

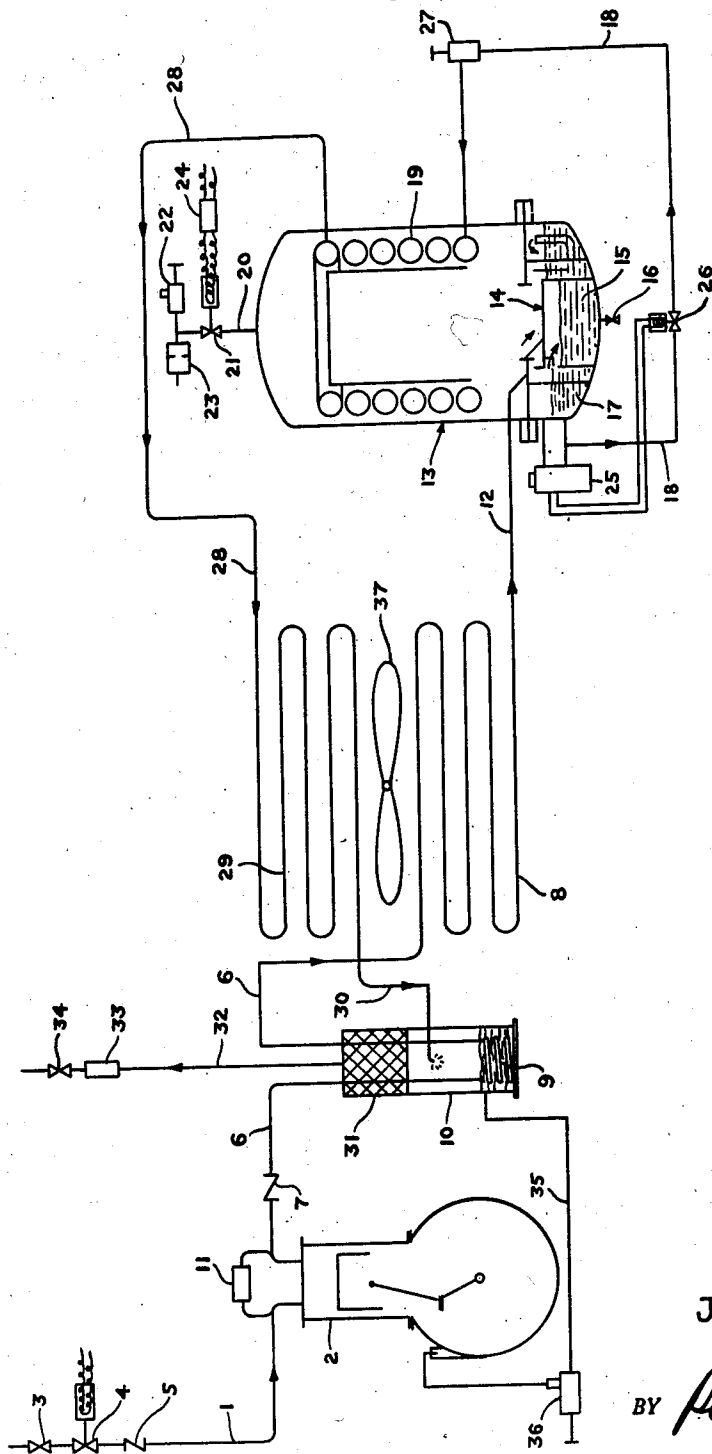
March 15, 1949.

J. R. ZWICKL

2,464,631

PURGING SYSTEM FOR REFRIGERATION SYSTEMS

Filed Nov. 9, 1946



J. R. ZWICKL
INVENTOR.

BY *Robert Meyer*
attorney

UNITED STATES PATENT OFFICE

2,464,631

PURGING SYSTEM FOR REFRIGERATION SYSTEMS

Joseph R. Zwickl, East Orange, N. J., assignor to
Worthington Pump and Machinery Corporation,
Harrison, N. J., a corporation of Delaware

Application November 9, 1946, Serial No. 708,840

9 Claims. (Cl. 62-115)

1

This invention relates to purging systems for refrigeration plants and more particularly to means for removing impurities, such as oil, which are soluble in the refrigerant.

