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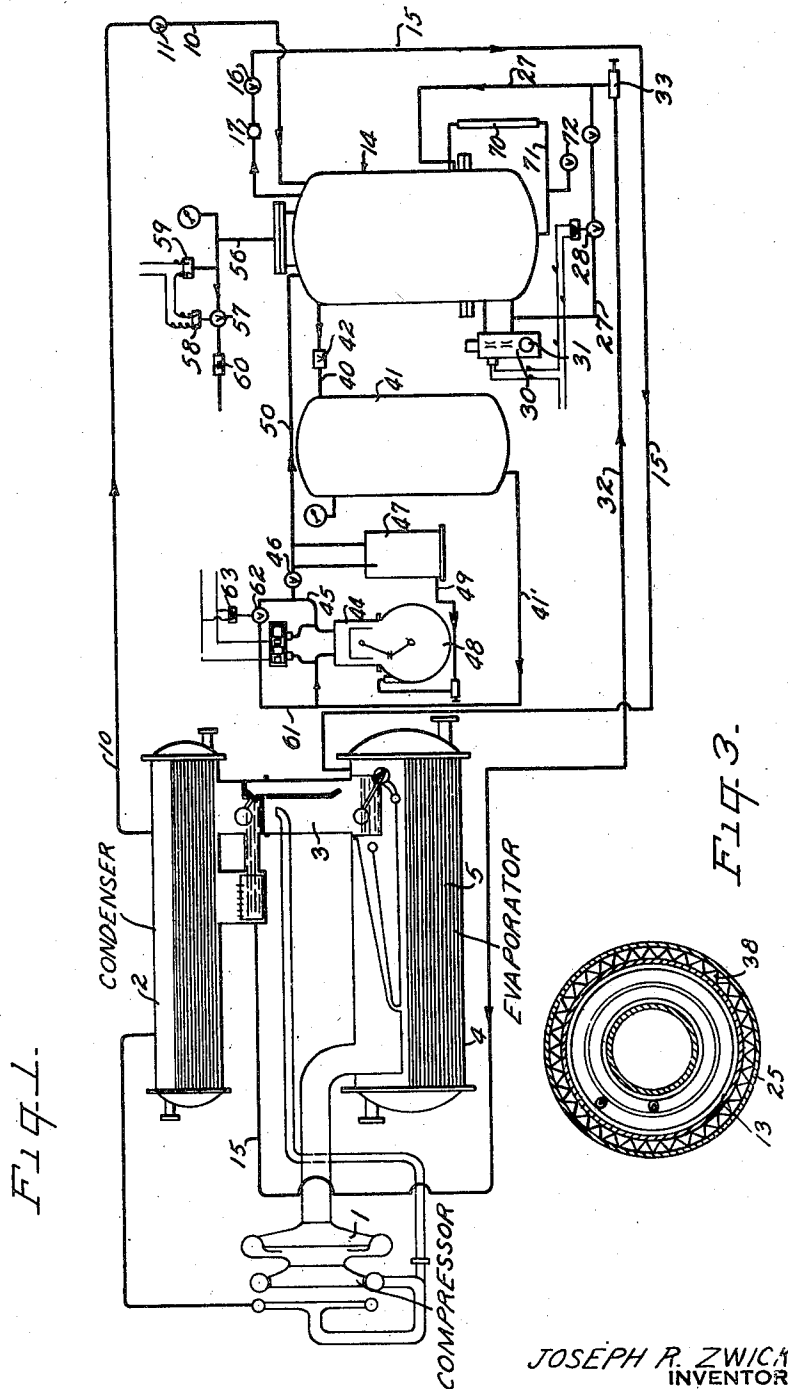
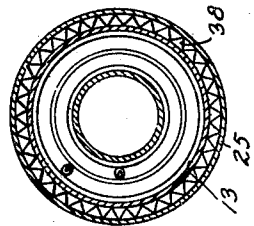
J. R. ZWICKL

