Jan. 2, 1923.

1,440,935.

W. G. SEE.

REFRIGERATING APPARATUS.

FILED MAR. 28, 1922.

4 SHEETS—SHEET 1.

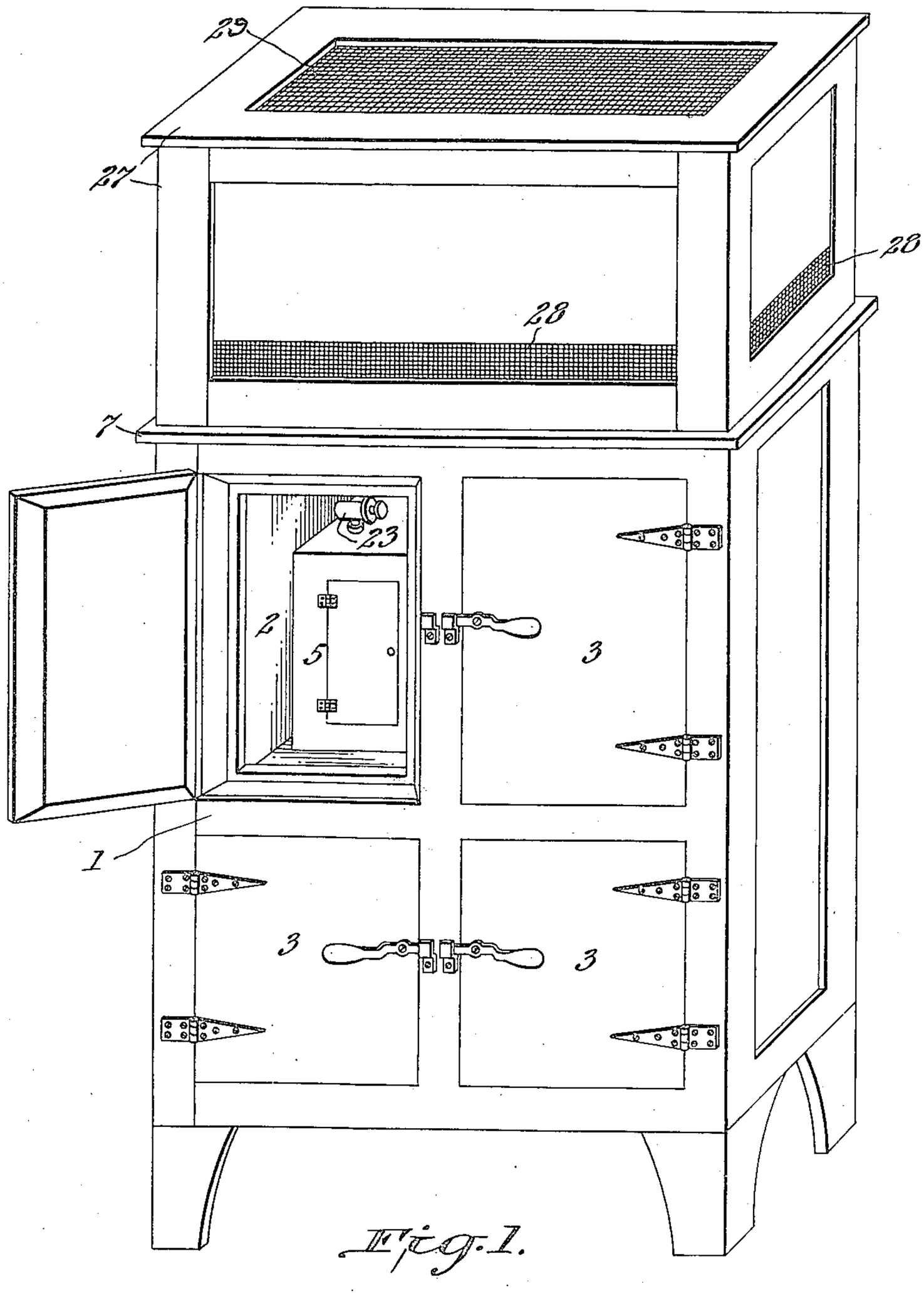


Fig. 1.

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4 SHEETS—SHEET 2.

