccentrics or cams 57*c* and associated parts of the manual control device 57 do not constitute a part of the present invention, and no claim to these details is made herein.

There are very particular and material advantages in having a common manual control device 57 for both the floor heat and the overhead reheat in that it prevents local overheating at the steam sidewall radiator 50 and avoids undue drafts from the overhead air as would be entailed if the flow of air were changed rather than having its heat content changed.

In operation, the thermostats 56 and 59 call for sidewall heating and added overhead air heating as required by their initial setting and momentary heat demands. The hand control 57 adjusts simultaneously, by a single movement, the level of operation of both. If the room occupant desires a room which is cooler or warmer than the average comfort setting he may move the pointer of the control 57 to cooler or warmer points on the scale and thereby obtain simultaneous regulation of the sidewall heating and the overhead air re-heating. In warm weather when the car system is changed over from heating to cooling the sidewall heater is inactive but the overhead air supply is cooled and air conditioned and the thermostat 59 will still function and the hand control 57 may still be used to establish the general temperature level desired in the particular compartment in which it is located. In general the air will be supplied to the main duct 23 several degrees cooler than would be comfortable if the air inflow temperature alone were concerned, and the re-heating is added at the exchanger 42 to raise the temperature. It is advantageous to raise the temperature even when the air is refrigerated in hot weather because this tends to eliminate excess moisture present in the air.

It is thus seen that the invention provides simple and relatively inexpensive and easily operated and adjusted apparatus for regulating the temperature of a plurality of related compartments and furnishing individual quickly-responsive control over the heat of each compartment to suit the choice of each occupant.

While one embodiment has been illustrated and described by way of example it is to be understood that there may be various embodiments within the general scope of the invention.

What is claimed is:

1. Thermal conditioning means for an enclosure, such as a rail car, having a main compartment, a separately enclosed end vestibule compartment, and an air supply chamber, comprising in combination, means for supplying outside fresh air to said air supply chamber, means for

forcibly supplying thermally conditioned air from the air supply chamber to the main enclosure compartment under pressure, and means for exhausting vitiated air from the main enclosure compartment and forcibly returning it under pressure to said air supply chamber and to said vestibule compartment.

2. Thermal conditioning means as set forth in claim 1, further characterized by the fact that means are provided for selectively varying the proportion of vitiated air under pressure directed to said vestibule and to said air supply chamber respectively.

3. Thermal conditioning means for an enclosure, such as a rail car, having a main compartment, a separately enclosed end vestibule compartment, and an air supply chamber, means for supplying outside fresh air to said air supply chamber, means for forcibly supplying thermally conditioned air from the air supply chamber to the main enclosure compartment, means for withdrawing air from said main compartment and forcing it away from the compartment, said last-mentioned means including means for forcing some of the vitiated air under pressure to said vestibule compartment, some to said air supply chamber, and some directly to the outside space, and means for selectively proportioning the amount of vitiated air directed into said vestibule compartment and into said air supply chamber.

4. Thermal conditioning means for an enclosure having a plurality of compartments, comprising in combination, means for supplying thermally conditioned air to all of said compartments, said air supply means including a branch air supply duct for each compartment, the compartment providing means for the flow of air out of the compartment to permit the continuous flow of air into the compartment by way of its air supply duct, a first heating means in the branch air supply duct of a compartment, a second heating means within the compartment, a first heat regulating means for the air heating means, a second heat regulating means for the compartment heating means, a first temperature responsive device located in the flow of air out of the compartment for controlling the action of said first heat regulating means for the inflowing air, a second temperature responsive device located adjacent said second heating means for controlling the action of said second heat regulating means for the compartment, and common manual control means within the compartment for simultaneously affecting the action of both of said temperature responsive devices on their respective associated heat regulating means.

5. Thermal conditioning means for an enclosure having a plurality of compartments, comprising in combination, means for supplying thermally conditioned air to all of said compartments, said air supply means including a branch air supply duct for each compartment, a first heating means in the branch air supply duct of a compartment, a second heating means within the compartment, a first heat regulating means for the air heating means, a second heat regulating means for the compartment heating means, a first temperature responsive device located where it will be responsive to the temperature of air in movement for said compartment for controlling the action of said first heat regulating means for the inflowing air, a second temperature responsive device located where it will be responsive to the temperature of air within the compartment adjacent said compartment heating means for controlling the action of said second heat regulating means for the compartment, and common manual control means within the compartment for simultaneously affecting the action of both of said temperature responsive devices on their respective associated heat regulating means.

6. Thermal conditioning means for an enclosure having a plurality of compartments, comprising in combination, means for supplying thermally conditioned air to all of said compartments, a first energy supply means for each compartment for altering the temperature of the air as it enters the compartment, a second energy supply means in each compartment for altering the temperature within the compartment, a first control system for said air temperature altering means including a first energy supply regulator and a first temperature responsive device for controlling the action of said first energy supply regulator, a second control system for said compartment temperature altering means including a second energy supply regulator and a second temperature responsive device for controlling the action of the second said energy supply regulator, and a common manual control device for simultaneously affecting the action of both of said temperature responsive devices on their respective associated energy regulators.

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