While the present invention may be used in various purge systems, it is particularly adapted to improve the operation of the system disclosed in the inventor's prior Patent No. 2,400,620, issued May 21, 1946. This patent discloses a purge circuit in which the gases are led from the foul gas header of the main condenser to a purge compressor, from the compressor through an oil collector or separator to a condenser, and from the condenser to a separator drum wherein the refrigerant, water, and non-condensable gases are separated. Effective separation of the oil is not always obtained in this circuit, however, due to the fact that the gases leaving the compressor are at such a pressure that they are prone to condense or liquify before leaving the oil collector. The condensate which collects in the oil collector may be discharged back into the crankcase of the compressor where it vaporizes and otherwise interferes with the operation of the compressor.

It is the object of the present invention to eliminate this undesirable feature and to provide means for effectively withdrawing the oil, or other soluble impurities, from the refrigerant. This is accomplished by vaporizing the refrigerant received from the separator drum and passing the mixture of gas and liquid oil into a trap or collector wherein the oil is collected while the refrigerant vapor passes through to be guided back to the main refrigeration system. The collector contains a coil through which the hot compressed gases pass after leaving the compressor. This heats the oil in the separator and prevents re-absorption of the refrigerant. The evaporator is positioned adjacent to the condenser so that the heat released in the condensing stage may be utilized in the evaporation stage.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawing, showing a purging system for refrigeration plants of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

The drawing is a schematic diagram of a purge system embodying the improved means for removing soluble impurities from the refrigerant.

Refrigerant vapor containing impurities is drawn from the condenser (not shown) of the

2

main refrigeration plant through the inlet line 1 by the purge compressor 2. Suitable valves such as manually operated valve 3, solenoid operated valve 4, and check valve 5 are placed in conduit 1 to control the flow of gases therethrough. An outlet line 6, having the check valve 7, connects the compressor 2 with a suitable condenser 8 but permits the heated, compressed gases to pass through a coil 9 in the collector 10 prior to reaching the condenser 8.

The compressor 2 is controlled by a pressure actuated switch structure 11 of approved construction which is connected to the compressor motor (not shown) and to the inlet and outlet lines 1 and 6 so that the compressor will operate only within predetermined limits of pressure in the lines 1 and 6.

The refrigerant vapor and condensable impurities such as water vapor are substantially all condensed in the condenser 8 and the condensate together with the non-condensibles passes through the line 12 into the lower portion of the purge or separator drum 13. The lower portion of the drum 13 contains a separator structure 14, fully described in the previously mentioned Patent No. 2,400,620, which utilizes the difference in densities to separate the liquid refrigerant from the condensed impurities, such as water. The water is collected in the inner chamber 15 having an outlet 16 and the liquid refrigerant is collected in the outer annular chamber 17 having an outlet line 18. The non-condensable gases entering the drum 13 with the liquid constituents rise and fill the remaining portion of the drum and carry with them a certain amount of non-condensed refrigerant and water vapor. These gases contact the strip condenser 19 within the drum 13 and are effectively stripped of the refrigerant and water which condense and fall into the separator structure 14 where they are collected in chambers 15 and 17.

The upper portion of the drum 13 has an outlet line 20 in which are placed a solenoid operated valve 21, a needle valve 22, and an orifice 23. The solenoid valve 21 is operated by a suitable pressure switch 24 to control the release of non-condensable gases and to maintain the pressure in the drum 13 within predetermined limits. Normally, the orifice 23 prevents rapid escape of gases from the drum and therefore increases the duration of the strip condensing stage, but rapid venting may be obtained by opening the needle valve 22, which is placed between the orifice 23 and the solenoid valve 21.

The separated refrigerant collected in chamber 17 is used as a cooling medium for the strip condenser 19. A float valve structure 25, of suitable construction, is connected to a solenoid operated valve 26 in the line 18 to control discharge of liquid refrigerant from chamber 17 in accordance with its level therein. The outlet line 18 also has an expansion needle valve 27 which controls the flow of the expanded cold refrigerant through the strip condenser 19.