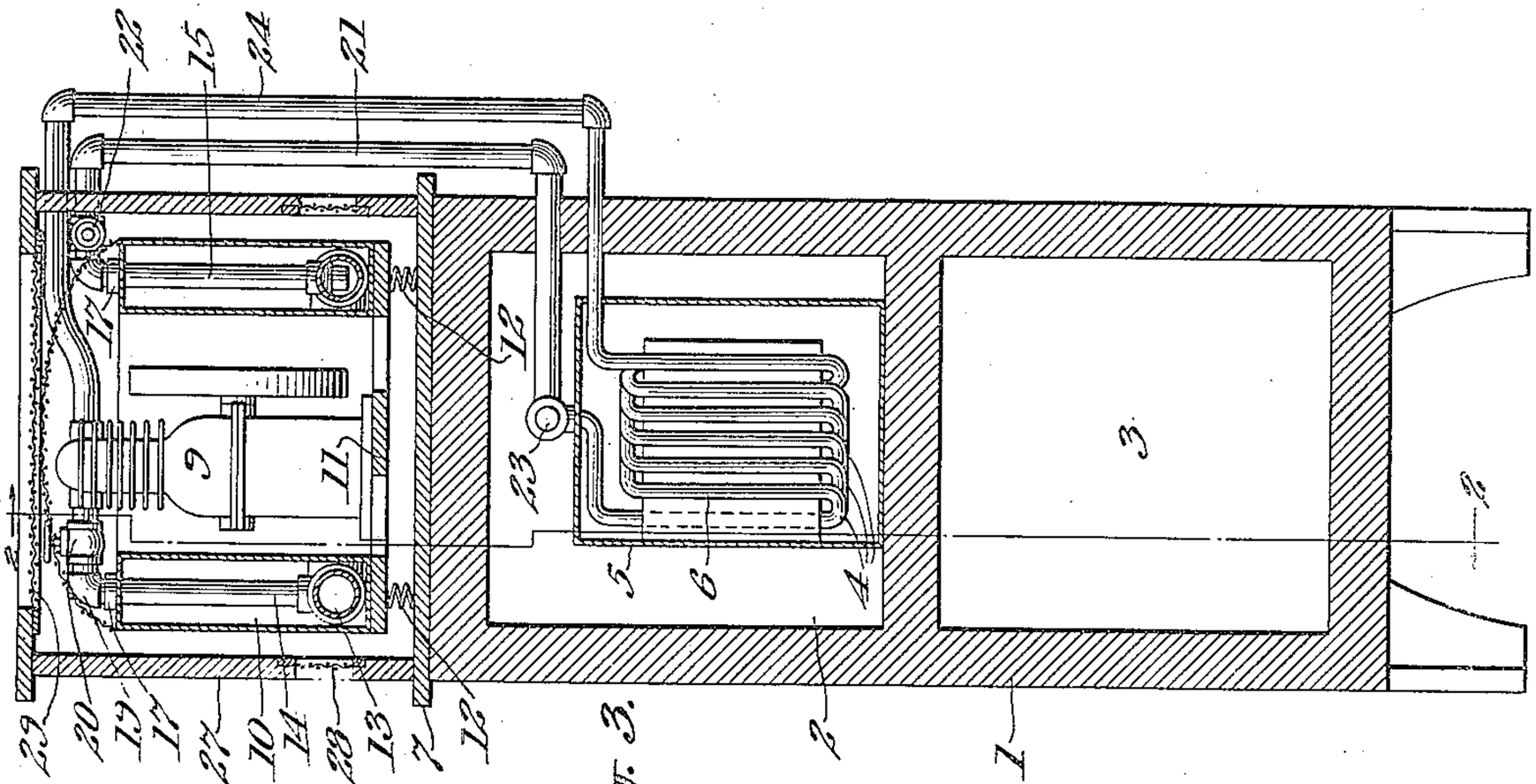

Fig. 3.

