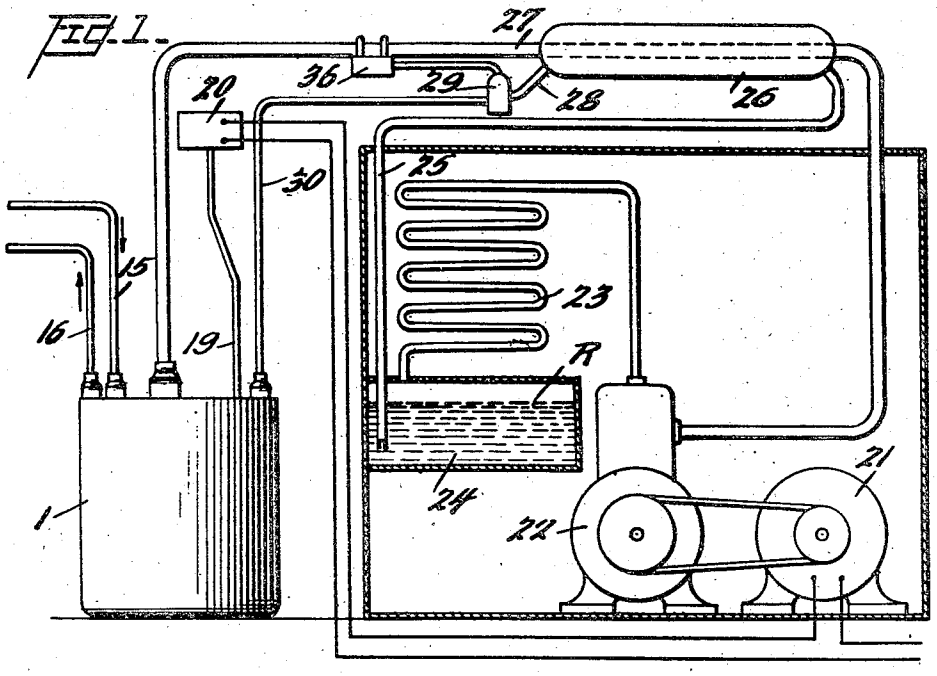
Oct. 5, 1948. H. B. MILLET 2,450,735

APPARATUS FOR REFRIGERATION OF LIQUORS

Filed Sept. 3, 1947 2 Sheets-Sheet 1

FIG. 1.



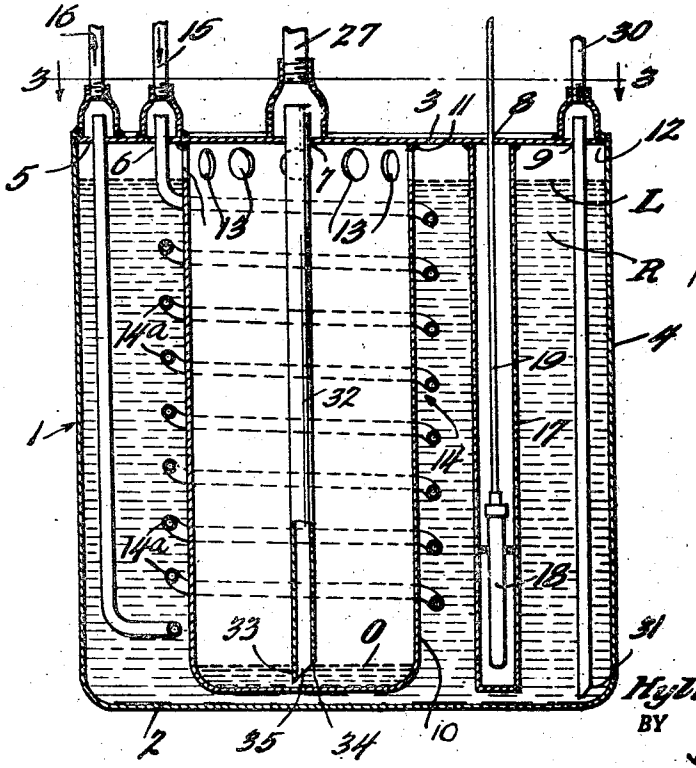


FIG. 2.