2,450,707

PURGING SYSTEM FOR REFRIGERATING SYSTEMS

Filed June 6, 1945

3 Sheets-Sheet 1



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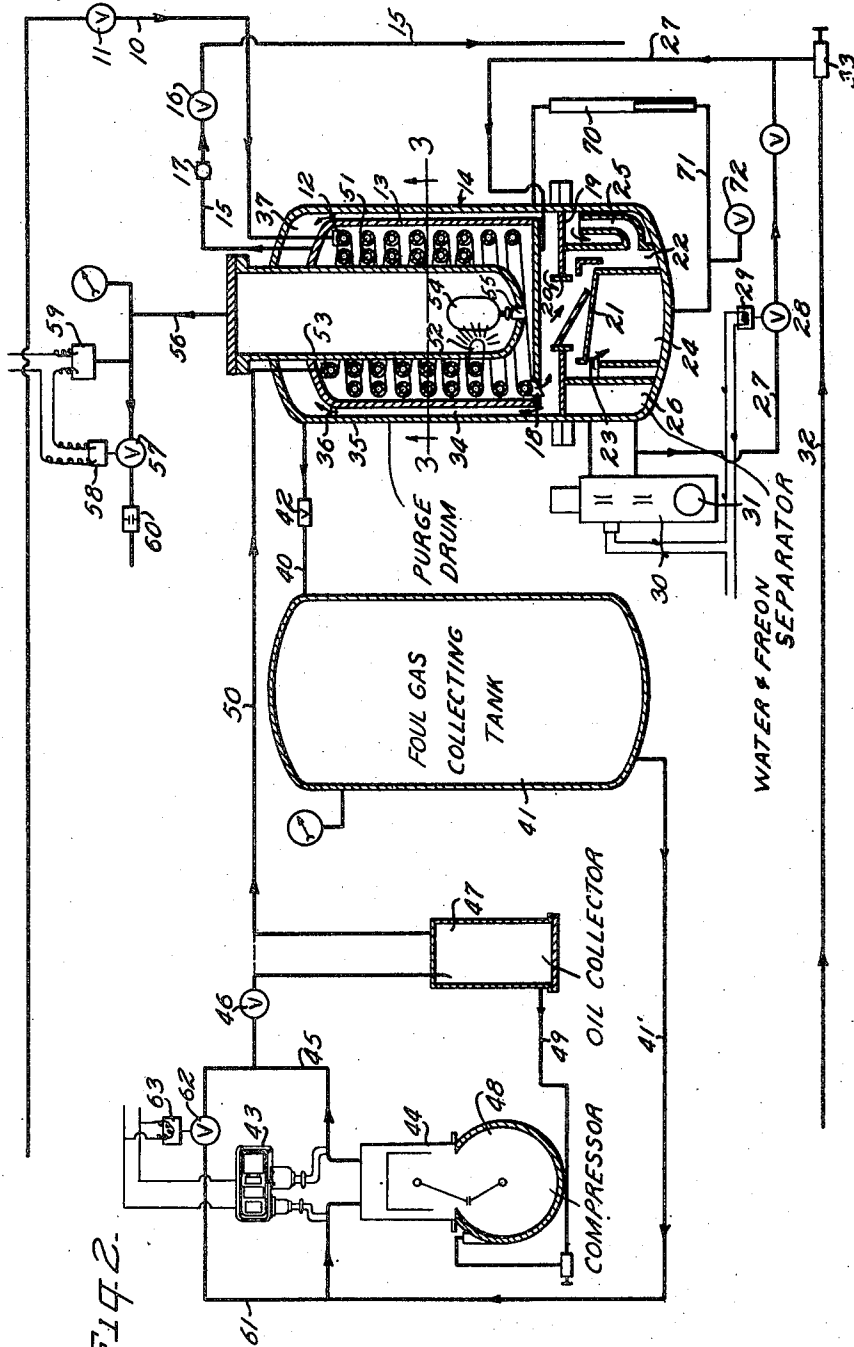
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3 Sheets-Sheet 3