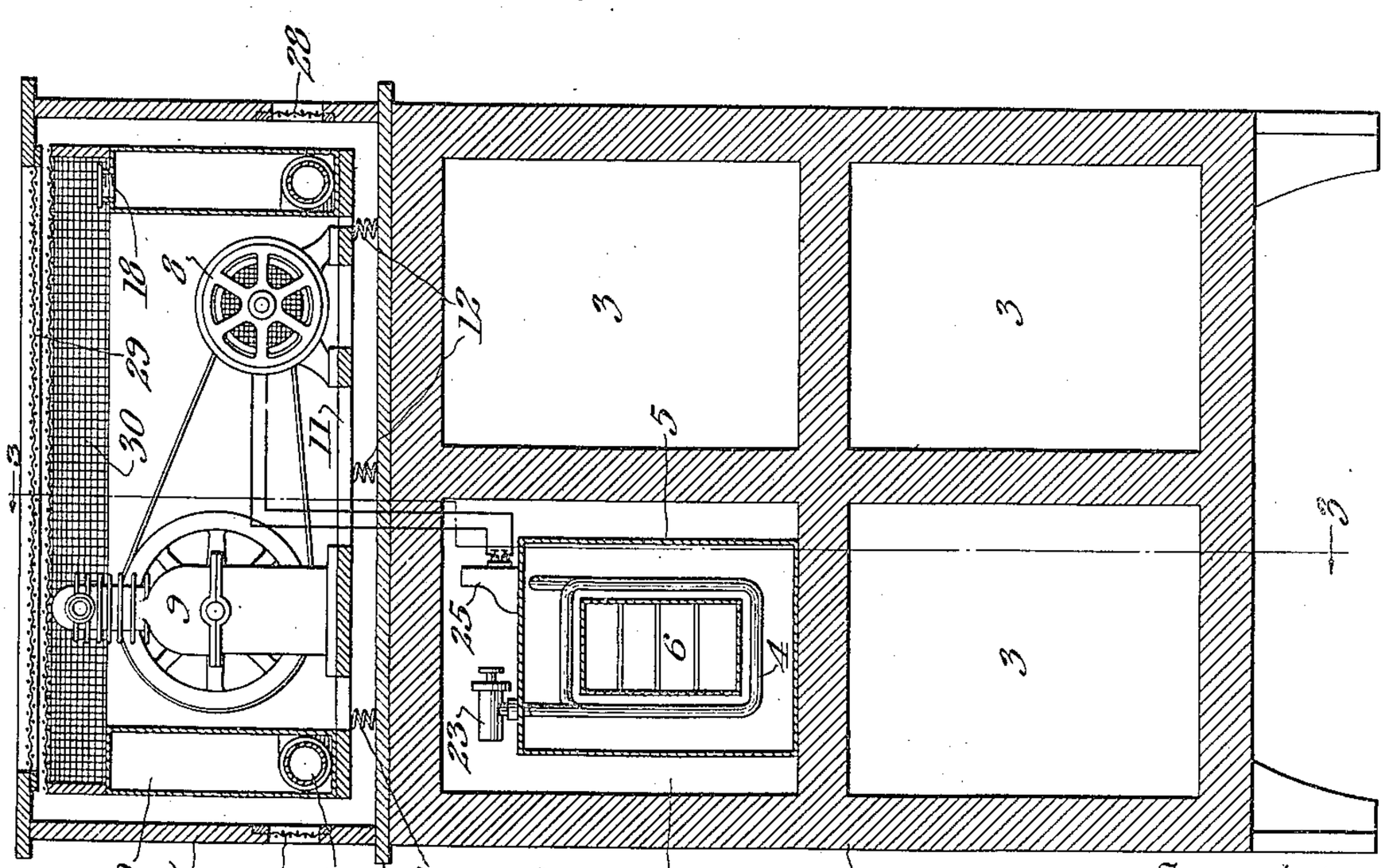

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 4.

