Nov. 11, 1958 D. L. EVANS 2,859,596

REFRIGERATION SYSTEM

Filed June 1, 1955 2 Sheets-Sheet 1

Fig. 1

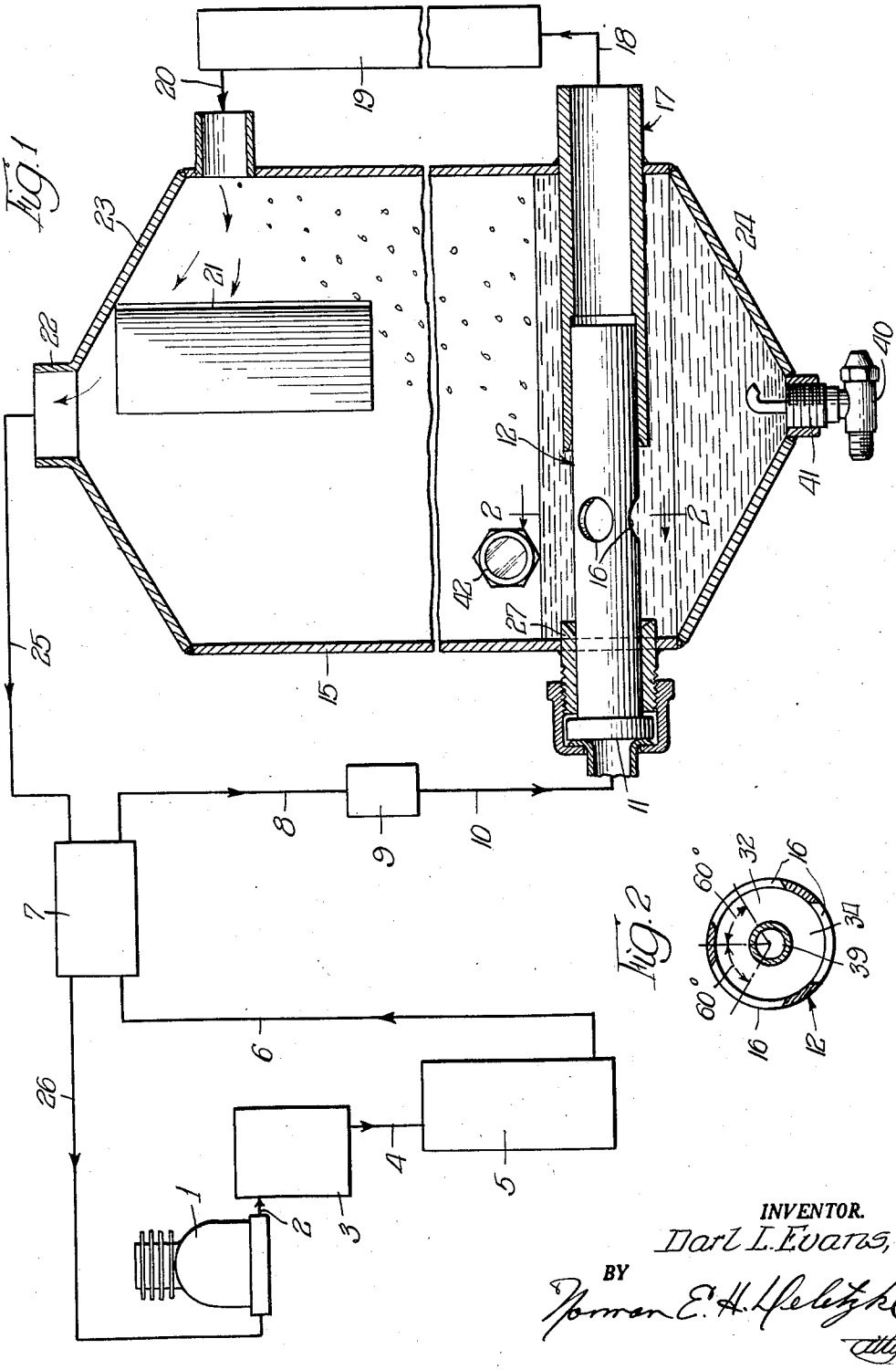

Fig. 2

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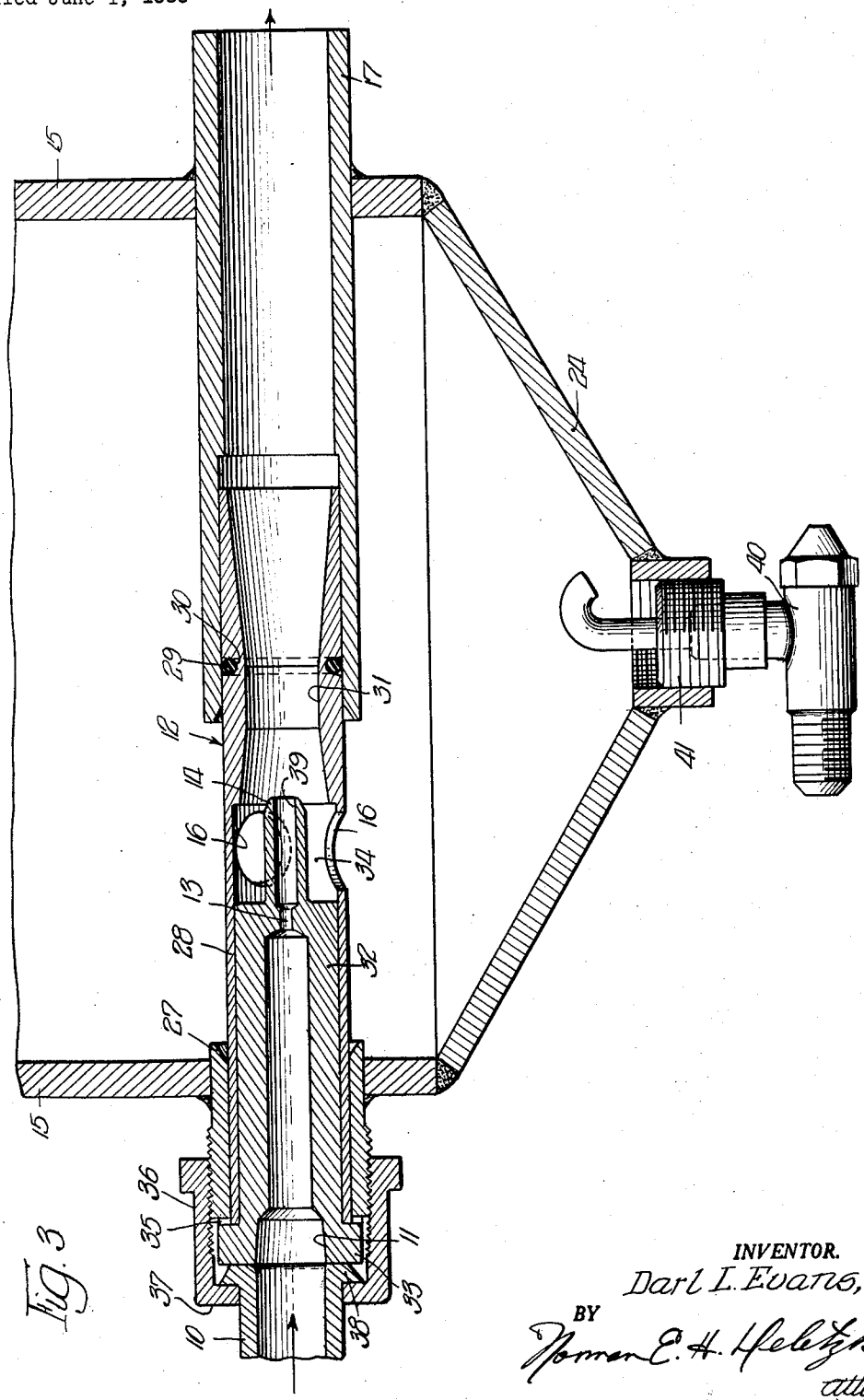

Fig. 3

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United States Patent Office

2,859,596

Patented Nov. 11, 1958

2,859,596

REFRIGERATION SYSTEM

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Application June 1, 1955, Serial No. 512,502

19 Claims. (Cl. 62—471)

This invention pertains to refrigeration apparatus. More specifically stated, this invention relates to improvements in refrigeration apparatus wherein refrigerant, which is not evaporated at the time of discharge from the evaporator, is recirculated directly through the evaporator.

Still more specifically stated, this invention relates to improvements in the arrangements for demountably supporting the refrigerant circulating jet type pump or injector and to the arrangements for securing and for maintaining the satisfactory operation of such pump.

The specific improvements in the herein described and illustrated jet type pump are more specifically described and are claimed in the co-pending companion application Serial No. 512,387, filed June 1, 1955, and entitled "Combined Jet Pump and Regulator."

