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H. D. POWNALL
REFRIGERATING APPARATUS

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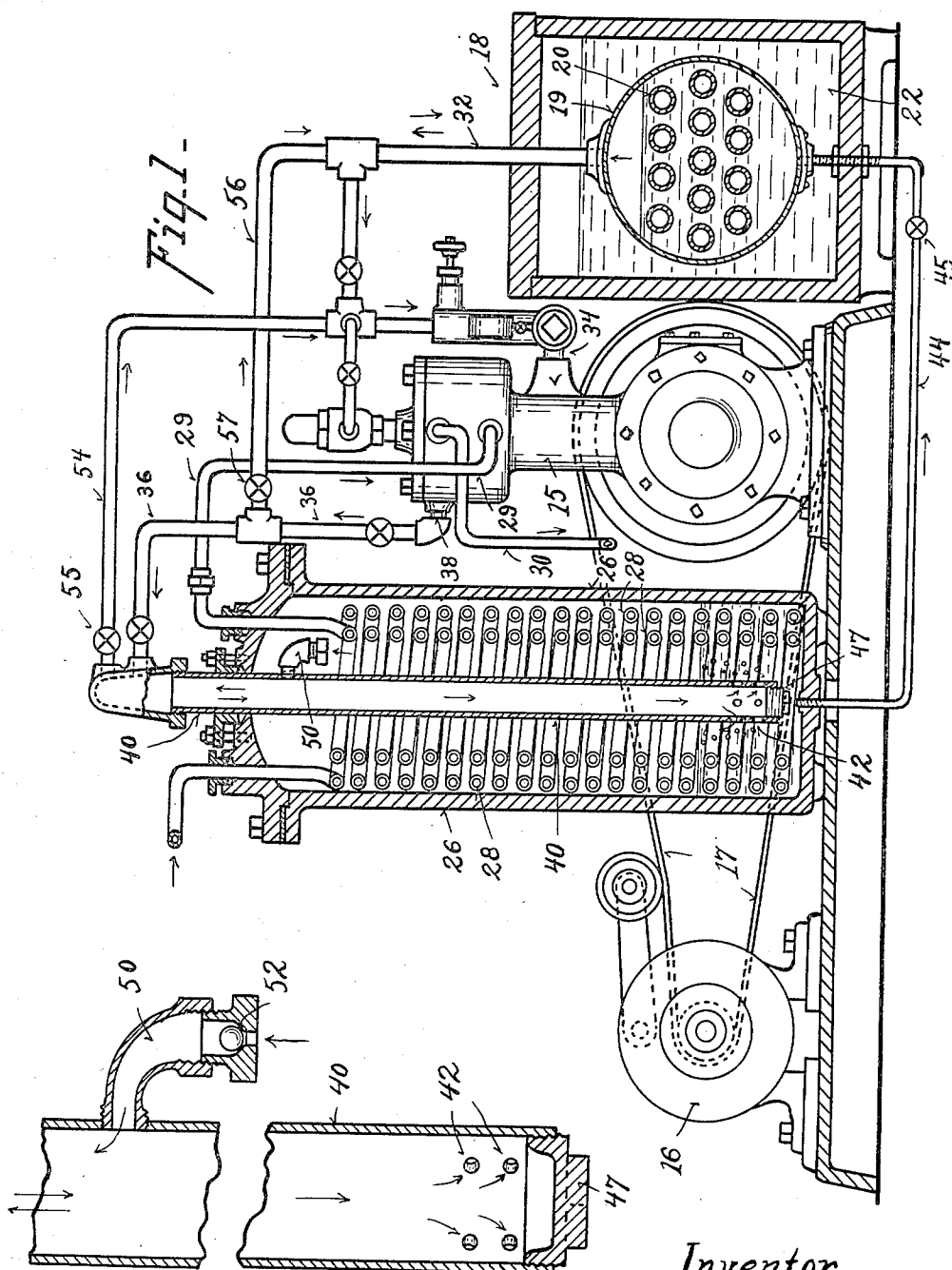


Fig. 2-

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UNITED STATES PATENT OFFICE.

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REFRIGERATING APPARATUS.

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To all whom it may concern:

Be it known that I, HENRY D. POWNALL, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

My invention relates to improvements in artificial refrigerating apparatus. One of its objects is to provide improved means to condense the heated refrigerant as it leaves the compressor. Another object is to enable a condenser of relatively small dimensions to be efficiently employed. Another object is to provide an improved condenser adapted to receive and store the entire charge of refrigerant while the refrigerator or brine cooler is undergoing repairs or replacement. Another object is to provide improved means to enable the refrigerant to be entirely removed from the condenser using the refrigerating compressor as a means of transfer. My invention also comprises certain details of form and combination of components, all of which will be fully set forth in the description of the accompanying drawings in which:

Fig. 1 a side elevation partly in section of an artificial refrigerating apparatus embodying my invention.