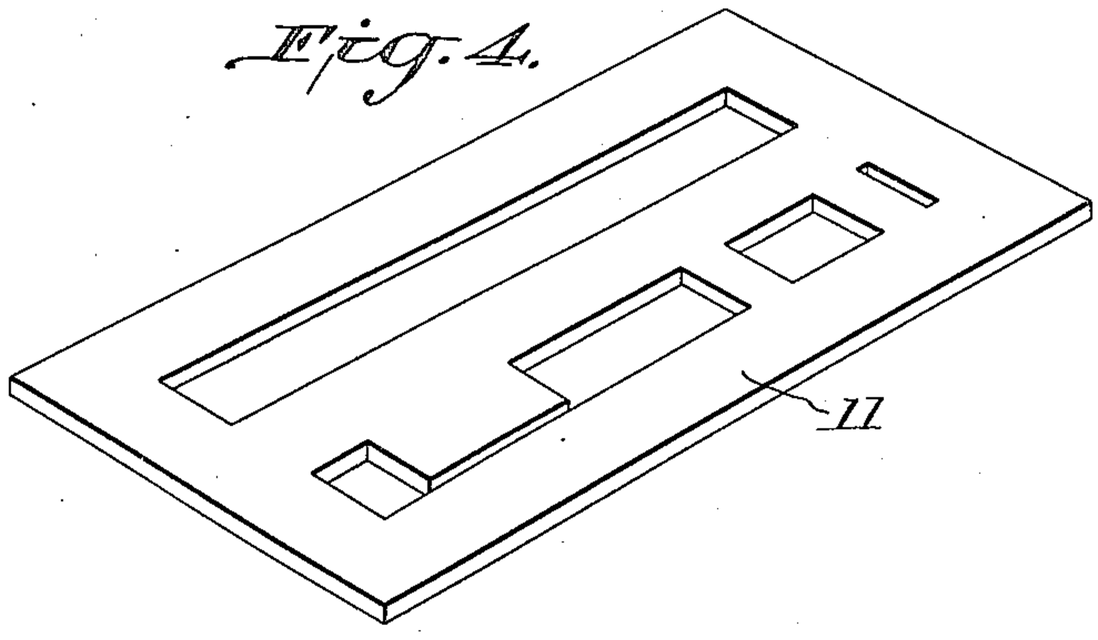
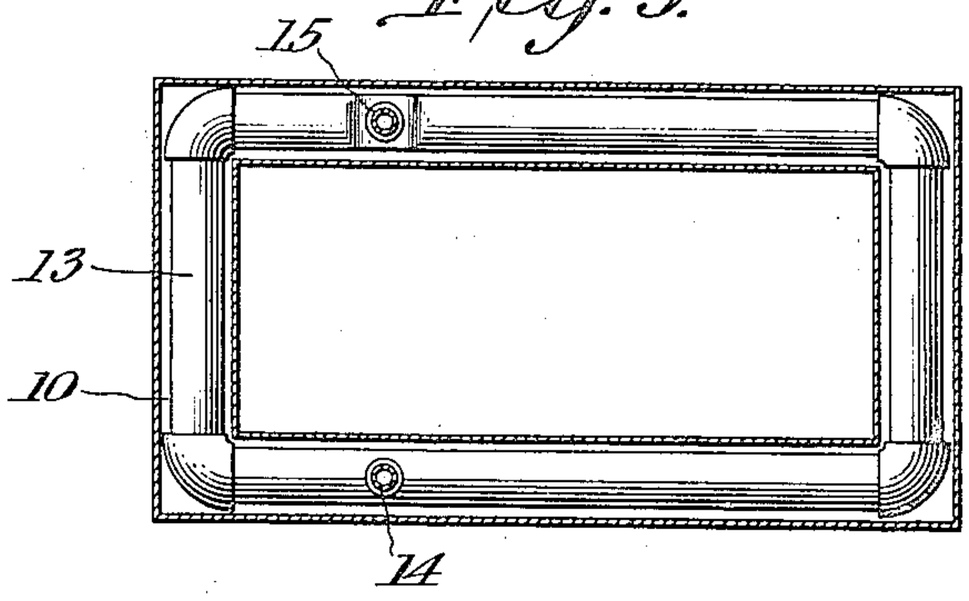



Fig. 5.



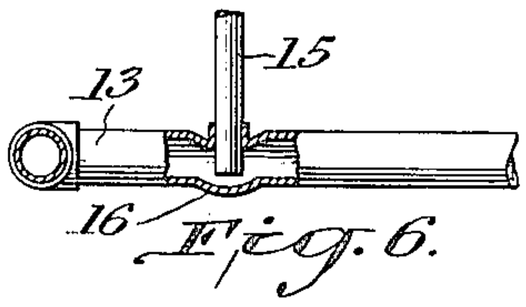




Fig. 6.

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4 SHEETS—SHEET 4.

Fig. 7.