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FIG. 3.

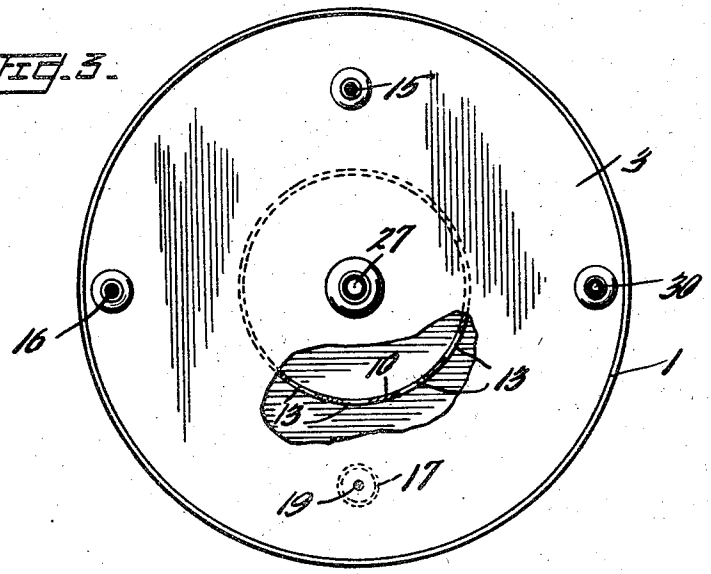
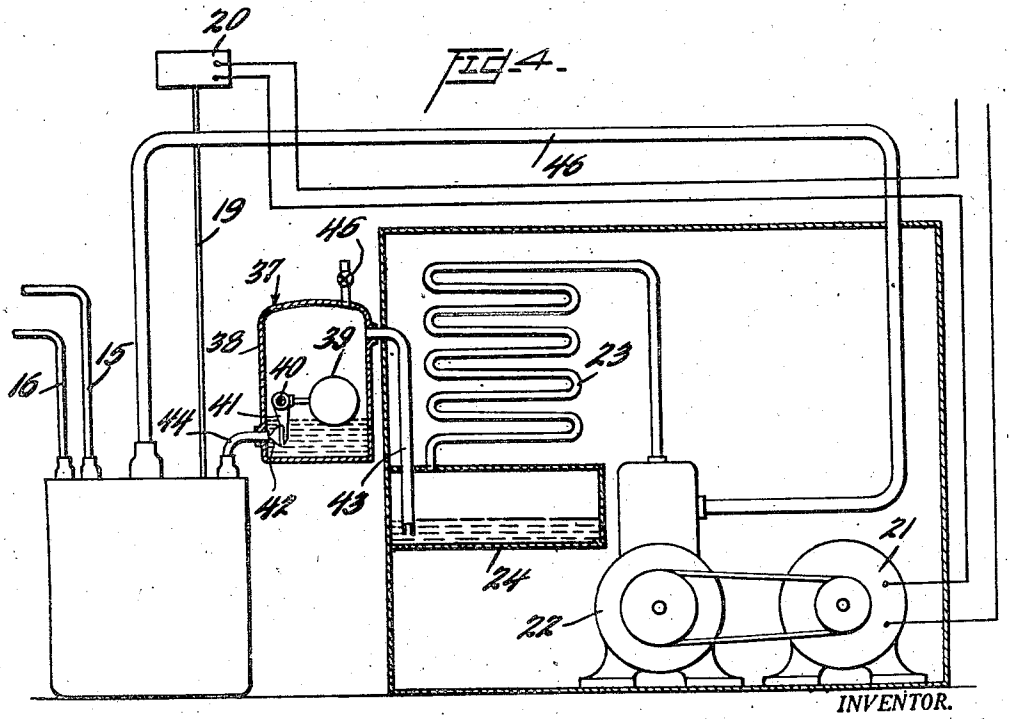


FIG. 4.



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UNITED STATES PATENT OFFICE

2,450,735

APPARATUS FOR REFRIGERATION OF LIQUORS

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Application September 3, 1947, Serial No. 771,891

15 Claims. (Cl. 62—7)

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The present invention relates to the intense cooling and refrigerating of liquors such as beverages and liquid chemicals, the beverages being exemplified by water, carbonated water, and beer, and the liquid chemicals being exemplified by gasoline, butane, oils, and similar compounds or compositions.