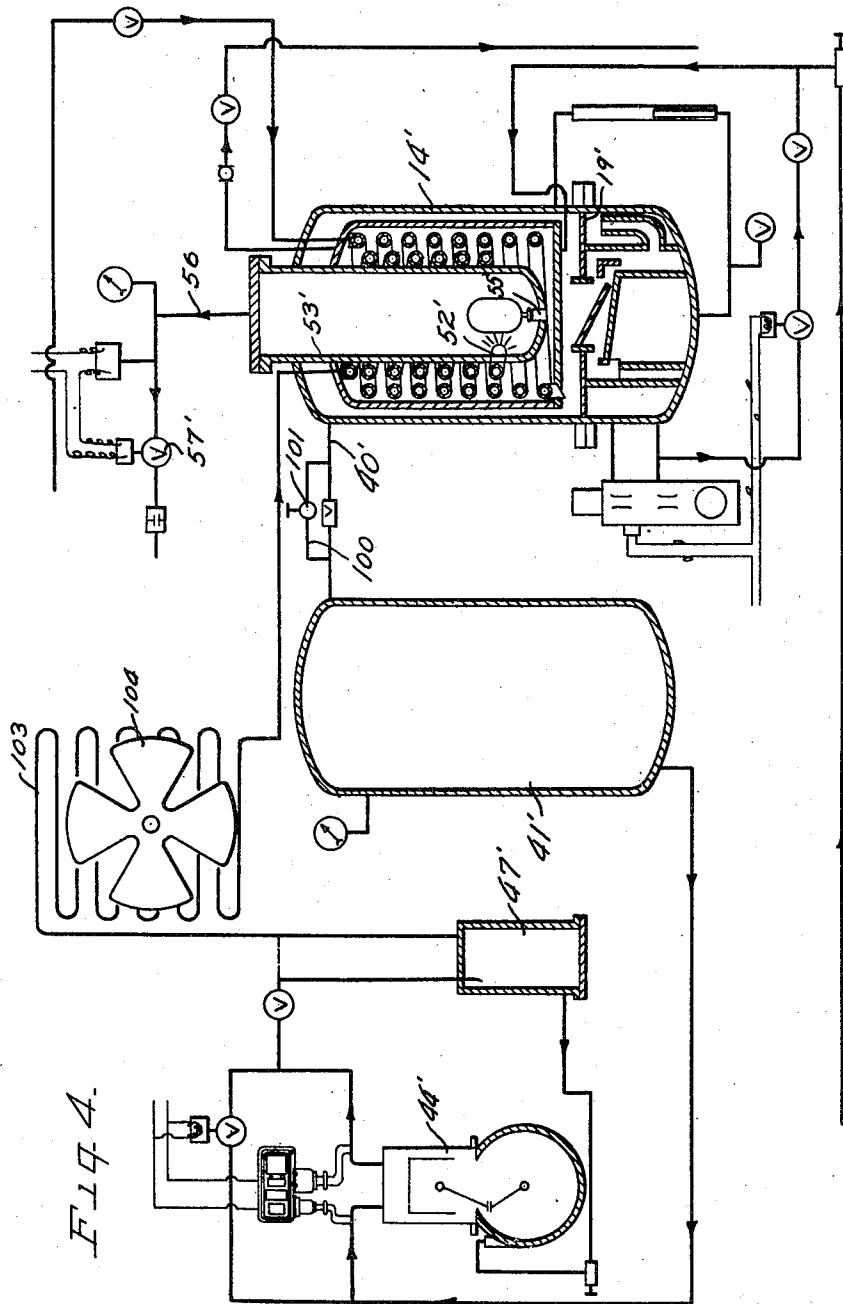


Fig. 4.

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UNITED STATES PATENT OFFICE

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PURGING SYSTEM FOR REFRIGERATING SYSTEMS

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Application June 6, 1945, Serial No. 597,849

19 Claims. (Cl. 62—115)

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This invention relates to refrigeration systems, and more particularly to purging systems and apparatus for use in refrigerating systems.

The present invention is particularly adapted for use in closed refrigeration systems wherein a refrigerant, such as those of the Freon class, is circulated through a closed system embodying an evaporator or cooler, a compressor, and a condenser. If such systems operate below atmospheric pressures, they are subject to in-leakage of air with its contained water vapor which causes pollution or fouling of the refrigerant. Such pollution or fouling of the refrigerant interferes with the effectiveness of the system, and hence it is desirable, even necessary, to remove these polluting agents from the refrigerant in the system and maintain the refrigerant in as great a degree of purity as is possible so as to insure maximum effectiveness of the operation of the system.

The present invention comprehends a purge system for use in such closed refrigerating systems, including first strip means for separating the larger percent of the condensible refrigerant vapor carried along with the air and foul gases to the purge system from the main condenser; the compressing of the stripped foul gases, separation of oil from the compressed vapor and non-condensibles gases, a final strip means through which the compressed gases and vapor are passed to finally strip practically all condensibles from the gases, and suitable means for separating the condensed water vapor from the condensed refrigerant vapor, with the return of the condensed refrigerant vapor to the system for recirculation, while the water and noncondensibles are drawn out of the system.

Heretofore in purging from closed refrigerating systems the pollution agents such as oil, air, and water, the practice has been to pass the refrigerant vapor containing the gases and water vapor direct from the main condenser to the purge compressor where the mixture of vapors and gases were compressed, and subsequently such oil as was picked up by the refrigerant during its passage through the system and during its compression was separated from the mixture of vapor and gas, and the vapor was then condensed.

However, it has been found that, due to peculiar conditions met with in such refrigerating systems, particularly where certain types of refrigerant are employed, refrigerant vapor containing only a small percent of noncondensibles or foul gas can not be compressed in a small purge compressor to the high pressures needed for efficient purging of the system without con-

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densation of some of the refrigerant vapor in the cylinder or cylinders of the purge compressor. As a result of such condensation in the cylinder of the compressor, the lubricating oil on the cylinder walls is washed off by the condensing refrigerant, resulting in unduly and undesirable rapid wear on the piston rings of the compressor; also some of the condensed refrigerant will find its way into the crank case of the compressor and dilute the lubricating oil therein, causing a foaming of the oil when under reduced pressure, with the consequent loss of lubricating oil and ineffective lubrication of the compressor parts.

