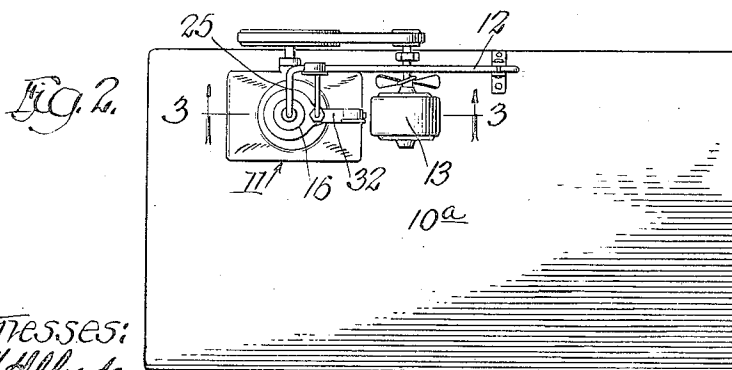
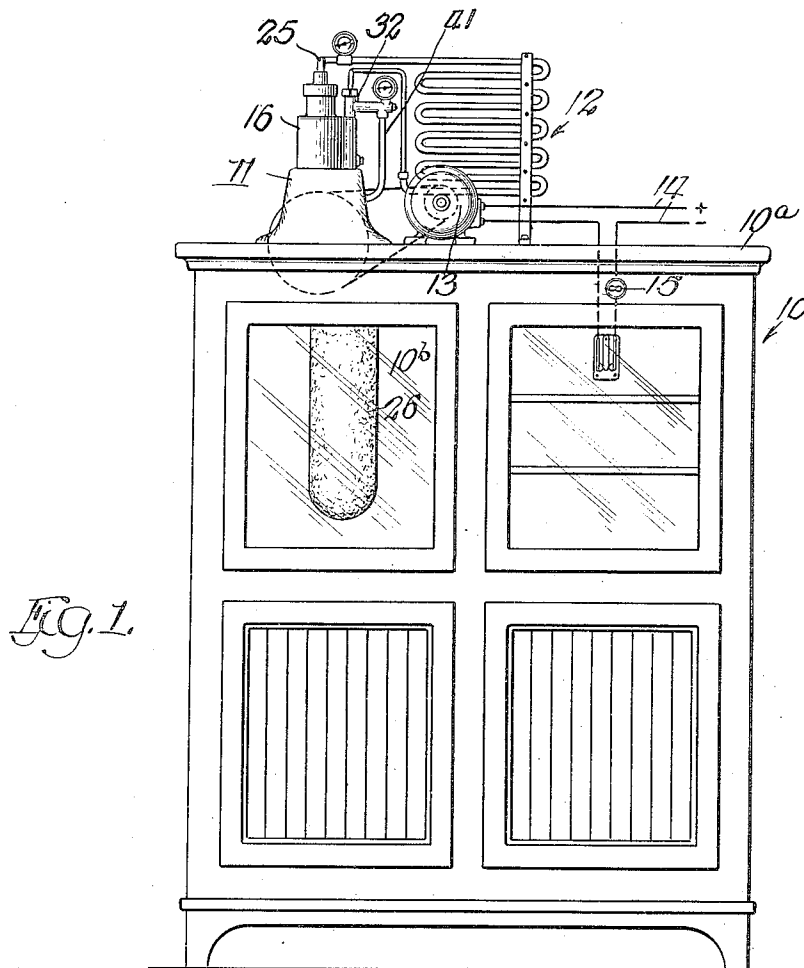


F. W. WOLF.
REFRIGERATING APPARATUS.
APPLICATION FILED APR. 7, 1913

1,126,605.

Patented Jan. 26, 1915.

2 SHEETS—SHEET 1.



Witnesses:
J. H. Hildebrand
A. W. Ball

Inventor
Fred W. Wolf
by Brown & Hildebrand Attys

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2 SHEETS—SHEET 2.

Fig. 3.