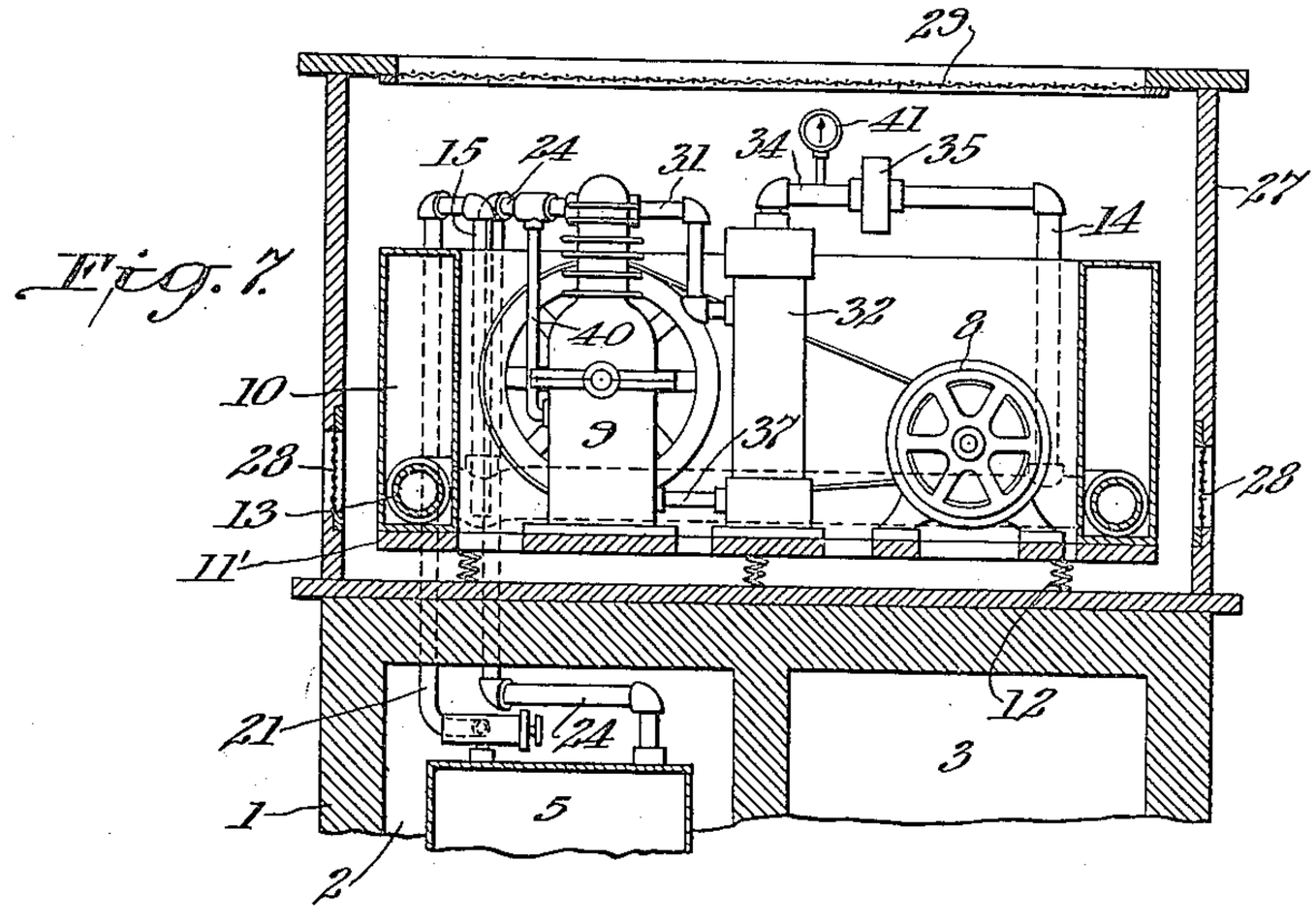
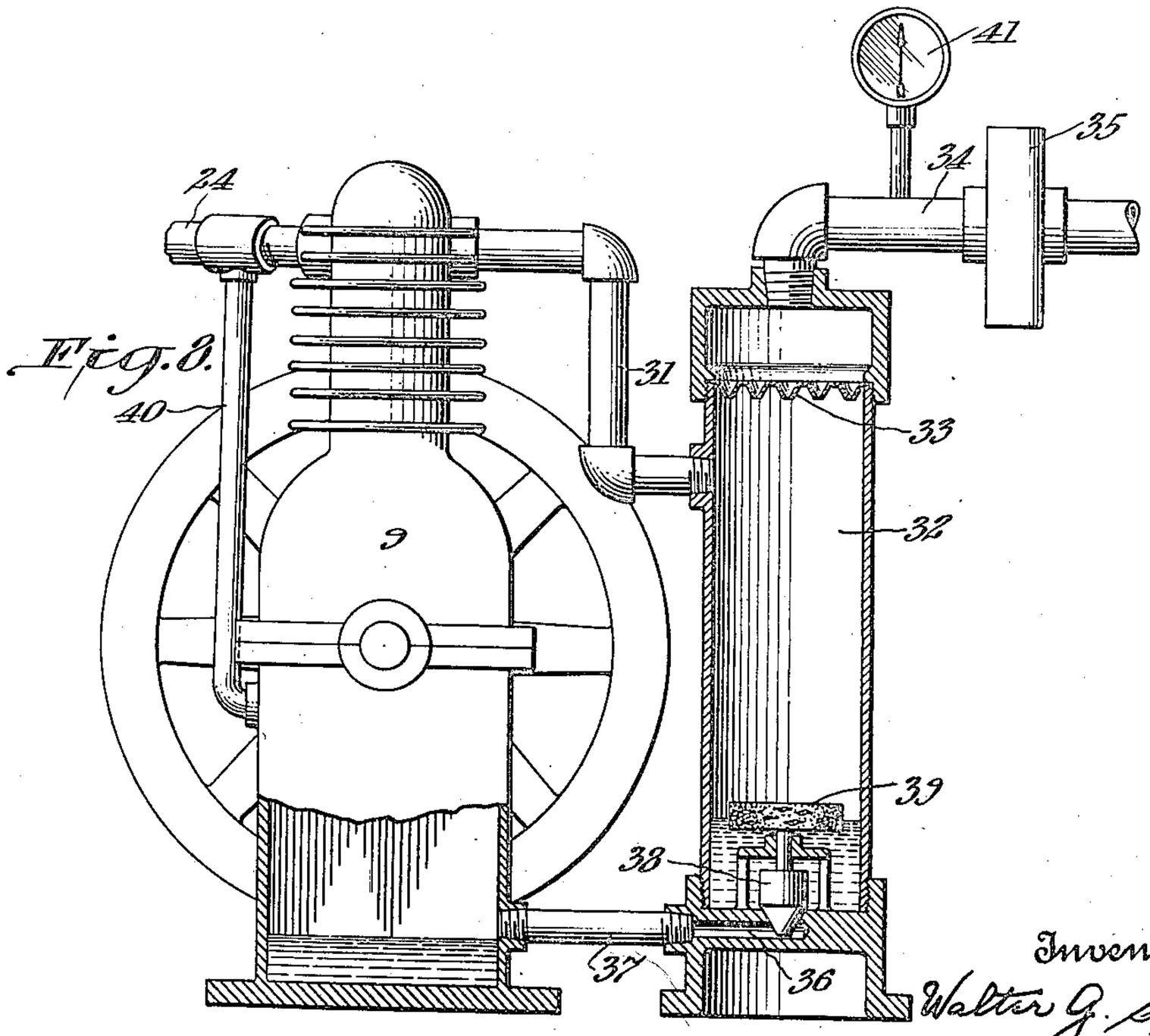