To prevent this undesired condensation in the purge compressor, which in a short time detrimentally affects the efficiency of the entire system through failure of proper purging, the present invention comprehends the provision of a purge system wherein the greater part of the refrigerant vapor is condensed and removed from the mixture of vapor and gas drawn from the main condenser of the system, before this vapor and gas mixture is compressed, thereby greatly reducing the percent ratio of refrigerant vapor to non-condensibles gas in the mixture which is passed to the compressor for compression. This reduction of the percent ratio of refrigerant vapor to non-condensibles gas in the mixture greatly reduces or prevents the condensation of condensible vapors in the purge compressor, with a resultant removal of the detrimental effects of such condensation from the operation of the system.

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 drawings, showing a purging system for refrigerating systems of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is diagrammatic view of a refrigerating system embodying the improved purge system.

Figure 2 is a diagrammatic view of parts in section of the improved purging system.

Figure 3 is a cross-section taken on the line 3—3 of Figure 2.

Figure 4 is a diagrammatic view partly in section of a modified form of the purging system.

Referring more particularly to the drawings, a closed refrigeration system of the type embodying a centrifugal compressor 1, a condenser 2, an

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economizer 3, and an evaporator or cooler 4 is shown diagrammatically in Figure 1 of the drawing; in such a system, which is closed, the vaporized refrigerant is taken from the upper portion of the evaporator 4 into the compressor 1 where it is compressed. The compressed refrigerant is then delivered to the condenser 2 where it is condensed. From the condenser 2 the condensed refrigerant passes through the economizer 3 to the evaporator or cooler 4 where it evaporates and serves to cool the fluid to be cooled as the fluid to be cooled is circulated through the tubes 5 of the evaporator. If such systems operate below atmospheric pressure, they are subject to in-leakage of air with its contained water vapor which causes pollution or fouling of the refrigerant. Then also, during its circulation through the refrigerant system and through the purge system which co-operates therewith, the refrigerant may pick up lubricating oil which also has a detrimental action on the effectiveness of the operation of the system.

The noncondensable gases mixed with refrigerant vapor accumulate in the top of the condenser 2 and are taken off the top of the condenser 2 through a suitable pipe connection 10 which delivers such mixture of vapors and gases to the purge system. The pipe 10 has a valve 11 interposed therein by means of which the flow of the mixture of noncondensable and uncondensed vapor to the purge system may be controlled. This valve is operated during the starting up period of the purge system as a throttle valve until the purge system fills sufficiently with foul or noncondensable gas so as to prevent its flooding by too rapid condensation. After the purge system is sufficiently filled with noncondensable gas, the valve 11 is opened to such degree as to permit free flow of the mixture of noncondensable gases and refrigerant vapor into the purging system, without overloading its capacity.

The pipe 10 delivers the noncondensable gas and refrigerant vapor mixture to a pipe coil 12 which extends vertically in the inner shell 13 of the purge drum structure 14. The annular chamber within the inner shell 13 is filled with liquid refrigerant in the manner which will be hereinafter described, and is connected by means of suitable piping 15 with the evaporator 4 so that the liquid refrigerant within the inner shell 13 is essentially at the same pressure and temperature as the liquid refrigerant in the main evaporator 4. In the event that the temperature in the main evaporator 4 is below the freezing point of water, the pressure, and consequently the temperature, of the liquid refrigerant in the inner or coil chamber 13 of the purge drum 14 is maintained sufficiently high by means of a back pressure valve 16 in the line 15 so as to prevent freezing of water condensed with the condensable vapors passing through the coil 12. If it is so desired, a bull's eye or transparent eye, as indicated at 17, may be placed in the pipe or line 15 so as to permit visual observance of the liquid flowing through the line 15 so as to ascertain that sufficient liquid refrigerant passes through the inner or coil chamber 13 to insure that the coils therein are totally submerged in the cold liquid refrigerant.