The invention will be described in connection with the accompanying drawing in which:

Fig. 1 is a side view of one form of apparatus for carrying out the present invention;

Fig. 2 is a vertical section through the outer and inner container members;

Fig. 3 is a sectional view on line 3—3 of Fig. 2 with part of the top broken away; and

Fig. 4 is a modified form of the invention.

It is an object of the present invention to provide a practical, economical, and efficient cooler for liquids having beverages, chemical compounds or chemical solutions passing therethrough.

Another object of the invention is to provide an instantaneous cooler for liquors which comprises an outer container having a liquid refrigerant therein and an inner expansion chamber, an oil accumulator and separator chamber, the latter being provided with a series of apertures adjacent the top thereof adapted to pass liquid or a mixture of liquid and gaseous refrigerant from the top of the outer container into the inner gas expansion and oil accumulator chamber when the liquid refrigerant expands or is converted into a gas or vapor state.

It is another object of the invention to provide a pick-up conduit in the inner container, said conduit extending into the oil accumulated on the bottom of the oil accumulator chamber, said conduit being separated under suction and delivering refrigerant gas and oil to the compressor.

It is an additional object of the present invention to provide the lower end of the pick-up conduit with an opening extending into the oil accumulated on the bottom of the oil accumulator chamber, the end of the conduit being provided with means whereby at least a portion of the opening of the pick-up conduit always receives and delivers through the pick-up conduit gaseous refrigerant vapors carrying entrained oil.

Referring to the Figs. 1 and 2, the apparatus comprises an outer container 1 provided with a bottom wall 2, the top wall or plate 3 and a vertical wall 4, said top plate being provided with apertures 5, 6, 7, 8, and 9. Carried by the top plate 3 is an inner expansion chamber and a used oil accumulator and separator 10. The latter may be secured to the top plate 3 by any suitable means but preferably by welding at the periphery as indicated at 11 of Fig. 2. The plate 3 is secured to the top of the wall 4 by welding as at 12. The expansion member 10 is provided adjacent its top with apertures 13 for a purpose to be presently described. Surrounding the expansion member 10 is the liquid cooling coil 14 comprising a number of turns 14a, the liquid to be cooled being supplied through the liquid inlet conduit 15 and returned through the return conduit 16.

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There is provided a well 17 adapted to receive a thermostatic feeler bulb 18 provided with a capillary tube 19 in operative connection with the thermostatic switch 20 functioning to throw the condensing and compressing unit on and off and to thereby control the temperature of the refrigerant in the outer container 1, the liquid refrigerant being exemplified by methyl chloride and the like.

In order to cool the liquid passing through the coil 14 there is introduced into the container 1 a liquid refrigerant such as methyl chloride, difluorodichloromethane, CCl_2F_2 known as F-12, sulfur dioxide, and other refrigerants well known in the prior art.

A compressing and condensing unit is provided, said unit comprising a motor 21, a compressor 22, a condenser 23, and a liquid receiver 24 all in operative connection. From the receiver 24 there extends a liquid refrigerant line 25 which passes through a heat exchanger conduit 26 through which passes the suction line conduit 27 carrying the refrigerant return vapors and/or gases.

Connected with the heat exchanger conduit 26 is a conduit 28 leading to the thermostatic expansion valve 29 which has connected thereto the liquid refrigerant supply tube 30, the latter passing through the aperture 9 in top plate 3. The tube 30 terminates at 31 adjacent the bottom wall 2 of the container 1.

The suction conduit 27 is contiguous with the pick-up tube 32 which passes preferably centrally through the inner chamber 10, the end 33 of the tube 32 being preferably beveled as at 34 to provide an opening 35.