Many refrigeration devices consist basically of a compresser and a condenser and an evaporator connected in series in the order mentioned, having a return connection from the evaporator to the compressor and having a by-pass connection between the inlet and discharge connections of the evaporator, whereby, to permit a pump associated with such by-pass to immediately recirculate through the evaporator that portion of the volatile refrigerant which failed to evaporate in the evaporator on its initial passage therethrough. In such devices it is common practice to use jet type pumps, using the high pressure refrigerant as working fluid or working substance for recirculating the unevaporated refrigerant through the evaporator. Such jet type pumps are commonly located at the lower or discharge end of a separator tank or surge tank or accumulator through which all of the refrigerant discharged from the evaporator passes and in which the liquid refrigerant and entrained oil and scale and other foreign matter is separated from the gaseous refrigerant being returned from the evaporator to the compressor. In many instances the design of, and the location of, such recirculation pumps is such that the oil and scale separated from the refrigerant in the accumulator or similar tank enter into the recirculation pump and at least greatly interfere with the satisfactory and efficient operation of such pumps. In many instances such pumps are so constructed or are so arranged in the refrigeration system as to be relatively unaccessible and if accessible, difficult to disassemble and reassemble.

In many instances it becomes desirable to vary the refrigerating capacity of the refrigeration apparatus and such variation commonly involves the cumbersome task of completely replacing the jet pump which controls the flow into the evaporator of both the high pressure refrigerant and the recirculated refrigerant.

It is therefore one of the objectives of this invention to provide an improved refrigeration system of the type described, having a readily removable and readily adjustable jet type pump, for the recirculation of refrigerant, positioned in the lower portion of a surge tank or accumulator above a sump arranged for the collection of

oil, scale and other foreign matter separated from the refrigerant, and from which sump such materials may be easily removed from the refrigeration system.

It is a further object of this invention to provide in a closed circuit refrigeration system an improved, simple and effective arrangement in means for collecting and discharging, in an inexpensive and reliable manner with a minimum loss of refrigerant and without interfering with a refrigerant jet pump, the accumulated oil and other foreign matter, such as scale, from a relatively undisturbed portion of the refrigeration system, such as the accumulator or surge tank of a refrigeration system.

Another object of the present invention is to provide, in a refrigeration system of the type described, an improved arrangement for the recirculating of refrigerant, wherein, a cylindrical jet type of refrigerant recirculation pump is demountably housed for easy interchange in the lower portion of the surge tank and is operatively connected to and supported in the adjacent spaced ends of cylindrical tubing forming part of the refrigerant flow system fixed in the walls of the surge tank, for the ready assembly and disassembly of the complete pump or essential parts of the pump.

Still another objective of the invention is to provide a simplified form of apparatus for refrigeration, wherein, a critical relationship is established between certain interacting parts, which arrangement will permit substantially automatic control of the operating characteristics of the improved refrigeration system.

A further objective of this invention is to provide a simple arrangement for easy interchange of elements of the refrigerant circulating pump for resisting the passage of the working substance or high pressure volatile refrigerant from the high pressure side of the system to the low pressure side of the system whereby to enable the control and establishment of desired operating characteristics of the refrigeration unit.

Another feature of the invention is to provide a refrigeration system including a compressor, a condenser, an evaporator, a pressure chamber through which the refrigerant is circulated, a jet pump for circulating refrigerant through the evaporator, and an interchangeable fixed orifice arrangement in the pump, having a critical relationship to the capacity of the refrigerant compressor, for controlling the effective pressure of the working high pressure refrigerant admitted into the jet pump whereby to control the performance characteristics of the refrigeration system when operating on a conventional cycle or on a vapor-gas principle.

Another feature of the invention resides in precooling the refrigerant supplied to the jet orifice of the jet pump to control the operation characteristics of the jet pump.

A still further objective of this invention is to maintain a substantially constant and predetermined input pressure on the working refrigerant delivered by the pressure and flow control orifice to the inspirator or jet nozzle of the jet pump, whereby, to electively establish and maintain predetermined operating characteristics of the jet pump in the pumping and delivery of refrigerant to the evaporator of the refrigeration system.

The foregoing and other objectives, important novel features and advantages of this invention will become more apparent and be more easily understood upon examination of the following description thereof and upon the examination of the accompanying drawings and consideration of the appended claims. It should, however, be understood that, without desire of limitation, this invention will be described as improvements in a simple refrigeration system. Certain changes and variations may suggest themselves to those skilled in the pertinent arts, which changes may not, however, depart from the

spirit of this invention and may come within the scope of the appended claims.

In the accompanying drawings:

Figure 1 is a schematic view diagrammatically illustrating an embodiment of the improved refrigeration system of this invention.

Figure 2 is a vertical cross-sectional view taken along line 2—2 of Figure 1 of the drawings, and

Figure 3 is a longitudinal vertical central sectional view taken through a slightly modified form of the jet type pump and the lower portion of the refrigerant surge tank assembly.

