Dec. 20, 1938. H. W. OHLHAVER 2,140,810

REFRIGERATION SYSTEM CONTROL

Filed July 30, 1935 3 Sheets-Sheet 1

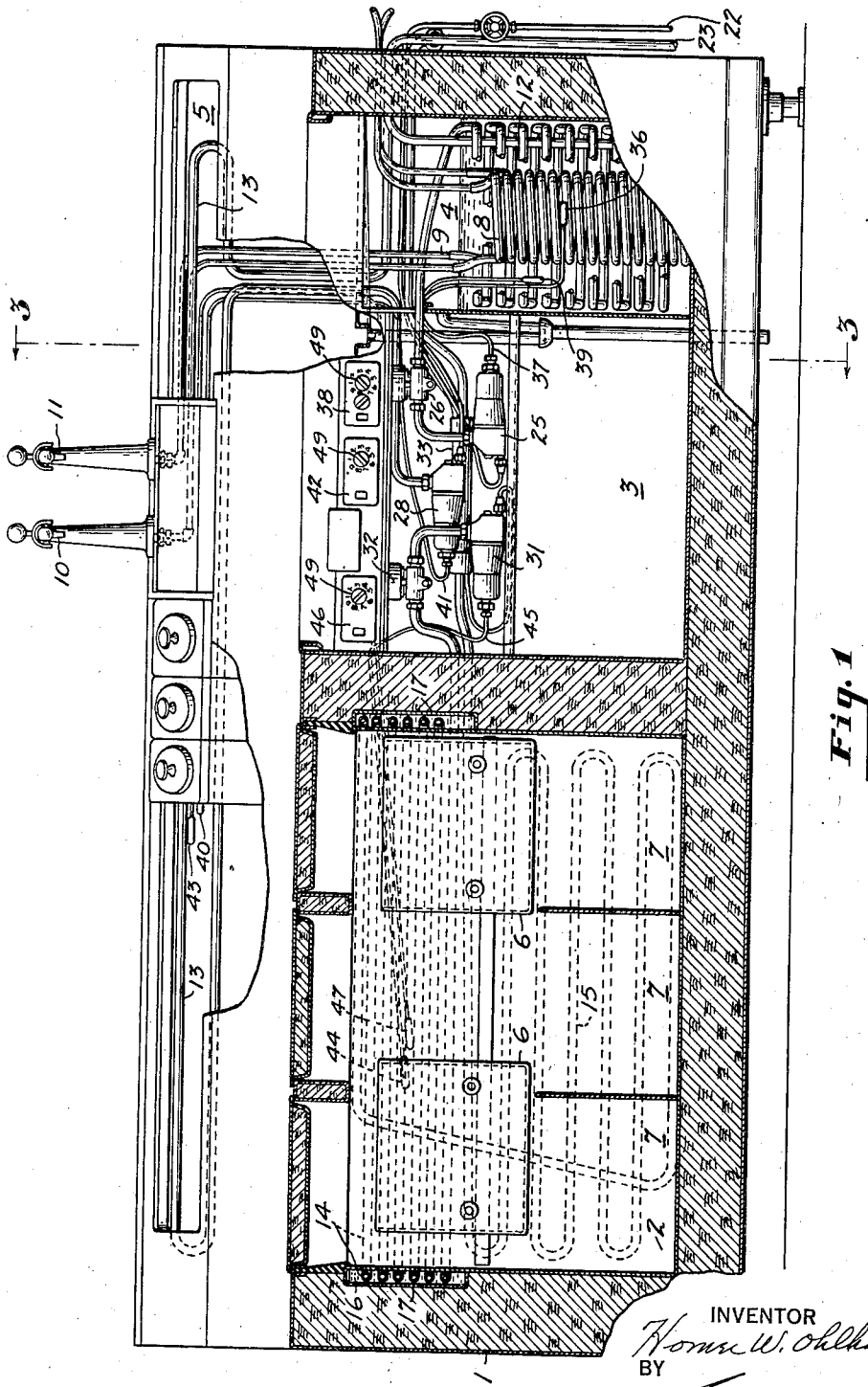


Fig. 1

INVENTOR
Homer W. Ohlhaver
BY
Evans & Mecay
ATTORNEYS

Dec. 20, 1938. H. W. OHLHAVER 2,140,810

REFRIGERATION SYSTEM CONTROL

Filed July 30, 1935 3 Sheets-Sheet 2

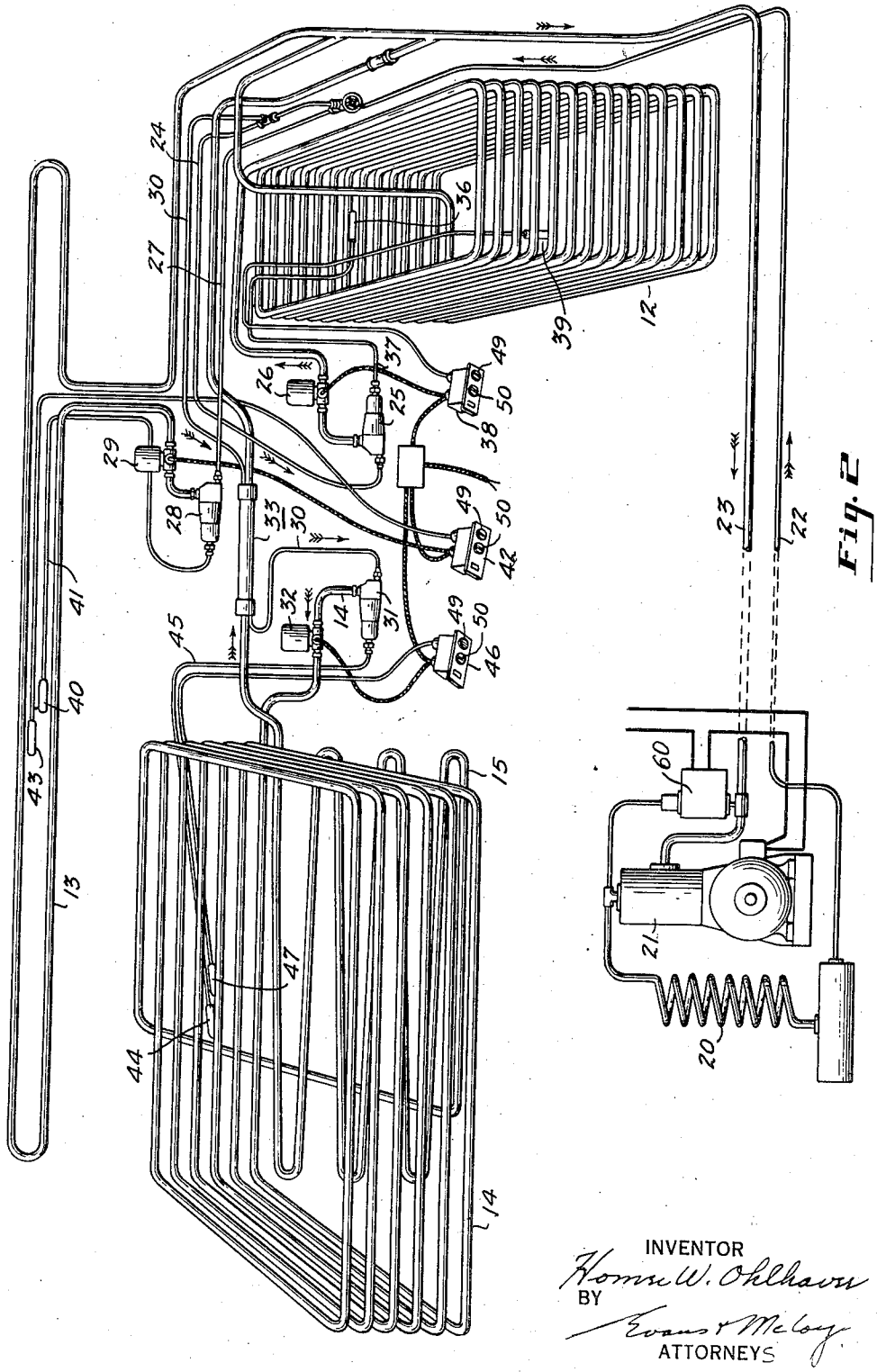


Fig. 2

INVENTOR
Homer W. Ohlhaver
BY
Evans & Mecoy
ATTORNEYS

Dec. 20, 1938. H. W. OHLHAVER 2,140,810

REFRIGERATION SYSTEM CONTROL

Filed July 30, 1935 3 Sheets-Sheet 3

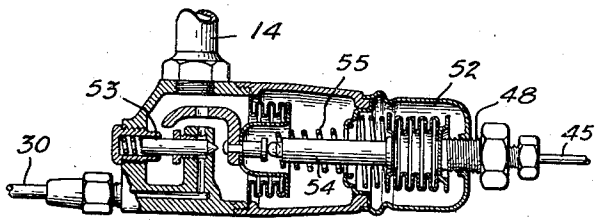


Fig. 4

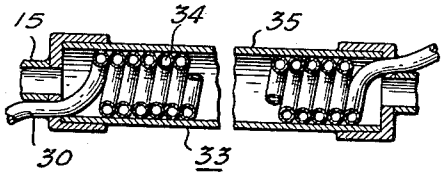


Fig. 5

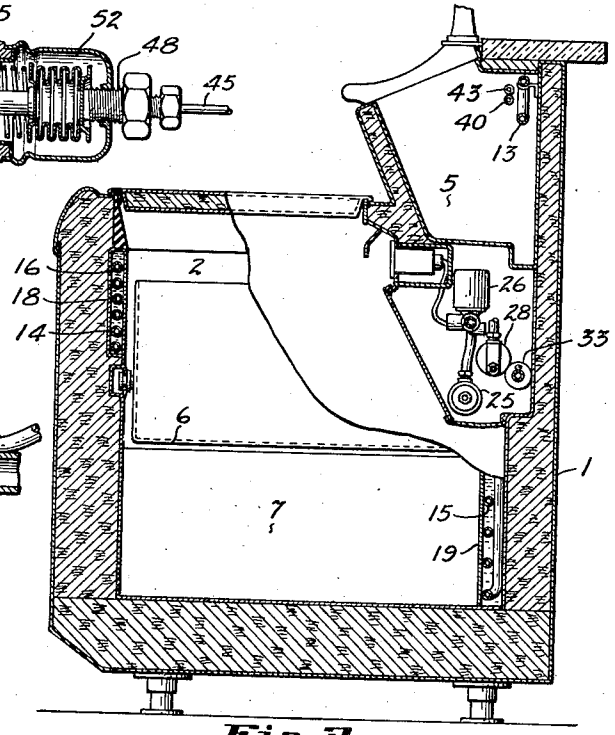


Fig. 3

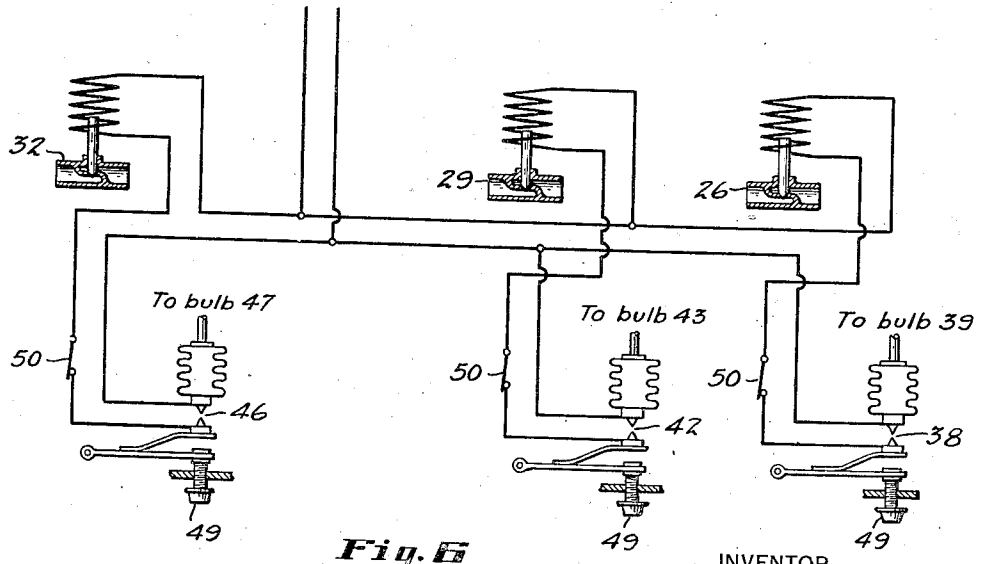


Fig. 6

INVENTOR
Homer W. Ohlhaver
BY
Evans & McCoy
ATTORNEYS

Patented Dec. 20, 1938 2,140,810

UNITED STATES PATENT OFFICE

2,140,810

REFRIGERATION SYSTEM CONTROL

Homer W. Ohlhaver, Lakewood, Ohio, assignor, by mesne assignments, to The Bastian-Blessing Company, Chicago, Ill., a corporation of Illinois

Application July 30, 1935, Serial No. 33,841

6 Claims. (Cl. 62—4)

