

March 5, 1929.

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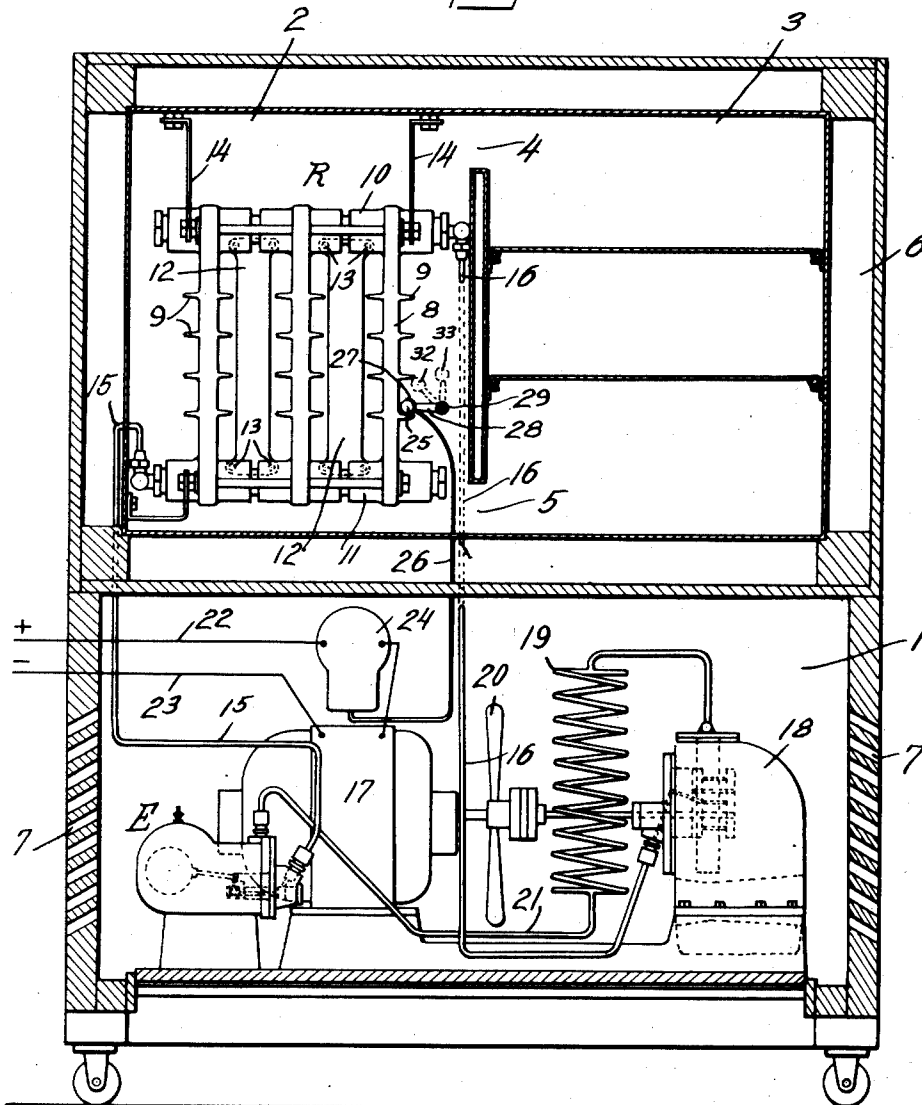
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REFRIGERATING APPARATUS

Filed Nov. 22, 1926

2 Sheets-Sheet 1

Fig. 1.