Referring to the drawings, wherein like elements are identified by like numerals, 1 represents generally any suitable refrigerant compressor, such as a conventional motor powered unit, from the discharge end of which compressed volatile refrigerant is supplied through conduit 2 to a condenser 3. From the condenser 3 the refrigerant is in turn discharged through conduit 4 to an underlying receiver 5. From the receiver 5 the refrigerant flows through conduit 6 to and through the high pressure and hot side of a heat exchanger 7 in which the high pressure refrigerant is cooled by the low pressure refrigerant being returned to the compressor 1 as will be hereinafter described. The cooled, high pressure refrigerant flows from the heat exchanger 7 through conduit 8 to and through a suitable refrigerant filtering or screening unit 9. From the filter 9 the filtered and precooled refrigerant flows through conduit 10 into the working fluid entrance port 11 of a jet type injector or refrigerant pump 12. Pump 12 includes a refrigerant pressure and flow control orifice 13 positioned in the pump 12 immediately ahead of the refrigerant inspirator or jet nozzle 14 as shown in Figure 3 of the drawings. The function of the orifice 13 is to control the pressure of the refrigerant supplied to the jet nozzle 14. The pump 12 is housed in, and to one side of, the lower portion of a refrigerant surge tank or pressure vessel 15, and the capacity thereof, particularly the capacity of the orifice 13, has a critical relationship to the capacity of the compressor 1.

The precooled high pressure refrigerant or working substance upon flowing through the injector or jet pump 12 draws accumulated refrigerant from the lower portion of the tank 15 into the pump 12 through the aspiration or suction ports 16. The refrigerant thus drawn into pump 12 through port 16 is discharged from the pump 12 together with the high pressure refrigerant from the orifice or pressure and flow restrictor 13 through the cold refrigerant discharge passage 17 into conduit 18. The refrigerant flows through conduit 18 into the evaporator 19 under pressure in excess of that prevailing in the upper portion of the surge tank 15. The suction ports 16 of pump 12 are positioned to one side of the central portion of the tank 15.

The warmed, gaseous refrigerant, together with any entrained unevaporated refrigerant, oil, scale, etc. is discharged from the evaporator 19 through conduit 20 into the upper portion of the surge tank 15. In the upper portion of the surge tank and separator 15, the refrigerant, oil, etc. impinges against the convex surface of a curved baffle element 21 mounted in the upper portion of the surge tank 15 toward one side of the vertical central portion of that tank and opposite from the aspiration ports 16 in pump 12. The baffle 21 is interposed in the normal path of movement of the gaseous refrigerant from pipe 20 toward the suction outlet 22 located at the apex of the conical upper cover portion 23 of the tank 15.

The impingement of the gaseous refrigerant and entrained liquid refrigerant, oil, scale, etc. against the baffle element 21 causes the separation of the gaseous refrigerant from the entrained materials some of which latter materials accumulate first upon the baffle element 21 and then drop with other like material into the lower portion of tank 15 directly below the baffle 21 to accumulate in the dished, lower head or inverted conical bottom wall 24 of the tank 15. Such accumulated foreign material may be discharged from the downwardly directed central apex portion of the bottom wall 24 in a controlled manner hereinafter described. The accumulated refrigerant is recirculated to the evaporator 19 by the jet pump 12.

From the surge tank 15 the warmed or spent refrigerant gas is drawn by suction from connection 22 into and through conduit 25 to and through the hot side of the heat exchanger 7 and thence flows through conduit 26 to the suction inlet of the compressor 1, thereby completing the flow cycle of the refrigerant.

The general arrangement in a refrigeration system as illustrated in Figure 1 of the drawings, wherein the system includes a series connected compressor, condenser, receiver, and evaporator is of course old. Similarly the use of filters or screens for filtering or screening the high pressure refrigerant before it enters a refrigerant circulating pump of the jet type is also old. The use of heat exchangers, whereby the partially warmed refrigerant gas being returned to the refrigerant compressor is utilized to chill or precool the high pressure compressed and condensed refrigerant, as well as the use of oil and other foreign matter separating arrangements for separating undesirable quantities of oil and other foreign matter from the refrigerant are also generally old. In like manner arrangements in refrigeration systems whereby a surge tank is connected in parallel with the evaporator for the accumulation of refrigerant to be circulated or recirculated through the evaporator and to separate, from the refrigerant being returned to the compressor, the unevaporated refrigerant entrained with the gaseous refrigerant discharged from the evaporator, as well as the use of jet type pumps for the recirculation of such returned refrigerant from the accumulator to the evaporator, is also generally old. This invention, however, provides a new, novel and useful arrangement of an interchangeable arrangement of a jet type refrigerant recirculating pump or injector removably mounted in the lower portion of the refrigerant surge tank above an oil and scale accumulating portion of the tank and to one side of and below the entrained unevaporated refrigerant oil and scale separating baffles whereby the satisfactory and efficient operation of the jet type pump is assured. The ready interchangeability of the improved jet pumps or essential parts of the jet pumps, whereby to repair damage to the pump or to adjust the pumps to the desired operating characteristics is made readily possible by this invention.