Oil separates from the saturated refrigerant which is a mixture of a gas and liquid refrigerant, and oil accumulates at the bottom of the container 10 to form an oil layer O. As the oil layer O rises in the container 10 it is picked up by the pick-up suction tube 32 and is returned through the suction conduit 27 to the compressor 22. If the pick-up tube 32 terminates with a flush end there is a tendency for slugs of oil to be drawn

through the pick-up tube 32, said slugs damaging the discharge valves of the compressor 22. If, however, the end is beveled as at 34, the gaseous refrigerant entrains the oil and delivers increments of entrained oil in such a manner as to have a more or less steady flow of oil through the pick-up tube 32 and the suction conduit 27 thereby inhibiting any damage to the discharge valves or the compressor. This arrangement provides means whereby at least a portion of the pick-up tube opening always receives and delivers through said pick-up tube or conduit gaseous refrigerant vapors carrying entrained oil.

The operation of the above system will be illustrated using methyl chloride as a refrigerant for the refrigerating of water by heat transfer. If it is desired to cool water entering the inlet conduit 15 to a predetermined temperature as for example 38° F. then the methyl chloride refrigerant present in the receiver 24 is introduced into the conduit 25 at a pressure varying between 60 and 150 lbs. per square inch depending on the temperature surrounding the condenser unit, said temperatures, of course, varying during the winter and summer months. Thereafter, the refrigerant passes through the heat exchanger to the expansion valve 29 and through this valve to the container 1 filling said container to liquid refrigerant level L which is maintained at a level whereby the liquid refrigerant can spill over and into the apertures 13 in the expansion chamber and oil accumulator and separator 10.

After the container 1 is filled with the refrigerant R, water to be cooled is introduced through the water inlet 15 and into the coil 14, said water being at atmospheric temperature which may vary, for example, between 70 and 90° F. The liquid refrigerant R present in the container 1 absorbs heat from the water, cooling the same and causing the refrigerant to boil. When the liquid refrigerant boils it expands into a gaseous state and then there is present in container 1 a refrigerant in a gaseous state or there is present a mixture of a gaseous and liquid refrigerant which spills over through apertures 13 into the expansion chamber 10, said gas and liquid refrigerant in the expansion chamber 10 being known as "saturated vapors" carrying or having entrained therewith particles of oil which also pass through the apertures 13 into the expansion and oil accumulator and separator 10. Thereafter the pickup tube 32 picks up the refrigerant gas and the oil particles and these pass via the suction conduit 27 to and through the compressor 22 where they are recompressed and during said recompression the gaseous refrigerant retains a certain amount of oil, said refrigerant carrying entrained oil passing to the condenser 23 and then to the receiver 24. If too much liquid refrigerant is spilled through the apertures 13, cool raw refrigerant comprising saturated vapors will pass through the suction conduit 27 and will chill the thermostatic feeler bulb 36 which in turn retards the liquid flow through the thermostatic expansion valve 29, or may close the valve entirely for a predetermined period of time and thereby entirely discontinue feeding of liquid refrigerant to the container 1.

When the liquid refrigerant in container 1 gets below the liquid refrigerant level line L, then only vapors pass through the suction line 27 and the relatively hot vapors warm the feeler bulb 36 of expansion valve 29 causing the same to open and thereupon the liquid refrigerant starts flowing

through conduit 38 into chamber 1. For successful operation the coil 14 should be always immersed in the liquid refrigerant. In the form of the apparatus shown in Fig. 4 instead of employing a thermostatic expansion valve 29, there is employed the equivalent thereof which is a high side float valve unit 37 enclosed in a casing 38.

There is located in the casing a float 39 pivoted at 40 to an arm 41 which is connected to a needle valve 42. The casing 38 is connected to the receiver 24 by a conduit 43, and to the container 1 by means of a conduit 44.

In order to start the cooling unit functioning the operation of the compressor or condensing unit is effected whereby the liquid refrigerant, as for example, methyl chloride, is caused to pass from an auxiliary container not shown through the compressor 22 and condensing unit 23 into receiver 24. When the refrigerant level in receiver 24 rises to the lower end of the pick-up tube or conduit 43, the refrigerant liquid passes over and into the casing 38, the liquid refrigerant level therein rising and causing the ball 39 to open valve 42. The liquid refrigerant then passes into the container 1. When the liquid refrigerant reaches apertures 13, then a small amount of liquid refrigerant spills over through said apertures and into the expansion chamber 18 and saturated vapors are produced. Then there is a definite change in temperature in the conduit 46, the latter becoming cooler. This change in temperature can be ascertained by the operator by the placing of the hand on the conduit 46. When the change in the temperature of the conduit becomes effective, this is the signal that the system is properly charged with the liquid refrigerant. If the container 1 or the system is overcharged, which may be indicated by the excess cooling of conduit 46, then the purge valve 45 of the float unit 37 is opened. Upon the opening of this valve, the liquid level in the container 38 is lowered and the float functions to close valve 42 thereby preventing further liquid momentarily from passing into the container 1. This purging is continued until the conduit 46 becomes warmer and then the purge valve 45 is closed. The system is then properly charged.