The separated refrigerant leaving the strip condenser 19 by means of pipe 28 is substantially all liquid because of the small quantity of heat released by the constituents not condensed in condenser 8 and may contain soluble impurities such as oil which may have been picked up in the purge compressor 2. To separate the oil from the refrigerant the line 28 carries them to a suitable evaporator 29 wherein the refrigerant is vaporized while the oil, or other impurity less volatile than the refrigerant, remains liquid. The mixture of refrigerant vapor and oil passes through the pipe 30 and is discharged into a suitable trap or collector 10, which may be purchased on the open market, wherein the oil settles to the bottom. The vapor rises through the Raschig rings, or tortuous baffle means, which removes any remaining traces of liquid particles and flows back to the main refrigeration system through the outlet line 32, constant back pressure valve 33, and manually operated valve 34.

The oil collected in the separator 10 may be returned to the crankcase of the compressor 2 through the line 35. The passage therethrough may be controlled by suitable means such as a needle valve 36 or a float valve structure (not shown). As previously mentioned the oil in the collector 10 is heated by means of the compressed gases passing through the coil 9 therein, though other heating means could be employed to the end that the refrigerant will not be absorbed in the oil.

While any suitable type of condenser and evaporator may be used in the purge system, it has been found to be particularly efficient to use an air-blast condenser-evaporator as schematically illustrated in the drawing. In this structure the condenser 8 is cooled with air driven by the fan 37 which may be connected to the compressor motor. The air which is heated by contact with the condenser is then passed over the evaporator 29 and supplies the heat for vaporizing the refrigerant passing through its coils.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a purging system for removing impurities from a volatile refrigerant of a refrigeration plant, means for removing impurities soluble in but less volatile than the refrigerant including an evaporator for vaporizing the refrigerant, a collector connected to said evaporator for collecting and separating impurities from the vaporized refrigerant, and means connected to said collector for returning the refrigerant vapor to the main refrigeration system, said last mentioned means including tortuous baffle means to prevent the passage therethrough of liquid particles.

2. In a refrigeration plant employing a volatile refrigerant and having a purge system containing a compressor, a condenser, means for sepa-

rating the condensibles and non-condensibles from the refrigerant, and connections for the flow of the refrigerant and impurities from the compressor to the condenser to the means; the means for removing oil from the refrigerant including an evaporator for vaporizing the refrigerant, means for delivering the separated refrigerant to said evaporator, a collector connected to said evaporator wherein the oil is separated from the vaporized refrigerant, means for heating the oil collected in said collector, said means comprising a coil immersed in the oil and having an inlet and outlet inserted in the connection between the compressor and the condenser whereby the compressed gases flow through said coil, means connected to said collector for returning the refrigerant vapor to the main refrigeration system, and means for delivering the oil collected in said collector to the crankcase of the compressor.

3. In a refrigeration plant employing a volatile refrigerant and having a purge system containing a compressor, a condenser, means for separating the condensibles and non-condensibles from the refrigerant, and connections for the flow of the refrigerant and impurities from the compressor to the condenser to the means; the means for removing oil from the refrigerant including an evaporator for vaporizing the refrigerant, a connection between said evaporator and the separating means for delivering separated refrigerant and impurities dissolved therein to said evaporator, a collector connected to said evaporator for collecting and separating the oil from the vaporized refrigerant, means for heating the oil collected in said collector, means connected to said collector for returning the refrigerant to the main refrigeration system, and means for delivering the oil collected in said collector to the crankcase of the compressor.

4. In a refrigeration plant employing a volatile refrigerant and having a purge system which includes a compressor, an air-blast condenser, means for separating the condensibles and non-condensibles from the refrigerant, and connections for delivering refrigerant and impurities from the compressor to the condenser and from the condenser to the separating means; the means for removing oil from refrigerant including an evaporator for vaporizing the refrigerant, means for delivering the separated refrigerant from the separating means to the evaporator, a collector connected to said evaporator for separating and collecting the oil from the vaporized refrigerant, said evaporator being positioned adjacent to the air blast condenser whereby the heat removed from the constituents flowing through said condenser will be utilized to vaporize refrigerant flowing through the evaporator, and means connected to said collector for returning the refrigerant vapor to the main refrigeration system.