The foregoing desirable demountable and interchangeable features are made possible by the use of a cylindrical jet pump 12 which extends diametrically through the lower portion of the surge tank 15, slightly above the oil and scale accumulating station within the lower wall 24 of tank 15. Pump 12 is telescoped at its opposite ends into the axially aligned, cylindrical, diametrically oppositely positioned support elements 17 and 27 permanently fixed in the vertical wall of the tank 15 as by welding. The support element 17 also functions as the refrigerant discharge connection for the flow of refrigerant from the tank 15 to the evaporator 19.

The cylindrical casing or body or housing 28 of the pump 12 is telescoped snugly, at its opposite ends, into the associated but spaced and axially aligned supports or hangers 17 and 27, and, if desired, the discharge end of the pump 12 may be removably sealed to the support 17, as illustrated in Figure 3 of the drawings, by the use of an O ring type elastic seal element 29. Seal 29 is seated in groove 30 in the outer surface of the pump housing 28 and sealingly engages the housing 28 and the inner surface of the support 17. The spacing of the adjacent ends of the supports 17 and 27 is such as not to overlap the laterally opening, equally spaced, aspiration ports 16 in the casing 28 of the pump 12.

The pump 12 consists primarily of the cylindrical housing 28 having an integrally formed Venturi element, generally identified by the numeral 31, in the discharge

end thereof, and having, at the opposite end of the housing 28, a hollow cylindrical, plug-like, ported closure element 32 snugly telescoped thereunto until a peripheral shoulder 33 at the outer end of element 32, surrounding the entrance port 11, engages the adjacent end of the casing 28. The inner end of the plug-like insert element or flow passage means 32 is spaced from the adjacent inner end of the Venturi element 31 to form thereby an aspiration chamber 34 within the casing 28 and between the inner ends of the plug-like closure element 32 and the Venturi element or discharge passage element 31. Access to the aspiration chamber through the wall of casing 28 for the material to be pumped or recirculated is provided by the three circumferentially equally spaced, circular aspiration or suction ports 16, one of which ports 16 is preferably directed downwardly as clearly illustrated in Figure 2 of the drawings.

An annular gasket 35 is snugly telescoped over the casing 28 of pump 12 and is sealingly interposed between the adjacent opposed, parallel faces of the flange 33 and the support 27 and sealingly engages the outer surface of the adjacent end of the pump casing 28 for releasably sealing the plug or ported closure element 32 to the casing 28 and for sealing the outer end of the assembly of the pump 12 to the support 27. A single conventional type coupling nut 36, having an inwardly directed flange 37 which overlaps the shoulder 33 of the flow passage element or plug 32, is threaded onto the support 27 and is utilized to sealingly compress the flared end 38 of refrigerant conduit 10 between the juxtaposed flanges 33 and 37 whereby to seal the end of pipe 10 to the entrance port 11 in plug 32, and is also utilized to compress the gasket 35 into sealing engagement with shoulder 33, casing 28 and support 27, and is also utilized to lock the pump 12 to the hanger or support 27.

Projecting inwardly through the aspiration chamber 34 beyond the ports 16 toward the Venturi element 31, there is provided a cylindrical inspirator nozzle or jet nozzle 14 extending inwardly from the inner end of the plug 32. Jet nozzle 14 is integrally formed with the ported closure or plug 32 and is also coaxial with plug 32. The cylindrical jet nozzle passage 39 is coaxially arranged with the casing 28, the plug 32, the orifice 13, the nozzle 14, and the Venturi element 31. Passage 39 extends from the orifice 13, located inside of the plug 32, centrally through the aspiration chamber 34 to the entrance end of the Venturi element 31.

In the operation of the improved device in the illustrated closed cycle refrigeration system, the high pressure precooled, refrigerant or working substance supplied by the compressor 1 through the condenser 3 and receiver 5 and heat exchanger 7 and filter 9, is restricted in its flow to and through the jet nozzle passage 39 by the refrigerant pressure and flow regulating orifice 13, whereby to assure that the desired quantity of refrigerant at the desired pressure is supplied to the nozzle passage 39. The expansion of the refrigerant while flowing from the orifice 13 into the jet nozzle passage 39 prevents the flow of relatively warm compressed refrigerant into the Venturi element 31. The chilling effect of such initial expansion of the refrigerant upon entering the passage 39 is absorbed by the relatively heavy pump closure element 32 which is due to its snug fit into the pump casing 28 and the snug fit of the casing 28 into the hanger elements 17 and 27 enables the closure element 32 to conduct sufficient heat from these elements and from the incoming compressed refrigerant so as to preclude the "freez-on" of condensate which may be present in the refrigerant onto the orifice 13 or nozzle 14.