Thereafter, water to be cooled passes into coil 14 and begins to boil the liquid refrigerant R in the container 1 and the liquid refrigerant and/or vapors pass through apertures 13 into the expansion chamber and oil accumulator and separator 10. These gases return via conduit 46 to the compressor 22 and then are delivered to the condenser 23 and thereafter in liquefied form to the receiver 24. When the refrigerant gas which has been passed through the compressor 22 and which has been liquefied in the condenser 23 enters the receiver 24 and is delivered to the casing 38, the liquid level in the casing rises and causes ball 39 to open valve 42 to thereby deliver liquid refrigerant via conduit 44 and supply tube 36 to the container 1. The thermostatic switch 28 operatively connected to the feeler bulb 18 by means of capillary tube 19 functions to start and stop the motor on the condensing unit as set forth in detail in connection with the operation of that form of apparatus set forth in Fig. 1.

While in Fig. 3, which is a plan view, the various conduits have been shown 90° apart which is the preferable arrangement, the conduits have been shown in a diametric line in Fig. 2 for the purpose of clear illustration.

What is claimed is:

1. In a cooler for liquids, the combination of an

outer closed container adapted to receive a refrigerant, means to feed liquid refrigerant thereto, an inner expansion, accumulator, and separator chamber disposed in said container, said chamber being adapted to have a layer of oil on the bottom thereof, means for delivering refrigerant from said outer chamber to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber and extending to a point adjacent the bottom of said inner chamber, suction means for withdrawing gaseous refrigerant carrying entrained oil from the pick-up conduit, means for maintaining a predetermined temperature in any liquid refrigerant fed into said outer container, and means located outside of said outer container for controlling the liquid refrigerating means and arranged to maintain a substantially constant liquid refrigerating level in said outer liquid refrigerant container when the cooler is in use.

2. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, means to feed liquid refrigerant thereto, an inner expansion, accumulator, and separator chamber secured to and inside of said container, said chamber being adapted to have a layer of oil on the bottom thereof, means for delivering refrigerant from said outer chamber to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber and extending to a point adjacent the bottom of said inner chamber, suction means for withdrawing gaseous refrigerant from the pick-up conduit, means for maintaining a predetermined temperature in any liquid refrigerant fed into said outer container, and means located outside of said outer container for controlling the liquid refrigerating means and arranged to maintain a substantially constant liquid refrigerating level in said outer liquid refrigerant container when the cooler is in use.

3. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, means to feed liquid refrigerant thereto, an inner expansion, accumulator, and separator chamber secured to and inside of said container, said chamber being adapted to have a layer of oil on the bottom thereof, a series of apertures in said chamber adjacent the top thereof of delivering refrigerant to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber and extending to a point adjacent the bottom of said inner chamber, suction means for withdrawing gaseous refrigerant from the pick-up conduit, means for maintaining a predetermined temperature in any liquid refrigerant fed into said outer container, and means located outside of said outer container for controlling the liquid refrigerating means and arranged to maintain a substantially constant liquid refrigerating level in said outer liquid refrigerant container when the cooler is in use.

4. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, means to feed liquid refrigerant thereto, an inner expansion, accumulator, and separator chamber secured to and inside of said container, said chamber being adapted to have

a layer of oil on the bottom thereof, a series of apertures in said chamber adjacent the top thereof for delivering refrigerant to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower open end of the conduit extending to adjacent the bottom of said inner chamber, said open end being provided with means whereby at least a portion of the opening of the pick-up conduit is adapted to always receive and deliver through the pick-up conduit gaseous refrigerating vapors carrying entrained oil, suction means for withdrawing gaseous refrigerant from the pick-up conduit, means for maintaining a predetermined temperature in any liquid refrigerant present in said outer container, and means located outside of said outer container for controlling the liquid refrigerating means and arranged to maintain a substantially constant liquid refrigerating level in said outer liquid refrigerant container when the cooler is in use.

5. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, means to feed liquid refrigerant thereto, an inner expansion, accumulator, and separator chamber secured to and inside of said container, said chamber being adapted to have a layer of oil on the bottom thereof, a series of apertures in said chamber adjacent the top thereof for delivering refrigerant to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower open end of the conduit extending to adjacent the bottom of said inner chamber, said lower end of the pick-up conduit being bevelled, suction means for withdrawing gaseous refrigerant containing entrained oil from the pick-up conduit, means for maintaining a predetermined temperature in the liquid refrigerant present in said outer container, and means located outside of said outer container for controlling the liquid refrigerating means and arranged to maintain a substantially constant liquid refrigerating level in said outer liquid refrigerant container when the cooler is in use.

6. In a cooler for liquids, the combination of an outer closed container adapted to receive refrigerant, means to feed liquid refrigerant thereto, an inner expansion, accumulator, and separator chamber secured to and inside of said container, said chamber being adapted to have a layer of oil on the bottom thereof, means for delivering refrigerant from said outer chamber to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber and extending to a point adjacent the bottom of said inner chamber, suction means for withdrawing gaseous refrigerant from the pick-up conduit, the latter and means for feeding liquid refrigerant being in heat-exchange relationship, means for maintaining a predetermined temperature in any liquid refrigerant present in said outer container, and means located outside of said outer container for controlling the liquid refrigerating means and arranged to maintain a substantially constant liquid refrigerating level in said outer liquid refrigerant container.

7. In a cooler for liquids, the combination of an outer closed container adapted to receive a

refrigerant, an inner expansion accumulator and separator chamber secured to and inside of said container, said chamber being adapted to have a layer of oil on the bottom thereof, a series of apertures in said chamber adjacent the top thereof for delivering refrigerant to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower end of the conduit extending to adjacent the bottom of said chamber, suction means for withdrawing gaseous refrigerant containing entrained oil from the pick-up conduit, a thermostatic expansion valve feeler bulb in operative connection with said suction means, means for feeding liquid refrigerant to said outer refrigerant container, a thermostatic expansion valve connected to said latter means to control refrigerant flow and thereby maintain a substantially constant liquid refrigerant level in the liquid refrigerant container, and means for maintaining a predetermined temperature in any liquid refrigerant present in the outer refrigerant container when the cooler is in use.

8. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, an inner expansion accumulator and separator chamber secured to and inside of said container, said chamber being adapted to have a layer of oil on the bottom thereof, a series of apertures in said chamber adjacent the top thereof for delivering refrigerant to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower end of the conduit extending to adjacent the bottom of said inner chamber, said open end being provided with means whereby at least a portion of the opening of the pick-up conduit is adapted to always receive and deliver through the pick-up conduit gaseous refrigerating vapors carrying entrained oil, suction means for withdrawing gaseous refrigerant containing entrained oil from the pick-up conduit, a thermostatic expansion valve feeler bulb in operative connection with said suction means, means for feeding liquid refrigerant to said outer refrigerant container, a thermostatic expansion valve connected to said latter means to control refrigerant flow and thereby maintain a substantially constant liquid refrigerant level in any liquid refrigerant present in the container, and means for maintaining a predetermined temperature in the liquid refrigerant present in the outer refrigerant container when the cooler is in use.

9. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, an inner expansion accumulator and separator chamber secured to and inside of said container, said chamber being adapted to have a layer of oil on the bottom thereof, a series of apertures in said chamber adjacent the top thereof for delivering refrigerant to said expansion and accumulator chamber, a coil surrounding said accumulator and expansion chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower end of the conduit extending to adjacent the bottom of said inner chamber, said lower end of the pick-up conduit being bevelled, suction means for withdrawing gaseous refrigerant containing entrained oil from the pick-up conduit, a thermostatic expansion valve feeler bulb in operative connection with said suction means, means for feeding liquid refrigerant to said outer refrigerant container, a thermostatic expansion valve connected to said latter means to control refrigerant flow and thereby maintain a substantially constant liquid refrigerant level in any liquid present in the refrigerant container, and means for maintaining a predetermined temperature in the liquid refrigerant present in the outer refrigerant container where the cooler is in use.