5. In a refrigeration plant employing a volatile refrigerant and having a purge system which includes a compressor, an air-blast condenser, means for separating the condensibles and non-condensibles from the refrigerant, and connections for delivering refrigerant and impurities from the compressor to the condenser and from the condenser to the separating means; the means for removing oil from the refrigerant which comprises an evaporator for vaporizing the refrigerant, said evaporator being positioned adjacent to the air-blast condenser whereby the heat removed from the constituents flowing through said condenser will be utilized to vapor-

ize refrigerant flowing through the evaporator, a connection between said evaporator and the separating means for delivering separated refrigerant and impurities dissolved therein to said evaporator, a collector connected to said evaporator for collecting and separating the oil from the vaporized refrigerant, means for heating the oil collected in said collector, said means comprising a coil immersed in the oil and having its inlet and outlet in the connection between the compressor and the condenser whereby the compressed gases flow through said coil, means connected to said collector for returning the refrigerant vapor to the main refrigeration system, said means including tortuous baffle means to prevent the passage therethrough of liquid particles, and means for delivering the oil collected in said collector to the crankcase of the compressor.

6. In a refrigeration plant employing a volatile refrigerant and having a purge system containing a compressor, a condenser, means for separating the condensibles and non-condensibles from the refrigerant, and connections for the flow of the refrigerant and impurities from the compressor to the condenser; means for removing oil from the refrigerant including an evaporator for vaporizing the refrigerant, means for delivering the separated refrigerant to said evaporator, a collector connected to said evaporator wherein the oil is separated from the vaporized refrigerant, means for heating the oil collected in said collector, said means comprising a coil immersed in the oil and having an inlet and outlet inserted in the connection between the compressor and the condenser whereby the compressed gases flow through said coil.

7. In a purging system for removing impurities from a volatile refrigerant in a refrigeration plant, means for removing impurities soluble in but less volatile than the refrigerant including an evaporator for vaporizing the refrigerant, a collector connected to said evaporator for collecting and separating impurities from the vaporized refrigerant, means in said collector for heating the vaporized refrigerant and soluble less volatile impurities to advance separation thereof, and independent outlets from said collector for the vaporized refrigerant and impurities.

8. In a purging system for removing impurities from a volatile refrigerant of a refrigeration plant, means for removing impurities soluble in

but less volatile than the refrigerant including a purge compressor for receiving refrigerant from the main refrigerating system, an evaporator for vaporizing the refrigerant, a collector connected to said evaporator for collecting and separating impurities from the vaporized refrigerant, a conduit in said collector having its inlet connected to the discharge of the compressor for conducting heated compressed refrigerant through the collector, means for returning refrigerant flowing through said conduit to said collector in isolated separation from the refrigerant flowing through the conduit whereby the refrigerant flowing through the conduit will heat the returning refrigerant to advance separation of refrigerant and soluble less volatile impurities, said collector having an outlet for the refrigerant and a separate outlet for the impurities.

9. In a purging system for removing impurities from a volatile refrigerant of a refrigeration plant, means for removing impurities soluble in but less volatile than the refrigerant including a purge compressor for receiving refrigerant from the main refrigerating system, an evaporator for vaporizing the refrigerant, a collector connected to said evaporator for collecting and separating impurities from the vaporized refrigerant, a conduit in said collector having its inlet connected to the discharge of the compressor for conducting heated compressed refrigerant through the collector, means for returning refrigerant flowing through said conduit to said collector in isolated separation from the refrigerant flowing through the conduit whereby the refrigerant flowing through the conduit will heat the returning refrigerant to advance separation of refrigerant and soluble less volatile impurities, said collector having an outlet for the refrigerant and a separate outlet for the impurities, and tortuous baffle means in said collector adjacent to the refrigerant outlet to prevent the passage of liquid particles therethrough.

JOSEPH R. ZWICKL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,246,244	Consley	June 17, 1941
2,314,516	Phillips	Mar. 23, 1943