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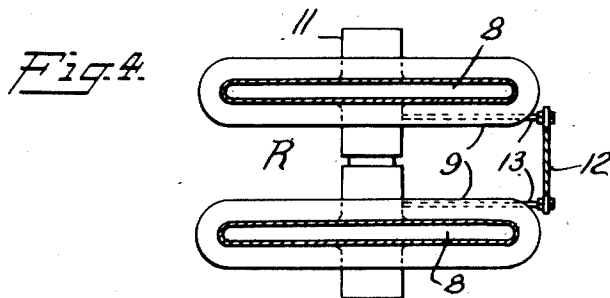
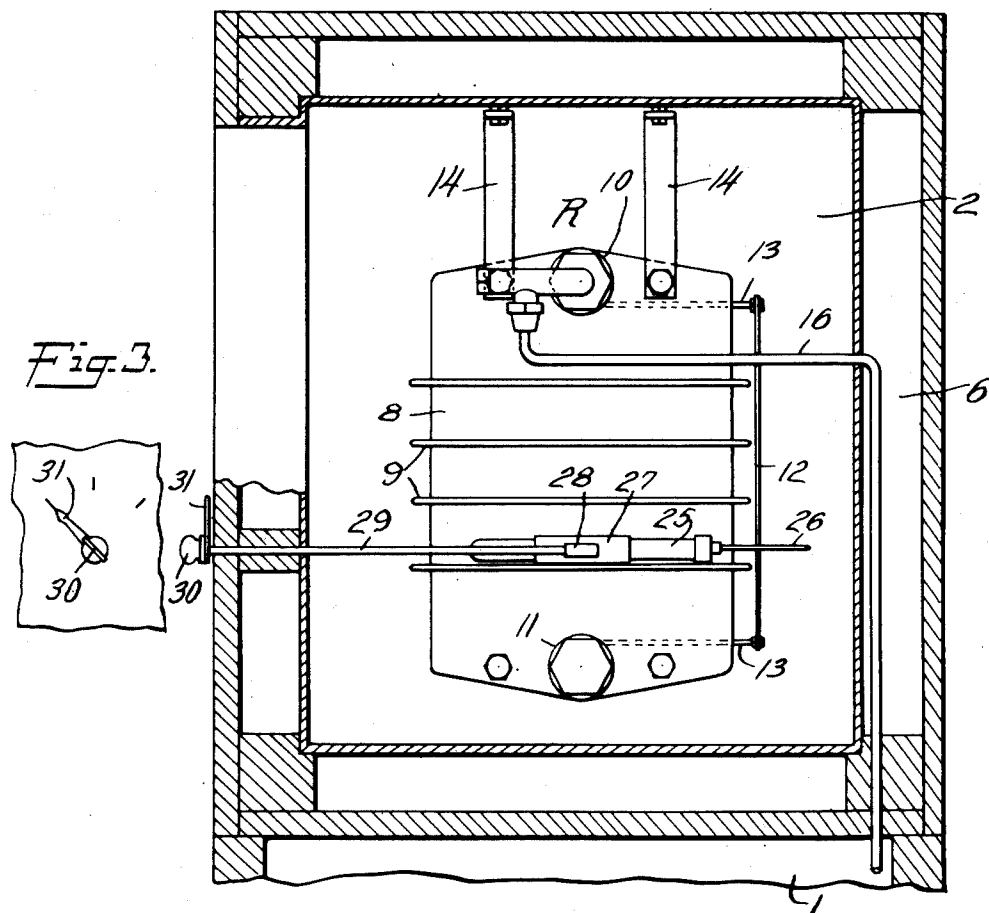
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Fig. 2.



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UNITED STATES PATENT OFFICE.

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REFRIGERATING APPARATUS.

Application filed November 22, 1926. Serial No. 149,845.

This invention relates to refrigerating systems, and more particularly concerns means for variably adjusting the temperature of a refrigerating system of the compression type.

In electric refrigerating systems of the compression type, a refrigeration or heat absorbing unit or element is customarily mounted in the cooling chamber of a refrigerator or other container where a low temperature is desired, this refrigeration unit being supplied with a compressed and liquefied refrigerant by a suitable power driven compressor through suitable expansion means. The refrigerant boils or gasifies within the refrigeration element, so bringing this element to a very low temperature, and the circulation of air through the refrigerator chambers permits the absorption of sufficient heat by the refrigeration element from the refrigerator and its contents to maintain the average temperature thereof at a point suitable for the preservation of foods or other perishable substances. The refrigeration unit is preferably provided with freezing compartments or chambers wherein liquids, desserts or other substances may be frozen.

In order that the refrigerator may be maintained at an approximately even temperature, refrigerating systems are ordinarily provided with temperature responsive control means, which operate, in some suitable manner, to cut off the power from the compressor when the temperature of the refrigerator drops below a given point, and to again start the compressor when this temperature rises above a predetermined value.