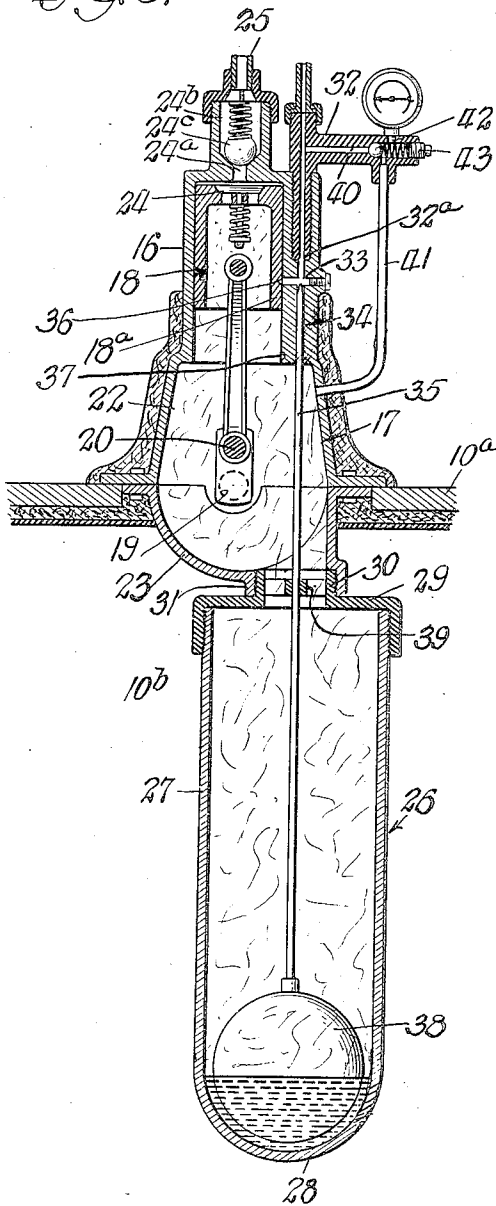
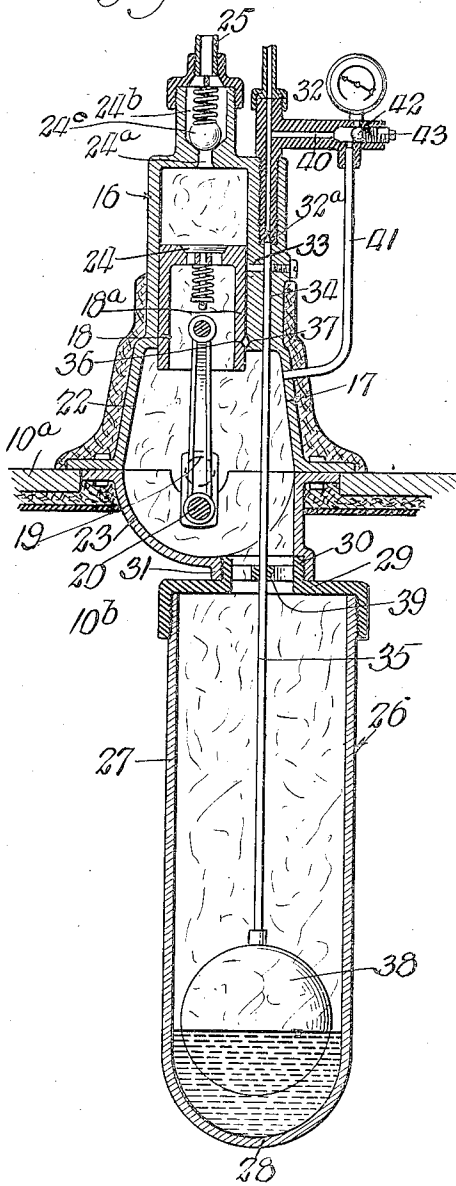


Fig. 4.



Witnesses:
F. W. Wolf
R. W. Wolf

Inventor
Fred W. Wolf
by Brown & Melchior, Attys

UNITED STATES PATENT OFFICE.