Fig. 8.

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Patented Jan. 2, 1923. 1,440,935

# UNITED STATES PATENT OFFICE.

WALTER G. SEE, OF KANSAS CITY, MISSOURI.

## REFRIGERATING APPARATUS.

Application filed March 28, 1922. Serial No. 547,530.

*To all whom it may concern:*

Be it known that I, WALTER G. SEE, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

My invention relates to refrigerating apparatus and particularly to the small self-contained units intended for use with domestic refrigerators of the type commonly known as "iceless refrigerators."

It is an object of this invention to improve the construction of refrigerating apparatus of the type used with iceless refrigerators. An object of this invention is to provide an efficient condenser for use in refrigerating apparatus of the type stated. An object is to provide a refrigerating apparatus which will not be dependent upon air-cooling or upon water circulation for dissipating the heat of compression of the refrigerant during the running of the compressor. A further object of the invention is to provide a refrigerating apparatus which includes an efficient oil separator.

Other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings.

In the drawings which illustrate certain embodiments of my invention;

Fig. 1 is a perspective view of a refrigerator box to which my invention is applied;

Fig. 2 is a vertical section through the refrigerator box and my refrigerating apparatus, and taken on line 2—2 of Fig. 3;

Fig. 3 is a similar vertical section and taken on line 3—3 of Fig. 2;

Fig. 4 is a perspective view of the plate which supports the compressor-condenser apparatus;

Fig. 5 is a fragmentary horizontal section taken through the condenser tank and above the condenser coil;

Fig. 6 is a detail partly in section showing the construction of the condenser pipe and the outlet therefrom;

Fig. 7 is a fragmentary vertical section through another form of my apparatus; and

Fig. 8 is an elevation, partly in section, of the compressor and oil separator shown in Fig. 7.

In the drawings, the refrigerator box with which my refrigerating apparatus is used is designated by the numeral 1, and as here shown the box 1 is of the usual domestic type and includes a refrigerating compartment 2 and a plurality of food receiving compartments 3. The refrigerator box 1 may be of any desired construction and it may be a separately formed unit such as customarily employs ice for the cooling medium or it may be originally designed and manufactured for use with refrigerating apparatus embodying my invention. In the apparatus the expansion or refrigerating coil 4 is located in a brine tank 5 which is arranged in the refrigerating compartment 2 of the box 1, and the brine tank 5 is preferably provided with an interior chamber 6 having racks for the reception of molds for forming ice for table or other use. The other elements of the apparatus are carried upon a base 7 which rests upon the top of the refrigerator box 1, it being obvious however that the top of the refrigerator box may constitute the supporting base, if desired. The motor 8, compressor 9 and condenser tank 10 are mounted upon a plate 11, which as is best shown in Fig. 4 has openings therethrough for the free circulation of air. The plate 11 is spaced from the base 7 by resilient means such as springs 12 which deaden the vibration set up by the moving parts during the operation of the compressor.