The rapid flow and expansion of the jet of refrigerant discharged from jet nozzle 14 into the Venturi element 31 produces the suction whereby to draw in through the ports 16 of pump 12 the refrigerant which has accumulated in the lower portion of the surge tank 15. The pumped refrigerant is blended with the jet stream refrigerant supplied from nozzle 14, and the blended mixture is forced through pipe 18 to the evaporator 19 wherein the suction pressure is substantially the same as in the surge tank 15 which is connected in parallel to the evaporator 19 between the refrigerant supply and return pipes from compressor 1.

Entrained unevaporated refrigerant, oil and scale which is discharged from the evaporator 19 into the pressure surge tank 15, is separated, in the upper portion of tank 15, from the gaseous refrigerant as a result of the reduction in velocity of the flow of the refrigerant after leaving conduit 20 and entering surge tank 15, and as a result of the use of baffle 21, and as a result of precipitation of such materials to the lower portion of the tank 15 on the side thereof fartherest removed from the ports 16 of the jet pump 12. Such an arrangement prevents the objectionable entrance of such oil and scale into the pump 12. The accumulated oil may be drained from the tank 15 by opening the pet cock 40 positioned in the lower portion of the inverted, conical shaped, lower wall 24 of the tank 15. The accumulated oil together with any accumulated scale or other sediment may also be removed by removal of the clean out and drain plug 41, in which drain plug the pet cock 40 is mounted. Inspection of the interior of the surge tank 15 is made possible by the inspection glass 42 in the side wall of tank 15.

As has previously been mentioned, it is desirable, when using a jet type pump or injector 12 for the circulation of a volatile refrigerant into an evaporator to select a pump having the right size orifice 13 whereby to establish a desirable critical relationship between the pump 12 and the capacity of the compressor 1. To a somewhat lesser degree the relationship of the refrigeration load of the evaporator and the corresponding suction pressure in the evaporator 19 and in the surge tank 15 in which the pump 12 is housed, also has a similar bearing on the operating characteristics of the pump or injector 12. Consequently the advantages offered by this invention, whereby a simply constructed pump 12 may be easily and quickly interchanged as a unit in the refrigeration system to secure the desired pump capacity and operating characteristics, or whereby the closure element 32 wherein the orifice 13 is located, may be easily interchanged with a similar closure element 32 having a different size orifice 13 to secure the desired pump adjustment, become obvious.

The use of a jet type pump or injector 12 for the circulation and recirculation of refrigerant to an evaporator 19, which, may if desired, be located above the elevation of the pump 12 and above the normal "shut down" elevation of the refrigerant in the surge tank 15, has the further advantage that such an arrangement will permit the unevaporated refrigerant in the evaporator to drain back into the surge tank from the evaporator upon the discontinuance of the operation of the pump 12, thereby providing desirable control of the refrigeration procedure in the evaporator.

From the foregoing description of this invention and from the accompanying drawings, it will be apparent that this invention realizes the introductorily enumerated objectives respecting a refrigeration system, which refrigeration system possesses the hereinbefore listed advantages and provides a new, unique and useful arrangement in a readily adjustable refrigeration system including a demountable and interchangeable refrigerant recirculating pump in which interchange of certain essential and critical elements may be quickly and easily made to establish the desired operating characteristics of the pump by the disconnection of the liquid supply line leading to the jet pump and the interchange of pumps or the interchange of the orifice carrying closure element of the pump.

Having thus described and illustrated an embodiment of this invention in a refrigeration system, the invention

is not to be interpreted as being restricted to the specifically illustrated and described embodiment as set forth in the drawings and as hereinbefore described, except insofar as is necessitated by the disclosure of the prior art and the appended claims.

The invention is hereby claimed as follows:

1. In a refrigerating apparatus, the combination of a refrigerant evaporator, a surge tank and refrigerant separator, a jet pump demountably housed in and readily accessible in the lower portion of said tank for delivering refrigerant to said evaporator, baffle means positioned in said tank above said pump for separating entrained liquid refrigerant and oil from gaseous refrigerant discharged into said tank from said evaporator and for directing separated refrigerant and oil into the lower portion of said tank, said jet pump being ported on its lower side and opposite from the portion of said tank housing said baffle means for withdrawing refrigerant stored in said tank, means for supplying refrigerant under pressure to the jet nozzle of said jet pump, pressure control orifice means in said pump positioned at the inlet to said jet nozzle for controlling the pressure and quantity of the refrigerant flowing through said jet nozzle and for controlling the pumping action of said jet pump in the recirculation of refrigerant from the lower portion of said surge tank to said evaporator, and means for withdrawing gaseous refrigerant under reduced pressure from the upper portion of said surge tank.