FRED W. WOLF, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE MECHANICAL REFRIGERATOR COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ARIZONA.

REFRIGERATING APPARATUS.

1,126,605.

Specification of Letters Patent.

Patented Jan. 26, 1915.

Application filed April 7, 1913. Serial No. 759,331.

To all whom it may concern:

Be it known that I, FRED W. WOLF, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Refrigerating Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in refrigerating apparatus and consists of the matters hereinafter described and more particularly pointed out in the appended claims.

The invention relates especially to an automatic refrigeration apparatus of the compression type and is primarily intended for use with domestic refrigerators and for use in connection with the refrigerators used by butchers, grocers, bakers and the like.

The advantages of my improved apparatus will appear as I proceed with my specification.

In the drawings: Figure 1 is a view representing a refrigerator of the ordinary domestic type with my improved refrigerating apparatus applied thereto. Fig. 2 is a top plan view of the same. Fig. 3 is a view representing a vertical central section through a part of the refrigerating apparatus in a plane indicated by the line 3—3 of Fig. 2. Fig. 4 is a view representing a like section with the parts in a different position.

The refrigerating apparatus, including the compressor, the condenser and the motor for driving the compressor is mounted on top of the refrigerator, while the expansion chamber or refrigeration device proper is located in the usual ice-box of the refrigerator.

Referring now to that embodiment of my invention illustrated in the drawings: 10 indicates a refrigerator of usual construction containing an ice or cooling compartment 10^b; 11, a compressor mounted on the top wall 10^a of the refrigerator; 12, a liquid-refrigerant receiving and condensing coil; and 13, a motor for driving the compressor which is preferably a small electric motor of any familiar type.

14 indicates the electric mains connected to the motor for supplying current to the

same, and 15, an electric switch interposed in one of said mains and attached, as shown, to the front wall of the refrigerator.

The compressor is of any usual construction and is placed by preference in an upright position on the refrigerator. It comprises a cylinder 16 having a hollow base 17 which is bolted to the top wall of the refrigerator; a piston 18 working in said cylinder; a crank-shaft 19 and crank 20; and a pitman 21 connecting said crank-shaft to the piston.

22 indicates the crank-casing which is formed by the hollow base 17 of the cylinder and by a shell 23 bolted to the bottom of said base and depending, as shown, through a suitable aperture in the top wall of the refrigerator.

The piston 18 is hollow and is provided in its head with the usual spring controlled inlet valve mechanism 24. Said valve mechanism communicates by a port 24^a with a back pressure valve chamber 24^b in the cylinder-head, which is connected by a pipe 25 with the receiver 12. The valve-chamber 24^b contains a spring controlled back pressure valve 24^c which normally closes the port 24^a in the usual manner.

26 indicates the expansion chamber located within the usual ice or cooling compartment 10^b, of the refrigerator, preferably in a position vertically below the compressor 11. The expansion chamber, as shown herein, consists of an elongated tubular shell 27 having an integral spheric bottom wall 28 and being closed at the top by means of a cap 29 which is screw-threaded upon its upper end. Said cap has a tubular extension or neck 30 which is connected to a like tubular extension 31 on the bottom of the shell 23 of the crank-casing. Thus the interior of the expansion chamber communicates with the interior of the crank-casing, so that the contents of the expansion chamber may be withdrawn therefrom and forced by the piston into the receiver 12.

The receiver 12, as shown, consists of a coil of pipe, one end of which is connected to the pipe 25 leading from the compressor and the other end of which is connected to a tubular fitting 32, which is fixed in one side wall of the cylinder casing. The cylinder wall is provided in line with the fitting 32 with a longitudinal passage 34 which opens into said fitting. Said wall is

also provided a short distance below the fitting 32 with a transverse passage 33 which intersects the passage 34 and opens into the cylinder. In the passage 34 is mounted a rod or needle 35 which is longitudinally movable therein and which is capable of passing across the passage 33 and beyond the same until it comes to rest against a seat 32^a formed at the lower end of the fitting 32. With the needle 35 below the transverse passage 33 as shown in Fig. 3, it is apparent that a free path is offered for a flow of the liquid refrigerant between the receiver 12 and the transverse passage 33. With the needle in a position extending above said transverse passage and closed against the seat 32^a, as shown in Fig. 4, said path is absolutely closed. At any intermediary position the needle will act to choke the flow of the refrigerant from the receiver to the transverse passage 33.