As the mixture of the noncondensable gases and the condensable vapors, including refrigerant vapor and water vapor passes through the coil 12 which is chilled by the liquid refrigerant surrounding it, the refrigerant and water vapors, or at least the major portion of them, will be

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condensed; whereas, the noncondensables will naturally remain uncondensed. The condensate, that is, the condensed refrigerant and water vapor, flows from the outlet end 18 of the coil 12 upon an annular spill plate 19 located in the separation portion of the purge drum 14. As clearly shown in Figure 2 of the drawings, the separation portion of the purge drum 14 is positioned below the condensing or coil-containing portion of the drum 14. The mixed condensate flows over the circular weir 20 upon a distribution plate 21 and into the annular separation space 22. In the annular separation space 22, the water, being lighter than the condensed refrigerant, rises to the top of the mixture and flows through the opening 23 into the central water-containing portion 24, while the liquid refrigerant passes from the lower portion of the annular separating space 22 through a riser pipe 25 into the annular refrigerant storage space 26 in the separation portion of the purge drum 14. The liquid refrigerant is discharged from the refrigerant storage space 26 through a suitable pipe line 27 into the bottom of the inner or coil-containing shell 13 of the purge drum. The flow of the refrigerant from the storage space 26 is controlled by a solenoid-actuated valve 28 of any approved construction which may be purchased upon the open market. The energizing of the solenoid 29 of the solenoid-actuated valve structure 28 is in turn controlled by a float operated electrical switch structure 30 of any approved type which may be purchased upon the open market. The float actuated switch structure 30 is connected to the chamber 26 so that the float 31 of said structure moves under variances of the level of the refrigerant in the storage space 26 for opening or closing the valve 28, and, consequently, controlling the flow of the liquid refrigerant from the chamber 26 into the shell 13.

Since the liquid refrigerant supplied to the shell 13 from the annular storage space 26 is insufficient to submerge the coil 12, a make-up quantity of refrigerant is delivered from the main condenser 2 of the refrigerating system through a make-up pipe 32 and control needle valve 33, and thus sufficient liquid refrigerant may be circulated through the shell 13 at all times to maintain the coil 12 submerged.

The noncondensable gases with such relatively small percentage of the refrigerant and water vapors as are not condensed in the coil 12 flow out at the end of the coil with the condensate, and they, together with any gases or vapors which might be separated from the condensation in the lower separation portion of the purge drum 14, pass upwardly through the annular space 34 formed between the inner shell 13 and the outer shell 35 of the purge drum structure.

Restricting orifices are provided at the outlet of the annular space 34 as shown at 36, and the non-condensed gases and vapors pass through the restricted orifices 36 into the space 37 at the top of the drum 14. The annular space 34 has vertically extending, substantially radial fins 38 extending therethrough (as clearly shown in Figure 3 of the drawings) which are preferably soldered or welded to the inner shell 13 and serve to strengthen the inner shell against collapsing, since the pressure inside the shell is substantially the same as the pressure within the evaporator 4, and also to materially enlarge the heat transfer surface of the inner shell 3, and, consequently, enhance or increase the heat transfer action between the cold shell (chilled by the liquid refrigerant)

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erant therein) and the noncondensable gases with such condensible vapors as are still mixed therewith during their passage through the annular space 34, thus promoting and providing a stripping action on the noncondensable gas and vapor mixture which tends to condense out further such condensible vapors as are in the mixture during its passage through the space 34. Any condensibles condensed within the annular space 34 travel downwardly therein to the spill plate 19 and overflow therefrom for separation of the water from the refrigerant in the manner heretofore described.

The space 37 in the top of the outer shell 35 of the purge drum 14 is connected by suitable piping indicated at 40 with a collecting tank 41 for the foul or noncondensable gas. A differential pressure bleeder valve 42 of any approved construction which may be obtained on the open market is located in the piping 40 for allowing the noncondensable gases to flow to the tank 41 and prevent back flow of said gases to the space 37. This valve 42 is set so as to maintain in space 34 a pressure, which is always lower than the pressure in the main condenser 2, but only by such a differential as is required to maintain a sufficient flow of gas from the condenser 2 into the purger. It is essential to hold the pressure in space 34 as high as possible, because the higher this pressure the better will be the stripping action on the gas mixture as it drifts through space 34 along the chilled outer surface of shell 13. The condensing of the condensible vapors from the mixture of foul gas and vapor delivered to the coil 12 from the condenser 2 will very materially reduce the quantity of the mixture of gas and vapor flowing to the tank 41, and will, of course, very materially reduce the percentage of condensible vapors contained in the mixture. When the pressure of the stored mixture of gas and vapor in the tank 41 reaches a predetermined degree the pressure actuated switch 43 in the suction line to the purge compressor 44 will be opened to allow the compressor to draw gas and vapor mixture from the tank 41 until such time as the pressure in the tank falls below the degree required to operate the pressure switch 43.

The pressure actuated switch structure 43 is of an approved type which has long been known to the refrigeration art and which may be purchased upon the open market. The pressure actuated switch 43 starts the prime mover of the compressor 44, and the gas drawn from the tank 41 by the compressor 44 is compressed and discharged through the discharge line 45 of the compressor through a check valve 46 into an oil collector or separator 47. The oil which may be picked up by the mixture of noncondensable gas and condensible vapors in the compressor 44 separates out from the compressed mixture in the oil collector 47 and is returned to the crank case 48 of the compressor through a suitable connecting line 49. The compressed mixture passes from the oil separator 47 through a suitable piping 50 and enters a second or inner coil 51 in the inner or coil-containing shell 13 of the purge drum 14. If it is so desired, and if the quantity of oil picked up during the compression of the mixture is negligibly low, the oil separator 47 may be eliminated and the compressed mixture passed directly through the line 50 to the inner coil 51.