This invention relates to refrigeration systems and has for one of its objects the provision of means whereby a refrigerated compartment may be maintained at a uniform temperature from top to bottom, or, if desired, may be maintained at a colder temperature at the bottom region than at the top region of the compartment.

Another object is to provide a refrigeration system for refrigerating a plurality of compartments such as the ice cream and liquid cooling sections of a soda fountain, in which refrigerant is supplied from a common source of supply but so arranged that one compartment upon demand for increased refrigeration will cause operation of the refrigerant supplying source irrespective of the condition of the other compartment or compartments.

Another object is to provide a refrigeration system for refrigerating a plurality of sections of a soda fountain in which the temperature of each section may be maintained at a predetermined degree irrespective of the other sections.

With the above and other objects in view, the present invention consists of certain features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings and then claimed.

In the drawings which illustrate a suitable embodiment of the invention,

Figure 1 is a longitudinal section taken through a soda fountain, in which the refrigeration system of the present invention is incorporated;

Fig. 2 is a perspective diagrammatic view of the refrigeration system;

Fig. 3 is a transverse section through the soda fountain taken approximately on the line 3—3 of Fig. 1;

Fig. 4 is a longitudinal section through one of the expansion valves;

Fig. 5 is a longitudinal section taken through a heat interchanger used in the refrigeration system; and

Fig. 6 is a diagram showing the electric circuit.

Referring to the accompanying drawings in which like numerals refer to like parts throughout the several views, the soda fountain cabinet 1 selected for illustration is provided with four sections or compartments, namely, an ice cream compartment 2, a cold compartment 3, a liquid cooling compartment 4, and a syrup jar compartment 5.

The ice cream compartment 2 in the construction shown is provided with a pair of slidable trays 6 suitable for holding small ice cream containers, such as for example, containers of 2½ gallon capacity, and below these trays 6 a number of subcompartments 7 are provided which may be used for storing packages, bulk ice cream, or other articles.

The liquid cooling compartment contains the cooling coils 8 and 9 for drinking water and soda water, and these coils are respectively connected with faucets 10 and 11. The refrigeration coil 12 for the liquid cooling compartment 4 surrounds the coils 8 and 9 as shown in Fig. 1, and is immersed in a water bath. The cold compartment 3 is cooled through the wall of the liquid cooling compartment 4. The syrup jar compartment 5 in the construction shown is also provided with a refrigerating coil 13. In some instances such as when one or both of the sliding trays 6 are removed and when full length ice cream containers are disposed in the compartment 2, it is desirable to have the ice cream compartment of uniform temperature from top to bottom. In other instances such as when packaged ice cream is stored in the sub-compartment 7 and small containers are carried by the trays 6, it is desirable to maintain a lower temperature near the bottom of the ice cream compartment 2 in order to keep the packaged ice cream in the subcompartment 7 at a lower temperature than the ice cream carried by the trays 6.