In the cylindric wall 18^a of the piston there is provided a small recess 36 which is adapted, when the piston is at or near the end of its compression stroke, (as shown in Fig. 3), to register with the transverse passage 33 and which, when the piston is at or near the beginning of its compression stroke, is adapted to register with a like small recess 37 located in the cylinder wall at a distance below said passage 33, (as shown in Fig. 4). Since the transverse passage 33 (when the needle is in the position shown in Fig. 3) is open to the flow of refrigerant from the receiver, it is apparent that the liquid refrigerant in the condensation coil will fill the fitting 32 and also the transverse passage 33. With the needle-valve in this position, each time the piston brings the recess 36 into alinement with the transverse passage 33, a small particle or slug of the refrigerant will be forced into the recess 36 and in the downward movement of the piston will be carried down with the piston until the recess 36 comes to register with the recess 37. The refrigerant being under high pressure will fill the recess 27 and when the piston proceeding on its compression stroke returns to the opposite end of its stroke the slug of refrigerant left in the recess 37 will drop into the crank-casing and from there into the expansion chamber 26. There is thus provided a mechanical feed of the refrigerant from the receiver 12,—that is to say, the high pressure side of the system,—to the expansion chamber or low pressure side of the system. The rate of this mechanical feed has a definite predetermined relation to the timed movement of the piston of the compressor.

In the embodiment of the invention shown herein, when the movable member of the feeding device is the piston itself, the mechanical feed operates in synchronism with the piston, but manifestly the invention is

not limited to this construction nor to this particular predetermined ratio between the timed movement of the piston and the timed movement of the mechanical feed.

The refrigerant fed into the expansion chamber 27 collects upon the bottom 28 thereof and vaporizes and expands under the action of the heat acquired by the casing inclosing said chamber from the surrounding air in the refrigerator, thereby refrigerating said box in a familiar manner. The needle valve rod 35 depends downwardly through the crank casing into the expansion chamber 26, having bearing in a spider 39 secured in the vertical neck of the cap 29 on the upper end of said chamber. Said spider serves to hold the rod 35 in vertical alinement with the bore or passage 34 in the cylinder wall. A float 38, which, as illustrated herein, is a hollow metallic ball, is attached to the bottom of the rod 35 and is adapted to float in the liquid refrigerant collected in the bottom of the expansion chamber. It is evident that as the liquid refrigerant in the expansion chamber increases, the float 38 will rise and with it the valve-rod 35 will rise so as to choke and finally, at a predetermined level of liquid refrigerant in the expansion chamber, will absolutely cut off the flow of the refrigerant. Thus while the mechanical feed will continue to operate, the supply to the mechanical feed will be controlled by the liquid refrigerant in the expansion chamber, the amount fed by each stroke of the movable member of the mechanical feed being reduced as the needle valve rises and being finally reduced to nothing when said valve closes against its seat.

As the amount of liquid refrigerant in the expansion chamber is at all times dependent upon the conditions of temperature and pressure in the expansion chamber (the volume of said expansion chamber being constant) and as the compressor represents a constant pressure-reduction factor, and said reduction is offset by the constant feed of the mechanical feed, while the temperature required by the expansion chamber casing from ice box represents the single variable factor, the effect of the latter factor will predominate to determine the level of liquid refrigerant in the expansion chamber. Thus so long as the expansion chamber is acquiring heat sufficient to vaporize and expand the liquid refrigerant as rapidly as it is fed by the mechanical feed, the float will have no effect to choke or cut off the supply to said mechanical feed. As, however, the predetermined temperature that the apparatus is designed to maintain in the ice box is approached, the level of the refrigerant in the expansion chamber will rise, causing the float and needle valve rod 35 to choke the supply and finally when said prede-