The condenser tank 10 is preferably formed with outer walls which as viewed in plan form a rectangle having sides which are flush with the edges of the plate 11, and with inner walls which, in plan view, are also rectangular. This construction provides a passage extending vertically through the tank 10 within which passage the motor and compressor are arranged, and for convenience of description in the specification and claims a tank embodying this construction will be termed as having the form of a "double walled shell." The tank 10 contains a supersaturated solution of a chemical salt or salts having a high latent heat of solution, such for example, as ammonium chlorid or ammonium nitrate, or a mixture of these salts. Within the condenser tank 10

is located the condenser pipe which is preferably in the form of an endless or closed coil 13 having a gas inlet pipe 14 and a liquid outlet pipe 15 connected thereto. At the point where the pipe 15 is connected, the coil 13 is provided with a depression 16 so that the pipe 15 which extends into the coil 13 may have its mouth located at the level of the bottom of the main portion of the coil 13. The pipes 14, 15 extend upwardly from the coil 13 and pass through the top of the tank 10, the joints between the pipes and the tank being hermetically sealed, preferably by bushings 17, 17 which are welded or brazed both to the tank and to the respective pipes. The filling opening of the tank 10 is preferably provided with a cap 18 for hermetically sealing the tank to prevent evaporation of the solution. The pipe 14 is connected to the high pressure side of the compressor by a pipe 19 having a stopcock 20, and the pipe 15 is connected with the expansion coil 4 by a pipe 21 which is provided with a stopcock 22 and an expansion valve 23. The refrigerant circuit is completed by a pipe 24 which connects the low pressure side of the expansion coil 4 with the low pressure side of the compressor 9.

The motor 8 which is connected to an electric light socket by means of the usual flexible conductors and detachable plug, not shown, is automatically controlled by a thermostat 25 arranged on the brine tank 5 near the outlet end of the expansion coil 4, the details of this automatic control being well known in the art and forming no part of my invention.

For the double purpose of avoiding the unsightly appearance of the parts of the apparatus which are mounted above the top of the refrigerator box and of providing an efficient circulation of air around these parts, a ventilated cover 27 is mounted on the base 7 and encloses the condenser tank 10 and associated parts. The cover 27 which is provided with screened openings 28 near the bottom thereof and with a screened top opening 29 conforms in general shape and finish to the design of the refrigerator box 1. If desired a protecting screen 30 may be arranged over the moving parts of the apparatus and mounted on the condenser tank 10.

In Figs. 7 and 8 is illustrated a form of my apparatus which includes an efficient separator for removing the lubricant from the refrigerator. In general, the construction is similar to that above described and includes a motor 8, a compressor 9 and a condenser tank 10 which are carried by a plate 11'. A condenser coil 13 is located in the tank 10 and pipes 21 and 24 connect the expansion coil which is located in brine tank 5 with pipe 15 and with the inlet side of the compressor 9, respectively. The high pressure side of the compressor is connected by a pipe 31 to an intermediate portion of separating chamber 32 which has a cross sectional area materially greater than that of pipe 31. This enlargement in the refrigerant line causes a reduction in the velocity of the mixture of refrigerant gas and lubricant which permits the liquid lubricant to settle to the bottom of the chamber 32. The refrigerant gas moves upward through a perforated plate or screen 33 which removes the last traces of the lubricant and passes out through the pipe 34 and check valve 35 to the inlet pipe 14 of the condenser coil 13. The bottom of the chamber 32 is provided with a passage 36 which communicates with the crank case of the compressor 9 by means of a pipe 37, the opening from the chamber 32 into the passage 36 being controlled by a valve 38 having a float 39 connected thereto. A by-pass 40 establishes communication between the crank case and the pipe 24 which leads to the low pressure side of the compressor. A pressure gauge 41 may be located in the high pressure line that runs from the condenser, and preferably between the separating chamber 32 and the check valve 35. When the compressor is running the pressure in the chamber 32 will hold the valve 38 to its seat even though the level of the lubricant rises above the float 39. When the compressor stops the leakage of gas under high pressure through the pipe 31 and past the valves of the compressor into the pipe 24 and by-pass 40 allows the pressures in the chamber 32 and the crank case to become equalized. When the pressures are equalized the float 39 will lift the valve 38 from its seat and allow the lubricant to flow from the separating chamber into the crank case of the compressor.

The operation of the refrigerating apparatus is similar, in a general way, to that of previous forms of apparatus of this type. When the temperature in the brine tank 5 rises above a predetermined point the thermostat 25 cuts in the motor 8 and the compressor forces gas under high pressure into the condenser coil 13 where it is liquefied. The refrigerant then passes through the expansion valve 23 and expands in the coil 4 thus absorbing heat from the brine in the tank 5. When the temperature of the brine has fallen to a predetermined point the thermostat cuts off the motor 8, thus completing one cycle of operation.