Fig. 2 is an enlarged sectional detail of the conduit through which the refrigerant gas enters or leaves the condenser chamber.

The accompanying drawings illustrate the preferred embodiment of my invention, in which 15 represents a gas or refrigerant compressor, preferably driven from a motor 16 by means of a belt 17. An evaporating or refrigerating unit 18 may be of any approved type. As illustrated the refrigerator is of the flooded or submerged type, comprising a cylindrical container 19 provided with a series of flue tubes 20 extending from end to end thereof and open to the brine chamber 22 at both ends. The flues 20 within the container 19 are designed to be submerged in a body of liquefied refrigerant maintained in the container 19 under operating conditions. The container 19 is located within the chamber 22 of a refrigerator or brine cooler 18, being submerged under operating conditions in a body of brine maintained in said brine cooler 18. The cool brine from the brine cooler 18 is applied to any useful refrigerating purpose desired.

A refrigerant condenser comprises a container 26 in which is a coil of pipe 28. Cooling water is circulated through the coil of pipe 28, and thence is led by pipe 29 to the water jacket of the compressor 15, and thence by a pipe 30 to a sewer or other waste receptacle.

The liquefied refrigerant in the container 19 vaporizes at low temperatures, and its vapor or gas is taken from container 19 through a conduit 32 to the gas intake end 34 of the compressor. After the refrigerant gas has been compressed in the compressor it is conducted in a highly heated condition through a conduit 36 from the exit end 38 of the compressor to the upper end of the condenser where it is discharged into the upper end of a vertical tube 40, and flows downwardly within the tube 40 and escapes therefrom into the interior of the condenser chamber through a series of relatively small perforations 42 near the lower end of the tube 40. After the heated refrigerant gas enters the condenser chamber under pressure it comes in contact with the exterior of the water-cooled coil 28, where the heat is exchanged into the water and carried away, whereupon the gaseous refrigerant becomes liquefied and accumulates as a body of liquefied refrigerant in the lower portion of the condenser, which thereupon serves as a storage reservoir for such body of liquefied refrigerant until the liquefied refrigerant is again transferred through the conduit 44, and controlling valve 45 to the brine cooler 19.

For the purpose of inspecting and repairing or replacing the refrigerating member 18 or parts thereof, it is desirable to pump all of the refrigerant from the refrigerator member 19, and store it chiefly as a liquid in the condenser chamber 26, thereby causing the chamber 26 to be nearly filled with liquid refrigerant instead of only partially filled with liquefied refrigerant as under normal operating conditions. In order that the condenser chamber may be nearly filled with liquefied refrigerant without causing excessive or dangerous pressures in the compressor or in the condenser, I lead the gas intake conduit 40 down to the lower end of the chamber 26 where it dips into the liquefied refrigerant and closes the lower end of said conduit 40 by means of a cap or plug 47, thereby causing the refrigerant gas entering the chamber 26 to issue into the lique-

fied refrigerant in the chamber 26 in a finely divided state through the small perforations 42, and to rise in the form of bubbles through the liquefied refrigerant, thereby parting with the major portion of its heat directly to the liquefied refrigerant, which in turn is enabled to more readily exchange the heat into the condensing water than where the heated refrigerant gas comes directly into contact with the condensing coil 28. I am thus enabled to continue to pump heated refrigerant gas into the condenser even though the condenser chamber is nearly filled with liquefied refrigerant, without materially increasing the pressure in said condenser or in the compressor. I am also in this manner enabled to attain satisfactory normal operating conditions using a relatively smaller condenser than it would be otherwise necessary to employ, thereby effecting a material saving.

For the purpose of inspecting and repairing or replacing the condenser or any of its members, it is desirable to be able to pump practically all of the refrigerant through the compressor 15 into the refrigerator chamber 19, where the refrigerant can be stored until the condenser has been repaired or replaced ready to again receive all or part of the refrigerant. As the compressor 15 acts only as a gas pump and not as a liquid pump it would not be practical to pump the liquefied refrigerant through the compressor 15 into the refrigerant chamber 19. I, therefore, provide a branch conduit 50 leading from the side of the conduit 40 inside of the chamber 26 and into the upper end of said chamber 26 above the high level of liquid refrigerant in chamber 26. Said branch conduit 50 is provided with a ball or other check valve 52 which serves to prevent an escape of refrigerant from conduit 40 into the upper end of chamber 26 when the compressor is employed to pump refrigerant through conduit 40 into the chamber 26, and forces the gas to issue into chamber 26 through the ports 42 at the lower end of the conduit 40. When it is desired to pump the refrigerant from chamber 26 into the refrigerator chamber 19, a by-pass conduit 54 controlled by a valve 55, is employed to connect the upper end of the conduit 40 with the intake end 34 of the compressor, while a by-pass conduit 56 controlled by a valve 57 is employed to connect the exit end 38 of the compressor with the refrigerant chamber 19, whereupon the compressor being operated, takes its supply of gaseous refrigerant from the upper end of chamber 26, above the level of liquefied refrigerant in the chamber 26, through the check valves 52 and branch conduit 50 into conduit 40, and thence through by-pass conduit 54 to the compressor and