The inner coil 51, like the coil 12, is submerged in cold liquid refrigerant within the shell 13 and any condensible vapors, which might be contained

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in the compressed mixture delivered to the coil, are condensed during the passage of the compressed mixture through the inner coil 51. The noncondensable gas and any vapor condensed in the inner coil 51 passes from the outlet end 52 of the coil into the inner most chamber 53 with the coil-containing chamber or inner shell 13. The condensate from the coil 51 accumulates in the bottom of the chamber 53, and when a sufficient quantity thereof accumulates to move the float 54, the valve 55 will be operated by the float, allowing such condensate to pass out into the inner shell 13 and out of this shell 13 through the line 15 to the evaporator 4. The noncondensable gas accumulates in the top of the chamber 53 and is bled therefrom through an outlet pipe 56 in which is located a solenoid actuated valve 57. The energizing of the solenoid 58 of the solenoid operated valve structure 57 is controlled by a pressure actuated switch structure 59 which may be of any approved construction and is connected in the outlet pipe 56 so that the valve 57 will only be opened when the pressure of the noncondensable gases in the chamber 53 reaches a predetermined degree. The noncondensable gases are vented to atmosphere or to any suitable place (not shown), and if it is so desired, a pressure reducing orifice 60 may be connected in the outlet pipe 56 beyond the solenoid actuated valve 57.

In order to prevent any condensation in the cylinders or cylinder head of the compressor 44 when the compressor stops operating, and thus cools down, a by-pass line 61 is provided between the compressor inlet and discharge, and this line has a solenoid actuated valve structure 62 connected therein, the solenoid 63 of which is interconnected with the circuit of the motor (not shown) which operates the compressor 44, so that when the compressor 44 is running the valve 62 is closed, and when the compressor stops, the valve 62 will be opened to permit the reexpanding of the already compressed gas and vapor mixture which is in the compressor head and the line 45 up to the check valve 46. Since the dew point of this gas and vapor mixture is low there can be no condensation before the check valve 46, if the pressure is lowered properly.

With the arrangement and system shown in the drawings and described herein, the purge compressor 44 runs only when the accumulation of the gas and vapor mixture in the tank 41 reaches a degree where its pressure is sufficient to operate the pressure actuated switch 43, thus materially increasing the life of the compressor. The improved purge system herein set forth provides for a continuous removal of water from the system regardless and independent of operation of the purge compressor 44, because the pressure differential, causing the flow of gas from the main condenser 2 to the purge drum 14 is continuously maintained by the differential pressure bleeder valve 42 between the purge drum 14 and foul gas collecting tank 41. Also any condensation of vapor in the compressor with its resultant disadvantages as previously pointed out is eliminated.

A sight glass 70 is connected in a looped pipe 71 which has communication with the water-containing space 24 in the separator structure, and by means of the level of water in the sight glass 70, the quantity of water in the space 24 may be readily determined. When the quantity of water in the space 24 rises to such a height as to be apt to interfere with the operation of the

separator, the valve 72 is manually opened to drain water from the space 24.

The purge system shown in Figures 1 to 3 of the drawings and described herein above will purge the refrigerating system only when the refrigeration system is in operation, and will not purge the refrigeration system of noncondensibles when the system stands, or is not in operation, with equalized pressure in evaporator 4 and the condenser 2.

Figure 4 of the drawings shows a modification of the improved purge system whereby the refrigeration system may be purged of noncondensibles, while the refrigerating system stands with equalized pressure in the evaporator and condenser, or in starting the refrigeration system.

In the modified form shown in Figure 4 of the drawings a bypass 100 is connected in the piping 40' around the differential pressure bleeder valve 42'. A normally operated valve 101 is located in the bypass 100. When the valve 101 is open the purge compressor 44' is connected to the main condenser (not shown) of the refrigerating system through the collecting tank 41' and the purge drum 14' so that the compressor may continuously pump a mixture of air, refrigerant vapor etc., from the refrigeration system.

In order to separate the air of foul gases from the mixture drawn from the refrigeration system by the compressor 44' it is necessary to condense the condensibles in the compressed mixture. Since no liquid refrigerant is available in the purge drum 14', at such times, for this condensing action an air cooled coil condenser 103 is connected in the piping or line 50 between the oil collector 47' and the inner coil 51' of the purge drum structure 14'. The air cooled condenser coil 103 may be cooled by a fan 104.