In accordance with the present invention the refrigerating coil 14 for the ice cream compartment 2 extends completely around the compartment 2 only at the upper portion thereof and part way downwardly toward the bottom of the wall of the compartment as shown in Figs. 1, 2, and 3, and this refrigerating coil 14 is provided with an extension 15 which extends substantially to the bottom of the back wall only of the compartment 2, as shown in Figs. 1, 2, and 3. However, the extension 15 may also be arranged at the sides of the compartment 2. The coil 14 and extension 15 are surrounded by a fluid filled chamber 16 which is composed of the walls of the compartment 2, and spaced side, front and back members 17, 18, and 19, respectively, the back member 19 extending substantially the full height of the back wall of the compartment 2 and the side and front portions 17 and 18, respectively, extending only part way downwardly as shown in Figs. 1 and 3. Also, the coil 14 is coiled around the compartment 2 from its inlet in an upward direction, and the extension 15 is extended back and forth in an upward direction from the bottom of the compartment 2 and has its outlet adjacent the inlet of the coil 14.

The refrigerating system includes a condenser 20 and compressor 21 both of which are diagrammatically illustrated in Fig. 2, the feed and return conduits 22 and 23, respectively, extend to one end of the cabinet 1 and the feed line or conduit 22 is provided with three branches. One branch 24 leads to an expansion valve 25 and then to a solenoid operated valve 26 which is connected with the inlet end of the refrigerating coil 12 located in the cooling compartment 4. The outlet end of the refrigerating coil 12 is connected with the return line or conduit 23.

A second branch 27 of the feed line leads to an expansion valve 28 and then preferably to a solenoid operated valve 29 which is connected to the inlet end of the refrigerating coil 13 for the syrup jar compartment 5. The outlet end of the coil 13 is also connected with the return line or conduit 23.

The third branch 30 of the feed line or conduit 22 leads to an expansion valve 31 and then to a solenoid operated valve 32 which is connected to the inlet of the refrigerating coil 14. The outlet end of the extension 15 of the refrigerating coil 14 is connected with a heat interchanger 33 which includes a casing 35 which is connected with the return conduit 23 and within which a portion of the feed conduit 30 is coiled as shown in Fig. 5.

The expansion valve 25 is controlled by a bulb 36 connected thereto by a conduit 37 and which is located adjacent the coil 12, and which contains an expansible and contractable medium for opening the expansion valve.

The solenoid valve 26 is controlled by a switch 38 which is operated by pressure from a bulb 39 also located adjacent the coil 12.

The expansion valve 28 is controlled by a bulb 40 containing an expansible and contractible medium and is connected thereto by a conduit 41 which is located adjacent the refrigerating coil 13. The solenoid valve 29 is controlled by a switch 42 which is operated by pressure from a bulb 43 also located adjacent the coil 13.

Similarly, the expansion valve 31 is controlled by a bulb 44 containing an expansible and contractable medium and connected therewith by a conduit 45, the bulb 44 being located adjacent the coil 14. The solenoid valve 32 is controlled by a switch 46 which is operated by pressure from a bulb 47 also located adjacent the coil 14.

The expansion valves 25, 28, and 31 may be of any suitable construction, a conventional construction being shown in Fig. 4 which includes an adjusting means 48.

It is to be understood, however, that the expansion valves 25, 28 and 31 and their controlling mechanism are shown for the purpose of illustration and that any other suitable means for providing for the decrease in pressure of the refrigerant necessary to permit the desired transfer of heat, may be utilized.

The switches 38, 42, and 46 are of any suitable pressure operated type and are provided with means 49 for adjusting the same. Each of the circuits for the solenoid valves is preferably provided with a cutout switch 50.

In Fig. 6 is illustrated a wiring diagram for the adjustable switches 38, 42 and 46, which are connected in parallel with a common power source and control the solenoid valves 26, 29 and 32, respectively.