As the refrigerant condenses in the coil 13 the heat of compression is taken up in part by the rise in temperature of the solution in the tank 10 and also by the latent heat of solution of the chemical or chemicals which go into solution as the temperature rises. The liquefaction point of the refrigerant rises with the temperature in the condenser

coil and it is obvious that the temperature of the coil must be kept below the point where the corresponding liquefaction pressure would cause overloading of the motor 8. By using a solution of heat absorbing material in the tank 10 the heat of compression of the refrigerant may be taken up without causing an undue rise in the temperature of the condenser coil. The following specific example will illustrate the operation of my apparatus but it is to be understood that the invention is not limited either to the particular sizes of parts specified or to the particular solution described. Working with sulfid dioxid as the refrigerant and with a one-third horsepower motor for running the compressor I have found that by using a single coil of one and one-half inch pipe for the condenser and a condenser tank holding 100 pounds of water and 50 pounds each of ammonium chlorid and ammonium nitrate that the compressor will be in operation not more than one-third of the time on extremely hot summer days and that the temperature of the solution in the tank will not rise more than about 10 degrees Fahrenheit at any run of the compressor. During the rest periods of the compressor the air circulation which is promoted by the ventilated cover 27 and the plate 11 cools off the tank 10 and the solution therein, the salts which went into solution on the rise in temperature being precipitated out of the solution. Without heat absorbing salts in the solution this quantity of water would have attained a temperature so high that the liquefaction pressure of the refrigerant would have risen above the point where the load could have been handled by the motor. By using salts having a high latent heat of solution it is possible to use a relatively small condenser tank without necessitating the use of a larger motor than that ordinarily used with condensers which are cooled by water circulation. The advantage of this construction is obvious since it provides a compact refrigerating apparatus which requires no permanent connection to the house fixtures, the only connection being a readily detachable one to an electric light socket. The apparatus may be located in places which are too warm to allow use of refrigerators which are dependent upon air cooling of the condenser since the air cooling of the heat absorbing solution of my device takes place during the relatively long periods when the compressor is at rest instead of during the shorter periods of operation of the compressor. Since the condenser tank 10 is hermetically sealed no evaporation of the solution can take place and the tank therefore requires no attention during the operation of the apparatus. The only parts of the apparatus which need attention are the motor and compressor and these elements can remain in use for a long period before any overhauling is needed.

While the embodiments described are the preferred forms of my apparatus it is to be understood that they are but illustrative of my invention and that various changes in the parts, their relative sizes, shapes, proportions and locations may be made without departing from the spirit of my invention.

I claim:

1. In a refrigerating apparatus, an expansion coil, a condenser, and means for circulating a refrigerant from said expension coil to said condenser, said condenser comprising a condenser tank containing a supersaturated solution of a chemical having a high latent heat of solution, and a condenser pipe located in heat conductive relation to the solution in said tank.

2. In a refrigerating apparatus, an expansion coil, a condenser, and means for circulating a refrigerant from said expansion coil to said condenser, said condenser comprising a condenser tank containing a supersaturated solution of a chemical having a high latent heat of solution, and a condenser pipe located in said tank.

3. In a refrigerating apparatus, an expansion coil, a condenser, and means for circulating a refrigerant from said expansion coil to said condenser, said condenser comprising a condenser tank containing a supersaturated solution of a chemical having a high latent heat of solution, and an endless condenser coil having a continuous passage therethrough and located in the bottom of said tank.

4. A refrigerating apparatus comprising a plate, a motor and a compressor mounted on said plate, a condenser tank mounted on said plate and containing a supersaturated solution of a chemical having a high latent heat of solution, a condenser pipe located in said tank, an expansion coil, and pipes completing the refrigerant circuit.

5. A refrigerating apparatus as claimed in claim 4, in which the condenser tank comprises a double walled shell.

6. A refrigerating apparatus comprising a base, a plate supported on and spaced from said base, said plate having ventilating openings therethrough, a motor and compressor mounted on said plate, a sealed condenser tank mounted on said plate and containing a supersaturated solution of a chemical having a high latent heat of solution, a condenser pipe located in said tank, an expansion coil, and pipes completing the refrigerant circuit.

7. In a refrigerating apparatus, an expansion coil, a base adapted to be placed on the top of a refrigerator box, a plate having ventilating openings therethrough, resilient means supporting and spacing said plate from said base, a motor and compressor

mounted on said plate, a condenser tank mounted on said plate and having the form of a double walled rectangular shell surrounding said motor and compressor, said tank containing a supersaturated solution of a chemical having a high latent heat of solution, a condenser coil located in said tank, pipes completing the refrigerant circuit and a ventilated cover mounted on said base and enclosing said motor-compressor-condenser elements.

In testimony whereof I affix my signature.

WALTER G. SEE.