2. A refrigeration device comprising, in combination, a surge tank adapted to be partially filled in the lower portion thereof with liquid refrigerant under relatively low pressure, a jet pump removably housed and readily accessible in the lower portion of said tank below the normal level of liquid refrigerant therein, said pump comprising a ported suction chamber and a delivery tube having a restricted throat and a jet nozzle axially aligned with said restricted throat and extending into said suction chamber, said delivery tube being adapted to receive a jet of refrigerant from said nozzle together with any entrained refrigerant sucked into said suction chamber, a pressure control orifice at the inlet of said nozzle, refrigerant supply conduit means and refrigerant discharge conduit means releasably communicating respectively with said orifice at the inlet of said nozzle and the outlet of said throat, refrigerant compressor means and refrigerant condenser means connected in series for supplying refrigerant to said nozzle by way of said orifice and said supply conduit means, a refrigerant evaporator for receiving refrigerant from said discharge conduit means and discharging refrigerant into the upper portion of said surge tank, conduit means for withdrawing gaseous refrigerant from the upper portion of said surge tank and conducting same to said compressor means, baffle means housed within the upper portion of said surge tank in the normal path of travel of said gaseous refrigerant for separating therefrom entrained liquid refrigerant and entrained oil from the refrigerant discharged into the upper portion of said tank.

3. A closed circuit refrigeration apparatus comprising, a compressor, a condenser, a jet pump, a pressure control orifice in said jet pump, a surge tank, and an evaporator and connecting conduit means to establish the closed circuit of the refrigeration apparatus, said jet pump being housed in said surge tank and including a jet nozzle the inlet end of which nozzle is immediately adjacent the discharge side of said orifice and including a restricted throat into and through which jet nozzle a stream of refrigerant under controlled pressure is projected from said orifice into and through an aspirator chamber of said pump and into said restricted throat of said pump, for entraining low pressure refrigerant from said surge tank and combining such entrained refrigerant with high pressure refrigerant and circulating the combined refrigerants into an evaporator, and means detachably mounting said jet pump and having one end thereof extending outwardly through an opening in the wall of said surge tank so as to be readily removable from said surge tank through the opening in the wall thereof.

4. A refrigeration apparatus comprising, in combination, a compressor, a condenser, a receiver, a surge tank, an evaporator, refrigerant supply conduit means connecting all in series in the order mentioned, said refrigerant supply conduit means operatively communicating with the lower interior portion of said surge tank immediately above an inverted frusto conical bottom portion of said surge tank, refrigerant return conduit means connecting said evaporator and said surge tank and said compressor in series in the order mentioned, said refrigerant return conduit means operatively communicating with the upper interior portion of said surge tank, baffle means in the upper interior portion of said surge tank to baffle the flow of returning refrigerant as it passes through the upper portion of said surge tank, whereby to separate liquid refrigerant and oil and other foreign matter from gaseous refrigerant and cause the pecipitating of the liquid refrigerant and entrained oil and other foreign matter to the bottom of said surge tank wherein the oil will accumulate in the lowermost section of a frusto conical bottom portion, an oil drain cock in the lower section of said frusto conical bottom portion of said surge tank, and a readily accessible jet type injector removably housed in the lower portion of said surge tank and releasably connecting the adjacent ends of said refrigerant supply conduit means for aspirating accumulated refrigerant from the lower portion of said surge tank and injecting the aspirated refrigerant together with refrigerant supplied from the compressor into the refrigerant supply conduit leading to the evaporator.

5. A device according to claim 4, wherein said injector is provided with aspiration ports located to one side of the vertical central portion of said surge tank near the bottom thereof and wherein said baffle means is located on the opposite side of said vertical central portion of said surge tank near the top thereof.

6. In a refrigerating system, a compressor having a suction inlet and a pressure outlet, a condenser having an inlet and an outlet, first conduit means connecting the pressure outlet of said compressor with the inlet of said condenser, a surge tank having an upper portion and a lower portion, an evaporator having an inlet and an outlet, second conduit means connecting the outlet of said evaporator and the inlet of said compressor to the upper portion of said surge tank, third conduit means connecting the inlet of said evaporator and the outlet of said condenser to the lower portion of said surge tank, a readily accessible jet pump operatively and demountably connected into said third conduit means interiorly of said surge tank for transferring high pressure refrigerant from said condenser to said evaporator under lower pressure and for transferring refrigerant from the lower portion of said surge tank to said evaporator, and pressure restricting orifice means in said jet pump for controlling the pressure of the refrigerant passing through said pump from said compressor, the inlet end of said jet pump being of a maximum diameter of said jet pump and extending out of the interior of said surge tank through an opening in the wall of said surge tank, and means detachably mounting said jet pump and having one end thereof extending outwardly through an opening in the wall of said surge tank so as to be readily removable from said surge tank through the opening in the wall thereof.