In the expansion valve shown for illustration in Fig. 4, refrigerant is prevented from flowing by a spring pressed slide valve rod 53 which normally closes the expansion valve opening. Refrigerant will flow only when this valve rod 53 is moved to an open position by the expansion medium in the bulb and connecting the conduit. When there is a demand for the flow of a refrigerant the expansion bulb medium actuates a plunger 54 against the resistance of a spring 55 which brings the plunger and an associated part thereof into engagement with the valve rod 53 and moves the same to open position, the size of the opening through which the refrigerant passes being determined by the degree of movement of the plunger 54. By adjusting the adjusting means 48 the plunger 54 may be positioned closer to the valve rod 53 so that upon a demand for a refrigerant flow the valve opening will be increased in size or the plunger 54 may be positioned further away from the valve rod 53 so that upon a demand for refrigerant flow the valve opening will be decreased in size. The size of the valve opening, of course, determines the point in the refrigerating coil where the refrigrant completely passes from its liquid state to its gaseous state at which time it loses its effectiveness as a refrigerant. This point in the refrigeration coil can be selected by properly adjusting the expansion valve through the medium of the adjusting means 48.

It is well known that cold air will descend and that in a soda fountain or ice cream compartment it is necessary only to provide for refrigeration near the upper region of the compartment when it is desired to have a uniform temperature throughout the height of the compartment, such as when full length containers of ice cream are stored in the ice cream compartment.

It will be noted in the present construction that the coil 14 extends completely around the upper region of the compartment 2.

Assuming for example that full length ice cream containers are stored in the compartment 2, and that it is desired to maintain a temperature which is uniform throughout the height of the ice cream compartment 2, then the adjusting means 48 for the expansion valve 31 is so set that the refrigerant will be effective as a refrigerating medium only while it is in the refrigerant coil 14 and before it flows through the extension 15 of the coil 14. In other words, the expansion valve is so set that the refrigerant will have passed into the gaseous state by the time the refrigerant has reached the upper turn of the refrigerating coil 14, and so that the refrigerant flows in a gaseous state through the extension 15 thereby rendering the extension 15 ineffective.

On the other hand, if it is desired that the temperature at the lower portion of the compartment 2 in the region of the sub-compartments 7 be lower than the temperature at the upper region of the compartment 2 in the vicinity of the sliding trays 6, such as when packaged ice cream is stored in the subcompartments, then the adjusting means 48 of the expansion valve 31 is so set that the refrigerant will be effective as a cooling medium not only as it passes through the length of the refrigerating coil 14 but also throughout the length or any desired portion of the length of the extension 15 of the coil 14. In other words, the expansion valve 31 is adjusted so that the refrigerant will pass from the liquid to a gaseous state at a desired point in the extension 15.

The bulbs 36, 40, and 44 are, of course, affected by the temperature of the liquid medium adjacent the respective coils 12, 13, and 14, and when the

temperature rises to a predetermined degree the medium within these bulbs and conduits and the chambers 52 of the expansion valves expands and causes the expansion valves to open a predetermined amount and permit the circulation of the refrigerant through the refrigerating coils. As a predetermined lower temperature adjacent any particular bulb is reached, the contraction of the bulb medium permits the spring pressed valve rod 53 of the expansion valve in question to close the valve opening, and thereby prevent the flow of the refrigerant to the refrigerating coil. The temperature at which the expansion valve closes is determined by the setting of the adjusting means 48.

In the refrigeration system of the present invention, means are provided so that any one of the refrigerating coils 12, 13, and 14 may be supplied with refrigerant independently of the other coils. A single compressor may be used for supplying the coils 13, 12, and 14 with refrigerant and three separate controls are provided for the compressor, so that if any two of the refrigerated compartments are at the proper temperature and the third compartment demands additional refrigeration, the compressor will be started in operation to supply the demand of the coil for that compartment with refrigerant.