The condensate and noncondensibles flow from the air cooled coil condenser 103 into and through the inner coil 51', passing from the outlet 52' of the coil 51' into the inner chamber 53' where the condensate and the noncondensibles separate. When the pressure in the inner chamber 53' reaches a sufficiently high degree to cause operation of the solenoid actuated valve 57' the noncondensibles will be discharged through the outlet pipe 56'. When the level of the condensate in the inner chamber 53' reaches a sufficient height to operate the float actuated valve 55' the condensate is discharged upon the annular spill plate 19' in the separation portion of the purge drum 14' and from there into the separating space 22' wherein the refrigerant and water are separated in the manner described in connection with Figures 1 to 3 of the drawings. The separated out water is disposed of and the liquid refrigerant is returned to the refrigerating system in the same manner as described in connection with the system described above and shown in Figures 1 to 3 of the drawings.

During the normal operation of the refrigeration system the valve 101 is closed and the air cooled condenser 103 acts simply as a preliminary condenser so that less condensing will have to be done in the inner coil 51' of the purge drum 14'.

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. The method of purging a closed refrigeration system containing a volatile refrigerant and including a condenser and an evaporator, of pol-

luting agents such as air, water and oil which comprises taking from the condenser uncondensed refrigerant and water vapor mixed with noncondensibles gases and subjecting the mixture to a temperature lower than the temperature in the condenser, which lower temperature is produced by evaporation of refrigerant at a lower pressure so as to condense the greater quantity of condensible vapors in the mixture, collecting the residual mixture of noncondensibles and condensible vapor not condensed by said first condensing action, taking off a part of the collected mixture when its pressure reaches a predetermined degree, compressing the taken off part of the mixture, separating oil from the compressed mixture, subjecting the remaining compressed mixture to condensing temperature sufficiently low to condense practically all of the condensible vapors in the mixture, separating the condensed water vapor from the condensed refrigerant vapor, and returning the condensed refrigerant vapor as liquid to the system.

2. The method of purging a closed refrigeration system containing a volatile refrigerant and including a condenser and an evaporator of polluting agents such as air, water and oil, which comprises taking from the condenser uncondensed refrigerant and water vapor mixed with noncondensibles gases and subjecting the mixture to a temperature lower than the temperature in the condenser so as to condense the greater quantity of the condensible vapors in the mixture, compressing the non-condensed residual mixture, separating oil from the compressed mixture, subjecting the remaining compressed mixture to condensing temperature sufficiently low so as to condense practically all of the condensible vapors therein, separating the condensed water vapor from the condensed refrigerant vapor and returning the condensed refrigerant vapor to the system.

3. The method of purging a closed refrigeration system containing a volatile refrigerant and including a condenser and an evaporator of polluting agents such as air, water and oil, which comprises taking from the condenser uncondensed refrigerant and water vapor mixed with noncondensibles gases and subjecting the mixture to a temperature lower than the temperature in the condenser so as to condense the greater quantity of the condensible vapors in the mixture, compressing the non-condensed residual mixture, separating oil from the compressed mixture, subjecting the remaining compressed mixture to condensing temperature sufficiently low so as to condense practically all of the condensible vapors therein, separating the condensed water vapor from the condensed refrigerant vapor, utilizing the separated condensed refrigerant vapor as a cooling medium in the vapor condensing steps and finally returning the condensed refrigerant vapor to the system.

4. The method of purging a closed refrigerating system containing a volatile refrigerant and including an evaporator and a condenser, of polluting agents such as air, water and oil, which comprises taking from the condenser uncondensed refrigerant and water vapor mixed with noncondensibles gases and subjecting the mixture to a temperature lower than the temperature in the condenser so as to condense the greater quantity of condensible vapors in the mixture, collecting the residual mixture not condensed by said first condensing action, taking off a part of the collected mixture when its pressure reaches

a predetermined degree, compressing the taken off part of the mixture, separating oil from the compressed mixture, subjecting said residual mixture to condensing temperature sufficiently low to condense practically all of the condensable vapors in the mixture, separating the condensed water vapor from the condensed refrigerant vapor, utilizing the condensed refrigerant vapor as a cooling medium in the vapor condensing steps and finally returning the condensed refrigerant vapor as liquid to the system.

5. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering non-condensable gas mixed with condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, and means for returning the liquid refrigerant from said separating means into contact with the outside of the coil where it acts as a coolant to condense the condensable vapors passing through the coil.

6. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor, and means for delivering the compressed mixture from the compressor to said separator structure for final condensation of any condensible vapor contained in the mixture.

7. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering non-condensable gas mixed with condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor, and pressure actuated means for controlling delivery of mixed vapor and gas from said tank to said compressor.

8. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor, and means for delivering the

compressed mixture from the compressor to said separator structure for final condensation of any condensible vapor contained in the mixture, means for returning the liquid refrigerant from said separating means into contact with the outside of said coil where it acts as a coolant to condense the condensible vapors passing through the coil.

9. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering non-condensable gas mixed with condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor, means for delivering the compressed mixture from the compressor to said separator structure for final condensation of any condensible vapor contained in the mixture, and pressure actuated means for controlling delivery of mixed vapor and gas to the compressor from said tank.

10. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of noncondensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor, means for delivering the compressed mixture from the compressor to said separator structure for final condensation of any condensible vapor contained in the mixture, means for returning the liquid refrigerant from said separating means into contact with the outside of said coil where it acts as a coolant to condense the condensible vapors passing through the coil, and pressure actuated means for controlling delivery of mixed vapor and gas to said compressor from said tank.

11. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of noncondensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor for compression thereby, a second condensing coil in said separator structure, and means for delivering the compressed mixture from said compressor to said second coil for passage therethrough for final condensation of any condensible vapors from the mixture.

12. In a refrigerating system containing a volatile refrigerant and including a condenser and an

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evaporator, means for purging the system of noncondensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensible vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor for compression thereby, a second condensing coil in said separator structure, means for delivering the compressed mixture from said compressor to said second coil for passage there-through for final condensation of any condensible vapors from the mixture, and means for returning the liquid refrigerant from said separating means into contact with the outside surfaces of said coils, where it acts as a coolant to condense the condensible vapors passing through the coils.

13. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering non-condensable vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor for compression thereby, a second condensing coil in said separator structure, means for delivering the compressed mixture from said compressor to said second coil for passage therethrough for final condensation of any condensible vapors from the mixture, means for returning the liquid refrigerant from said separating means into contact with the outside surfaces of said coils where it acts as a coolant to condense the condensible vapors passing through the coils, and means for delivering liquid refrigerant from said condenser for contact with the outer surfaces of said coils where it acts as a coolant to condense condensible vapors passing through the coils.

14. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering non-condensable gas mixed with condensible vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, and means for delivering liquid refrigerant from the condenser into contact with the outside surface of said coil where it acts as a coolant to condense the condensible vapors passing through the coil.

15. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering non-condensable gas mixed with condensible vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable

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gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor, means for delivering the compressed mixture from the compressor to said separator structure for final condensation of any condensible vapor contained in the mixture, and means for delivering liquid refrigerant from a predetermined point in the system for contact with the outside of said coil where the liquid refrigerant acts as a coolant to condense the condensible vapors passing through the coil.

16. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensible vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, means for returning the liquid refrigerant from said separating means into contact with the outside of the coil where it acts as a coolant to condense the condensible vapors passing through the coil, and means for delivering liquid refrigerant from said separating means to said evaporator.

17. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensible vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, means for returning the liquid refrigerant from said separating means into contact with the outside of the coil where it acts as a coolant to condense the condensible vapors passing through the coil, and means controlled by variances in the level of liquid refrigerant in the separator for controlling the flow of refrigerant about said coil.

18. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering noncondensable gas mixed with condensible vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor for compression thereby, a second condensing coil in said separator structure, means for delivering the compressed mixture from said compressor to said second coil for passage there-through for final condensation of any condensible vapors from the mixture, means for returning the liquid refrigerant from said separating means into contact with the outside surfaces of said coils, where it acts as a coolant to condense the condensible vapors passing through the coil, and means controlled by variances in the level of liquid refrigerant in the separating means for controlling the flow of refrigerant about said coils.

19. In a refrigerating system containing a volatile refrigerant and including a condenser and an evaporator, means for purging the system of non-

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condensibles and polluting condensibles including a separator structure, a condensing coil in said separator structure, means for delivering non-condensable gas mixed with condensible vapors from the condenser to said coil, means for separating water and liquid refrigerant condensed in said coil, a storage tank, means for delivering mixed non-condensed vapor and noncondensable gas from said coil to said storage tank, a compressor, means for delivering mixed vapor and noncondensable gas from said tank to said compressor, a second condensing coil in said separator structure, means for delivering the compressed mixture to said second coil for passage therethrough for final condensation of any con-

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densible vapors from the mixture, means for returning the liquid refrigerant from said separating means into contact with the outside surfaces of said coils where it acts as a coolant to condense the condensible vapors passing through the coils, and means for delivering liquid refrigerant from said condenser for contact with the outer surfaces of said coils where it acts as a coolant to condense condensible vapors passing through the coils, and an air cooled condenser coil connected in the system between the compressor and said second coil.

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No references cited.