In the operation of a refrigerating system of the type described, it is often desirable or necessary to increase or decrease the temperature at which the refrigerator chambers and the freezing compartments are maintained. For example, the nature of the food or other substances in the refrigerator may be such that an exceptionally high or low temperature is required for the proper preservation thereof; it may be desired to freeze liquids rapidly in the freezing compartments; or it may be necessary to rapidly lower the temperature of the refrigerator after it has been shut down, or after the doors thereof have been maintained open for cleaning or other purposes. It has been proposed to provide suitable means for cutting

out the temperature responsive control means and running the compressor continuously to decrease the temperature of the refrigerator to an exceptionally low value, but this has proved rather unsatisfactory for the reason that the temperature responsive means is often inadvertently maintained inactive for too long a period, with the result that an excessive amount of power is consumed by the compressor driving means, and the temperature of the refrigerator is lowered to a point at which the foods therein are frozen.

With the above and other considerations in mind, it is proposed in accordance with the present invention to provide means for adjustably varying the temperature of a refrigerating system of the compression type, and more specifically it is proposed to provide adjustable means which serve to vary the operation of the refrigerant compressing means while maintaining this compressor under the control of the temperature of the refrigerator.

Other specific objects, advantages and characteristic features of the present invention will become apparent as the description thereof progresses.

In describing the invention in detail, reference will be made to the accompanying drawings, in which;

Figure 1 is a front elevation of the refrigerating system of the present invention as applied to a refrigerator of the domestic type;

Fig. 2 is a sectional side elevation of the refrigerator, showing the refrigeration element together with the temperature varying apparatus of the present invention;

Fig. 3 is a front elevation of the manual control means for the temperature varying apparatus; and

Fig. 4 is a sectional view of a portion of the refrigeration element.

Referring to the drawings, and more particularly to Fig. 1, the refrigerating system of the present invention has been shown installed in a refrigerator of the type commonly used for domestic purposes, it being understood that this system is equally adaptable to other types of refrigerators. The refrigerator shown comprises a lower mechanism compartment 1 containing the compressing and condensing mechanism of the system, a cooling chamber 2 containing the

refrigeration element, and a food chamber 3, the food chamber and the cooling chamber being connected by the passages 4 and 5 to permit the circulation of air therebetween, and being enclosed by heat insulating walls 6 of any suitable type. The lower compartment 1 is preferably provided with ventilating openings 7 in the walls thereof to permit the circulation of air therethrough for cooling the condenser coils.

The refrigeration element, designated as a whole as R, may take any suitable form, and as shown comprises a plurality of vertical passages 8 having fins 9 thereon, these passages being connected at their upper and lower extremities by the headers 10 and 11, respectively. The spaces between the vertical passages 8 serve as freezing compartments, liquids or other substances to be frozen being held in these compartments in suitable trays or other containers which may be carried on the fins 9. The freezing compartments are preferably closed at their rear ends by the plates 12 supported on the rods 13, as shown in Fig. 4. The refrigeration element R is suitably supported from the walls of the cooling chamber 2 by the brackets 14, and inlet and outlet pipes 15 and 16 are connected to this element through suitable valves as shown.

The compression and expansion apparatus located in the lower chamber 1 comprises a suitable source of power such as the motor 17, directly connected to a compressor 18. The compressor may be of any suitable type, and, as shown, comprises a pump of the rotary or gear type. The outlet pipe 16 of the refrigeration element R is connected to the intake of the compressor 18, while the outlet of the compressor is connected to the condenser coils 19, which coils are cooled by air currents from a fan 20 on the motor shaft. From the lower end of the coils 19, a pipe 21 extends to suitable expansion apparatus E, and the outlet of this apparatus is connected to the inlet pipe 15 of the refrigeration element R to complete the refrigerant cycle. The expansion apparatus E preferably includes an expansion valve of the float type, as more fully described in my co-pending application Serial No. 191,562 filed May 17, 1927.