10. In a cooler for liquids, the combination of an outer closed container provided with a side wall and a top wall, said container being adapted to receive a liquid refrigerant, an inner expansion accumulator and separator chamber disposed in said outer container and secured to the top wall thereof, said inner container being adapted to have a layer of oil on the bottom thereof, means to feed liquid refrigerant to the outer container, a series of apertures in said inner chamber adjacent the top thereof for delivering a refrigerant to said expansion and accumulator chamber, a coil for liquid to be cooled surrounding said expansion and accumulator chamber, a suction conduit disposed in said expansion and accumulator chamber, the lower end thereof extending to adjacent the bottom of said inner chamber, suction means for withdrawing gaseous refrigerant and any oil entrained therein from the pick-up conduit, means for maintaining a predetermined temperature for any liquid refrigerant adapted to be present in said outer container, and means located outside of said container for controlling the liquid refrigerating means and arranged to maintain a substantially constant liquid refrigerating level in the outer liquid refrigerant container when the cooler is in use.

11. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, means to feed a liquid refrigerant thereto, an inner expansion accumulator and separator chamber disposed in and fixed to said container, said chamber being adapted to have on the bottom thereof a layer of oil which is separated from the refrigerant, means for delivering refrigerant from said outer container to said expansion and accumulator chamber, a coil for cooling liquid surrounding the said chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower end thereof extending to adjacent the bottom of said inner chamber, suction means for withdrawing gaseous refrigerant and any oil entrained therein from the pick-up conduit, means for maintaining a predetermined temperature in any liquid refrigerant adapted to be present in said outer container, and float-controlled means located outside of said outer container for maintaining a substantially constant liquid refrigerating level in the outer refrigerant container when the cooler is in use.

12. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant, means to feed a liquid refrigerant thereto, an inner expansion accumulator and separator chamber disposed in and fixed to said container, said chamber being adapted to have on the bottom thereof a layer of oil which is separated from the refrigerant, a series of apertures in said chamber adjacent the top thereof for delivering refrigerant from said outer container to said expansion and accumulator chamber, a coil for cooling liquid surrounding the said chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower end thereof

extending to adjacent the bottom of said inner chamber, suction means for withdrawing gaseous refrigerant and any oil entrained therein from the pick-up conduit, means for maintaining a predetermined temperature in any liquid refrigerant adapted to be present in said outer container, and float-controlled means located outside of said outer container for maintaining a substantially constant liquid refrigerating level in the outer refrigerant container when the cooler is in use.

13. In a cooler for liquids, the combination of an outer closed container adapted to receive a refrigerant containing a small amount of oil, means to feed liquid refrigerant therein, an inner expansion accumulator and separator chamber disposed in said container, said chamber having on the bottom thereof a layer of oil, means for delivering refrigerant carrying entrained oil from said outer container to said expansion and accumulator chamber, a coil for cooling liquid surrounding said expansion and accumulator chamber, a suction pick-up conduit disposed in said expansion and accumulator chamber, the lower end thereof extending to adjacent the bottom of said inner chamber and into the oil present therein, suction means for withdrawing gaseous refrigerant containing entrained oil from the pick-up conduit, means for maintaining a predetermined temperature in any liquid refrigerant present in said outer container, and means located outside of said outer container for controlling the liquid refrigerating feeding means and arranged to maintain a substantially constant liquid refrigerant level in said outer liquid refrigerant container when the cooler is in use.

14. The cooler apparatus of claim 13 wherein the means for delivering the refrigerant from the outer container to the expansion and accumulator chamber comprises a series of apertures adjacent the top of the inner container.

15. The cooler apparatus of claim 13 wherein the means for delivering the refrigerant from the outer container to the expansion and accumulator chamber comprises a series of apertures adjacent the top of the inner container and the lower end of the suction conduit is bevelled.

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