These controls are the three solenoid actuated valves 26, 29, and 32 and their respective pressure actuated switches 38, 42, and 46, which are in parallel with each other. The switch adjusting means 49 are set so that the solenoid actuated valve will close and the associated switches will open either at the temperature at which the expansion valves close or at any predetermined temperature above the temperature at which the expansion valves close.

Assuming for example that all of the expansion valves and all of the solenoid actuated valves are closed and the ice cream compartment 2 in time requires increased refrigeration, then the expansion of the medium in the bulbs 44 and 47 and their attendant mechanisms, respectively, cause the expansion valve 31 to open and the switch 46 to close, opens the solenoid actuated valve 32, which raises the pressure in the suction line, causing the pressure actuated switch 60 in the motor circuit to close, thus permitting the coil 14 to be supplied with refrigerant. When the desired temperature is reached, as determined by the setting of the adjusting means 49, solenoid valve 32 closes through the contraction of the medium in the bulb 47, irrespective of whether or not the bulb 44 is in condition to close the expansion valve, and the compressor motor then stops.

However, if in the meantime a demand for increased refrigeration in the compartment 4, for example, has been created, then the expansion valve 25 and solenoid valve 26 will have opened, but the opening of switch 46 and closure of valve 32 will not cause the compressor motor to stop, as the valve 26 permits the operation of the compressor motor.

It is thus seen that each of the refrigeration controls is provided with a separate control and is not dependent for its operation on the operation of any of the other refrigerating coils for its supply of refrigerant, and permits it to maintain its associated refrigerated compartment at the desired temperature.

Furthermore, the adjusting means 49, which determine the temperatures at which the solenoid valves 26, 29 and 32 will close, are readily accessible, so that the soda fountain operator or dispenser can easily select a desired temperature for conditioning the ice cream or to increase or decrease the cooling capacity of the coil 12.

If desired, the solenoid actuated switch 42 and bulb 43 may be omitted, in which case the supply of refrigerant to the refrigerating coil 13 will be dependent upon the operation of the compressor through the demand created in compartment 2 or 4.

Although a single embodiment of the invention has been herein shown and described it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined in the following claims.

I claim:

1. In a refrigeration system, a refrigerating member, means for supplying fresh refrigerant under pressure to the member and withdrawing spent refrigerant therefrom, conductors for carrying the refrigerant between the refrigerating member and the supply means, throttle means responsive to temperature changes adjacent the refrigerating member for controlling the rate of flow of refrigerant into the refrigerating member, and arranged to permit an increase in the rate of flow upon an increase in said temperature and to decrease the rate of flow upon a decrease in said temperature, temperature responsive means associated with the refrigerating member for admitting refrigerant to the refrigerating member only when the latter is above a predetermined temperature, and means responsive to the pressure in the conductor carrying spent refrigerant from the refrigerating member to the supplying means to actuate the supplying means when the last named pressure exceeds a predetermined amount.

2. In a refrigerating system, a refrigerating member, means for supplying fresh refrigerant under pressure to the member and withdrawing spent refrigerant therefrom, conductors for carrying the refrigerant between the refrigerating member and the supplying means, throttle means responsive to temperature changes adjacent the refrigerating member for controlling the rate of flow of refrigerant into the refrigerating member, and arranged to permit an increase in the rate of flow upon an increase in said temperature and to decrease the rate of flow upon a decrease in said temperature, temperature responsive means associated with the refrigerating member, an electrically operable valve associated with the temperature responsive means for admitting refrigerant to the refrigerant member only when the latter is above a predetermined temperature, an adjustable means for selecting and predetermining the temperature at which said temperature responsive means will actuate the electrically operable valve, and means responsive to the pressure in the conductor carrying spent refrigerant from the refrigerating member to the supplying means to actuate the supplying means when the last named pressure exceeds a predetermined amount.