Referring now more particularly to the temperature regulating and varying feature of the present invention, the energizing circuit for the motor 17 comprises two wires 22 and 23 connected to a suitable source of electric power, a temperature controlled switch 24 being included in series with one of these wires, whereby the closing and opening of the switch acts to start and stop the motor 17. The temperature controlled switch 24 may take any one of a number of suitable forms, and is preferably of the well-known Mercoid type, comprising essentially a contact maker

and breaker, suitably controlled by a temperature responsive element 25. The contacts of the switch 24 are suitably operated to open the energizing circuit for the motor 17, and so stop the compressor 18, when the temperature of the temperature responsive element drops below a predetermined point, and to close the motor circuit and start the compressor when the temperature of this element rises above a predetermined value.

The temperature responsive element or bulb 25 of the temperature controlled switch 24 is of the type arranged for use at a point remote from the switch, and, in the embodiment illustrated, this element is located in the cooling chamber 2 at a point adjacent the refrigeration element R, and is operatively connected to the switch 24 by a suitable flexible conduit 26. As shown in Figs. 1 and 2, the bulb 25 is supported in a U-shaped bracket 27, fixed to the end of an arm 28 which is secured to a shaft 29. The shaft 29 is journaled in a suitable opening in the front wall of the refrigerator, and is provided with an operating handle 30 and a pointer 31 on the outside of this wall, as shown in Figs. 2 and 3. The shaft 29 and the arm 28 are so constructed and arranged that by turning the handle 30, the bulb 25 may be swung to a position in which it lies adjacent to one of the vertical passages 8 of the refrigeration element R, or this bulb may be swung a predetermined distance away from the refrigerating unit to the positions shown in broken lines in Fig. 1.

In the operation of the refrigerating system of the present invention, when it is desired to maintain the refrigerator at a comparatively high temperature, the bulb 25 is swung as close as possible to the refrigeration element R, as shown in full lines in Fig. 1. In this position, the temperature of the bulb 25 is substantially equal to the temperature of the element R, and consequently the motor 17 and the compressor 18 are started and stopped by the temperature controlled switch 24 at spaced intervals, whereby the refrigeration element R is maintained substantially at the temperature for which the switch 24 is set. When for any reason it is desired to lower the temperature of the refrigerator, the handle 30 is turned in a clockwise direction, as viewed in Fig. 3, and the bulb 25 is thereby swung to a position more remote from the refrigeration element R, as shown in broken lines at 32 in Fig. 1. In this position, the temperature of the bulb 25 will be determined by the temperature of the air in the cooling chamber 2 a short distance from the refrigerating unit R, and, since this temperature is necessarily slightly higher than that of the unit R, the switch 24 will be closed and the compressor 18 operated until the temperature of the element R is lowered to a point at which the bulb 25 is brought to the prede-

terminated temperature at which the switch 24 is arranged to operate. When it is desired to still further lower the refrigerator temperature, the bulb 25 may be moved still further away from the element R by again turning the handle 30 in a clockwise direction, thus bringing the bulb 25 in the position indicated in broken lines at 33 in Fig. 1. As before, this brings the bulb 25 to a position in which the air surrounding this bulb is at a still higher temperature, and the switch 24 is therefore closed and the compressor 18 operated until the refrigerator temperature has been lowered to a point at which the temperature of the bulb 25 is reduced to the temperature for which the switch 24 is set. It should of course be understood that while the bulb 25 is maintained in any given position, the switch 24 is operated from time to time to start and stop the compressor 18, and thereby to lower the temperature of the refrigerator, thus maintaining the refrigerator temperature at a substantially fixed and even value, in spite of the fact that heat is continually being absorbed thereby from the surrounding air.

By the use of the temperature regulating and varying means of the present invention, the temperature of the refrigerator may be readily and quickly varied to suit changing requirements. The arrangement described presents many obvious advantages over the expedients heretofore employed for accomplishing this variable temperature control. With the temperature control handle 30 set at a given point, the refrigerator temperature is maintained at a steady value corresponding to this setting regardless of variations in the temperature of the air surrounding the refrigerator or the temperature of foods or other articles placed within the refrigerator. If the operator should inadvertently leave the temperature control handle set for a temperature lower than is necessary, the refrigerator temperature will not be reduced to a point at which there is danger of freezing the foods therein, and an undue amount of current will not be consumed. In other words, the temperature regulation system of the present invention permits the variation of the refrigerator temperature, while at all times maintaining this temperature under control.