terminated temperature is reached positively cut off said supply. When this point is reached the mechanical feed will operate without effect to introduce additional liquid refrigerant into the expansion chamber, and this condition will maintain until by reason of the constant reduction of pressure in the expansion chamber by reason of the operation of the compressor, and the vaporization and expansion of the liquid refrigerant due to said lowered pressure and the consequent lowering of the level of the liquid refrigerant in the expansion chamber, whereupon the float falls, lowering the needle valve rod, and thus admitting a supply of liquid refrigerant to the mechanical feed. Manifestly, also, the opening of the ice box, so that the temperature therein rises above the predetermined temperature to be maintained therein, will have a like effect to boil off the liquid refrigerant in the expansion chamber and lower the level thereof.

Any refrigerant may be used in my improved apparatus but I prefer to use sulfuric acid (SO_2) which may be condensed and liquefied in a suitable coil by ordinary air cooling and without the use of cooling water. The dispensation of the use of cooling water and the use of an air cooled condenser instead is a great advantage in that it not only cuts out the expense of the cooling water, but also the cumbersome apparatus in connection therewith and the care and room required for such apparatus.

To prevent a pressure being produced or reached in the condenser 12 greater than a predetermined, safe pressure I connect the fitting 32, which is part of the high pressure side of the system, with the low pressure side of the system by means including a safety valve which will open under a predetermined pressure. The fitting 32 has a by-pass pipe 40 which is connected by a pipe 41 with the crank casing of the compressor. A spring controlled ball valve 42 is placed in position to close the by-pass pipe 40, a plug 43 being threaded into the end of the by-pass pipe beyond the ball valve for adjusting the pressure of a spring 42^a which acts directly on the valve, to close it. When the predetermined high pressure is reached in the condenser the ball valve 42 is forced from its seat and the liquid refrigerant escapes from the high pressure side of the system to the low pressure side of the system until said high pressure has been relieved.

While in the embodiment of the invention shown herein I have illustrated a float for controlling the supply of liquid refrigerant to the mechanical feed, it will be understood that the float is responsive to the thermo-

dynamic conditions of the refrigerant in the expansion chamber and that the invention is therefore not limited to a float for imparting the effect of said condition to control the supply to the mechanical feed.

I have also illustrated herein, in order to show one embodiment of the invention, various details of mechanical construction and arrangement, but it will be understood that the invention is in no way limited thereby, except as may be pointed out in the appended claims.

I claim as my invention:—

1. In a refrigerating apparatus of the compression type, including a compressor, an expansion chamber and a receiver, a mechanical feeding device interposed between said receiver and said expansion chamber for feeding liquid refrigerant from said receiver to said expansion chamber, means for operating said mechanical feeding device at a predetermined time ratio with reference to said compressor and means for controlling the supply of refrigerant to said mechanical feeding device depending for its operation upon the thermo-dynamic conditions of the refrigerant in said expansion chamber.

2. In a refrigerating apparatus of the compression type, including a compressor, an expansion chamber and a receiver, a mechanical feeding device timed to operate at a predetermined time ratio with said compressor interposed between said receiver and said expansion chamber for feeding liquid refrigerant from said receiver to said expansion chamber and means for controlling the supply of refrigerant to said mechanical feed including a float in said expansion chamber.

3. In a refrigerating apparatus of the compression type, including a compressor, an expansion chamber and a receiver, means providing a passage leading from said receiver and opening into the compressor cylinder, a recess in said compressor piston adapted to register with said passage when the piston is at one end of its stroke, and said cylinder being provided with a recess spaced from said passage, the recess in the cylinder being adapted to register with the said recess in the cylinder at the opposite end of its stroke and to uncover said recess at the first named end of its stroke.

In testimony, that I, claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 28th day of March A. D. 1913.

FRED W. WOLF.

Witnesses:

GEORGE R. WILKINS,
T. H. ALFREDS.