3. The combination in a refrigeration system of a plurality of refrigerating members, a common means for supplying fresh refrigerant to said members, conductors for carrying the refrigerant between the refrigerating members and the supplying means, throttle means for regulating the flow of refrigerant through each of said refrigerating members, each of said throttle means being responsive to temperature

changes adjacent the refrigerating member with which it is associated for controlling the flow of refrigerant into the refrigerating member, and arranged to permit an increase in the rate of flow upon an increase in said temperature and to decrease the rate of flow upon a decrease in said temperature, controls for each of said refrigerating members whereby to supply refrigerant thereto irrespective of the condition of the other of said refrigerating members, each of said controls including a temperature controlled electric switch in parallel with the like switch or switches of the other of said controls, an electically operable valve for regulating the admission of refrigerant to the refrigerating member, said control valve being operable with the closing of the temperature controlled switch to permit the supply of refrigerant to the refrigerating member, and means responsive to the pressure in the conductor carrying refrigerant to the supplying means to control the starting and stopping of the supplying means.

4. The combination in a refrigeration system of a plurality of refrigerating members, a common means for supplying refrigerant to said members, conductors for carrying fresh refrigerant from the supplying means to the refrigerating members, conductors for carrying spent refrigerant from the refrigerating members to the supplying means, individual throttle means associated with each refrigerating member, said throttle means each being responsive to temperature changes adjacent its particular refrigerating member, and arranged to permit an increase in the rate of flow of refrigerant thereinto upon an increase in said temperature and to decrease the rate of flow thereinto upon a decrease in said temperature, temperature responsive means associated with each of said refrigerating members, valve means operated by said temperature responsive means for admitting refrigerant to the associated refrigerating member only when said temperature responsive means registers a demand therefor, an adjustable means for selecting and predetermining the temperature at which said temperature responsive means actuates the valve means, and means responsive to the pressure in the conductor carrying spent refrigerant from the refrigerating members to the supplying means to actuate the supplying means when the last named pressure exceeds a predetermined amount.

5. The combination in a refrigerating system of a plurality of refrigerating members, a common means actuated by an electric motor for supplying refrigerant to said members, conductors for carrying fresh refrigerant from the supplying means to the refrigerating members, conductors for carrying spent refrigerant from the refrigerating members to the supplying means, individual throttle means associated with each refrigerating member, each throttle means being responsive to temperature changes in a portion of the refrigerating member with which it is associated, and arranged to permit an increase in the rate of flow of refrigerant thereinto upon an increase in said temperature and to decrease the rate of flow thereinto upon a decrease in said temperature, a plurality of electric solenoid valves for controlling the flow of refrigerant into the refrigerating member, a plurality of electric switches, each responsive to the temperature adjacent one of the refrigerating members, said switches connected in the electric circuits of the solenoid valves to actuate the latter individually and permit the flow of refrigerant into the corresponding refrigerating members upon a demand therefor transmitted through the temperature responsive switches, all of said switches being connected in parallel, and an electric switch series connected in the motor circuit, said last named switch being responsive to the pressure in the conduits returning spent refrigerant to the refrigerant supply means, and arranged to close upon said pressure exceeding a predetermined amount, whereby the refrigerant supply means is actuated upon an increase in pressure above a predetermined amount in the conduits returning spent refrigerant to the supplying means and the supply means is arrested upon a decrease in pressure in the spent refrigerant returning conduits below a predetermined value.

6. In a refrigeration system, a plurality of refrigerating members, a common means for supplying refrigerant to said members, conductors for carrying the refrigerant between the refrigerating members and the supplying means, individual throttle means for regulating the flow of refrigerant into each of said refrigerating members, and controls for supplying refrigerant to one of the refrigerating members irrespective of the condition of the others of said refrigerating members, said controls including an electric switch responsive to the temperature of its associated refrigerating member, an electrically operable valve for controlling the admission of refrigerant to the refrigerating member, said valve arranged to be energized through said switch to permit the flow of refrigerant to the refrigerating member, manually operable means associated with said switch for selectively predetermining the temperature at which the latter energizes the valve, and an electric switch responsive to the pressure in the conductor carrying refrigerant to the supplying means from the refrigerating members arranged to actuate the supplying means when said pressure exceeds a predetermined amount.

HOMER W. OHLHAVER.