through by-pass conduit 56 to the refrigerating chamber 19, causing the liquefied refrigerant in chamber 26 to be slowly vaporized and then transferred to chamber 19 where it is again liquefied and stored.

My invention is particularly serviceable when applied to refrigerating units of relatively small capacity, but is applicable with advantage to units of larger capacity. If desired a check valve may also be employed in conduit 40 below the intake 50 to insure a one way flow therein.

The apparatus herein shown and described is capable of considerable modification within the scope of the claims without departing from the spirit of my invention.

What I claim is:

1. A refrigerating apparatus comprising a refrigerator member, a compressor, a condenser chamber into which heated gaseous refrigerant is discharged to be condensed and in which liquefied refrigerant is stored, a cooling member into which heat from the heated refrigerant in the condenser is exchanged, a valve controlled refrigerant conduit through which heated gaseous refrigerant from the compressor is discharged into the lower portion of the condenser below the surface of the liquefied refrigerant in said condenser, and through which gaseous refrigerant may be conducted from near the top of said condenser and above the surface of liquefied refrigerant in said condenser to said compressor, and valve controlled conduits through which gaseous refrigerant may be conducted selectively through said compressor from said refrigerator member to said condenser or from said condenser member to said refrigerator member.

2. A refrigerating apparatus comprising a refrigerator member, a compressor, a condenser chamber into which heated gaseous refrigerant is discharged to be condensed and in which liquefied refrigerant is stored, a cooling member into which heat from the heat refrigerant in the condenser is exchanged, a conduit leading through said condenser chamber from the upper end thereof to near the bottom thereof and provided near its lower end with restricted exit ports to discharge heated gaseous refrigerant from the compressor in a finely divided state into said condenser chamber below the surface of the liquefied refrigerant therein, and provided inside of said condenser chamber and near the upper end thereof with a valve controlled port through which gaseous refrigerant from above the surface of the liquefied refrigerant therein may be conducted from the condenser chamber to the compressor, and valve controlled conduits through which gaseous re-

frigerant may be conducted selectively through said compressor from said refrigerator member to said condenser or from said condenser member to said refrigerator member.

3. A refrigerating apparatus comprising a refrigerator member, a compressor, a condenser chamber into which heated gaseous refrigerant is discharged to be condensed and in which liquefied refrigerant is stored, a cooling coil through which condensing water is adapted to be circulated and into which heat from the heated refrigerant in the condenser is exchanged, a valve controlled refrigerant conduit through which heated gaseous refrigerant from the compressor is discharged into the lower portion of the condenser below the surface of the liquefied refrigerant in said condenser and through which gaseous refrigerant may be conducted from near the top of said condenser and above the surface of liquefied refrigerant in said condenser to said compressor and valve controlled conduits through which gaseous refrigerant may be conducted selectively through said compressor from said refrigerator member to said condenser or from said condenser member to said refrigerator member.

4. A refrigerating apparatus comprising a refrigerator member, a compressor, a con-

denser chamber into which heated gaseous refrigerant is discharged to be condensed and in which liquefied refrigerant is stored, a cooling coil through which condensing water is adapted to be circulated and into which heat from the heated refrigerant in the condenser is exchanged, a conduit leading through said condenser chamber from the upper end thereof to near the bottom thereof and provided near its lower end with restricted exit ports to discharge heated gaseous refrigerant from the compressor in a finely divided state into said condenser chamber below the surface of the liquefied refrigerant therein, and provided inside of said condenser chamber and near the upper end thereof with a valve controlled port through which gaseous refrigerant from above the surface of the liquefied refrigerant therein may be conducted from the condenser chamber to the compressor, and valve controlled conduits through which gaseous refrigerant may be conducted selectively through said compressor from said refrigerator member to said condenser or from said condenser member to said refrigerator member.

In testimony whereof I have hereunto affixed my signature.

HENRY D. POWNALL.