Although the refrigerating system of the present invention has been described in connection with a rather specific arrangement and construction of parts, it should be understood that the invention is not limited to the exact embodiment shown herein. For example, the temperature responsive bulb 25 could be mounted at any suitable point within the cooling chamber of the refrigerator, this bulb could be suitably mounted to move relative to the refrigeration element in any one of a number of ways, and vari-

ous other changes, combinations and additions might be made without departing from the scope of the invention as defined by the appended claims.

I claim:—

1. In a refrigerating system, the combination of a refrigeration element, a cooling chamber enclosing said element, a temperature responsive device for controlling the operation of the refrigerating system, said device being arranged so that it is affected by both the temperature of the cooling chamber and the temperature of the refrigeration element, and means for varying the distance between said device and said element to change the relative effects produced thereon by said element and said chamber.

2. In a refrigerating system, the combination of a refrigeration element, means for compressing a gasified refrigerant, an electric motor for driving said compressing means, an electric circuit for said motor, a switch in said circuit, means for condensing the compressed refrigerant and for supplying the condensed refrigerant to the refrigeration element, a cooling chamber enclosing said refrigeration element, a temperature responsive device for actuating said switch, said device being arranged so that it is affected by both the temperature of the cooling chamber and the temperature of the refrigeration element, and means for adjustably moving said device toward and away from said element to change the relative effects produced on the device by said element and said chamber.

3. In a refrigerating system, the combination of a refrigeration element, compressing means for supplying a compressed refrigerant to said refrigeration element, an electric motor for driving said compressing means, an energizing circuit for said motor including a switch, a temperature responsive device for controlling said switch, said temperature responsive device being disposed adjacent said refrigeration element, whereby the temperature of said device is determined by the temperature of said refrigeration element, and means for varying the distance between said refrigeration element and said temperature responsive device.

4. In a refrigerating system, the combination of a refrigeration element, a cooling chamber enclosing said element, power driven means for supplying a compressed refrigerant to said element, control apparatus including a temperature responsive device responsive to the temperature of said element for controlling the operation of said power driven means, a support extending through a wall of said cooling chamber and supporting said temperature responsive device adjacent said refrigeration element, and manually operable means engaging said support outside of said chamber for moving said tem-

perature responsive device relative to said refrigeration element.

5. In a refrigerating system, the combination of a refrigeration element, a cooling chamber enclosing said element, a compressor for supplying a compressed refrigerant to said element, a shaft journaled in a wall of said chamber and extending within said chamber, an arm on said shaft adjacent said element, a temperature responsive device carried by said arm, means on said shaft outside of said chamber for moving the position of said temperature responsive device relative to said refrigeration element, and means for controlling the operation of said compressor in accordance with the temperature of said temperature responsive device.

6. In a refrigerating system, the combination of a refrigerating element, a refrigerator cabinet enclosing said element, a temperature responsive device for controlling the operation of the refrigerating system, said device being disposed within said cabinet in a position to be affected by the temperature of said refrigerating element, and means operable from the exterior of said cabinet for varying the position of said device with respect to said element to change the temperature of said device relative to the temperature of said element.

7. In a refrigerating system, the combination of a refrigerating element, a refrigerator cabinet enclosing said element, a temperature responsive device for controlling the operation of the refrigerating system said device being disposed within said cabinet in a posi-

tion to be affected by the temperature of said refrigerating element, means operable from the exterior of said cabinet for varying the position of said device with respect to said element to change the temperature of said device relative to the temperature of said element, and means for indicating the position of said device.

8. In a refrigerating system, in combination with a refrigeration element, power driven means for lowering the temperature of said refrigeration element, control apparatus including a temperature responsive device responsive to the temperature of said refrigeration element for controlling the operation of said power driven means, means for pivotally mounting said temperature responsive device adjacent said refrigeration element, and means for moving said device to vary the distance between said device and said refrigeration element, whereby the relative temperatures of said device and said element may be adjustably varied.

9. In a refrigerating system, the combination of a refrigeration element, a temperature responsive device adjacent said refrigeration element for controlling the operation of the refrigeration system, and means for adjustably moving said temperature responsive device toward and away from said refrigeration element, whereby the difference in temperature between said temperature responsive device and said refrigeration element may be varied.

In testimony whereof I affix my signature.

ALFRED M. THOMSON.