7. A refrigeration system, comprising, in combination, a compressor, a condenser, a surge tank, and an evaporator connected together to form a closed cycle system, a jet pump housed in said surge tank in a conduit connection between said condenser and said evaporator, said jet pump having a readily removable jet nozzle element, said jet nozzle element and said pump housing being arranged in a readily demountable order for interchangeable association with different jet nozzle elements, there-

by to enable the varying of the operating characteristics of the refrigeration system, the inlet end of said jet pump being of a maximum diameter of said jet pump and extending out of the interior of said surge tank through an opening in the wall of said surge tank, and means detachably mounting said jet pump and having one end thereof extending outwardly through an opening in the wall of said surge tank so as to be readily removable from said surge tank through the opening in the wall thereof.

8. A device according to claim 7, having a pressure restricting orifice in said jet pump at the entrance to said jet nozzle, said orifice having a critical relationship to the capacity of said compressor, whereby to secure the satisfactory operation of said system.

9. A chilling apparatus comprising, in combination, an evaporator wherein a substance to be chilled may be maintained in indirect heat exchange relation with a vaporizable refrigerating medium, first conduit means for withdrawing vaporized and unvaporized refrigerant from said evaporator and conducting it to the upper portion of a refrigerant separating and storage receptacle wherein the pressure is substantially equal to the pressure in the evaporator, baffle means in the upper portion of said separating and storage receptacle for separating gaseous refrigerant from entrained liquid refrigerant and oil and discharging the liquid refrigerant and oil into the lower portion of said receptacle, second conduit means for conducting gaseous refrigerant withdrawn from the upper portion of said receptacle to compressor and condenser means, jet pump means so constructed and arranged as to be removably housed in the lower portion of said receptacle with one end of said jet pump extending out out of the interior of said receptacle and having an aspiration port communicating with the lower portion of said receptacle, third conduit means for supplying refrigerant under pressure from said compressor and condenser means to the jet nozzle of said pump, fourth conduit means for receiving from said pump the refrigerant supplied to said nozzle together with entrained refrigerant withdrawn from the lower portion of said receptacle through said aspiration port and supplying all such refrigerant to said evaporator at a pressure in excess of the pressure existing in said receptacle, and a refrigerant pressure regulating orifice means in said jet pump immediately ahead of said jet nozzle and intermediate said nozzle and said compressor and condenser means, said orifice means having an opening bearing a critical relation to the capacity of said compressor.

10. A refrigeration system having high and low pressure portions for refrigerant, comprising, in combination, a compressor and a condenser and an evaporator all operatively connected in series by connecting means in the order mentioned, a surge tank operatively connected in parallel to said evaporator intermediate said condenser and said evaporator on the high pressure side of said system and intermediate said evaporator and said compressor on the low pressure side of said system, jet pump means demountably housed in said surge tank and operatively connected in a readily releasable manner in the connection for supplying high pressure refrigerant from said condenser to said evaporator, means detachably mounting said jet pump means and having one end thereof extending outwardly through an opening in the wall of said surge tank so as to be readily removable from said surge tank through the opening in the wall thereof, and pressure restricting orifice means in said jet pump means immediately ahead of a jet nozzle means for restricting the pressure of the refrigerant supplied by said condenser for delivery to said jet nozzle means.

11. In a device of the character described, a chamber having opposed first and second openings in the side wall portion thereof, substantially horizontal conduit means passing through said opposed first and second openings and extending through said chamber, downwardly directed port means in said conduit means intermediate said opposed first and second openings, a Venturi member in said conduit means intermediate said port means and the first of said opposed first and second openings, a jet means demountably housed in said chamber for supplying a stream of refrigerant into said Venturi member at the end thereof adjacent the second of said opposed first and second openings, and an orifice integrally formed with said jet nozzle and positioned immediately ahead of the entrance to said jet means for restricting the flow of refrigerant into said jet means, said jet means comprising a ported closure for one end of said conduit means and extending out of one of said openings in the side wall portion of said chamber and arranged and constructed so as to be readily removable from said chamber.

12. A refrigeration unit comprising, in combination, a compressor, a condenser, a jet pump, a surge tank and refrigerant separator, an evaporator, a suction connection establishing communication between the upper portion of said tank and the suction inlet of said compressor for the return of refrigerant under suction pressure to said compressor, said evaporator having a refrigerant supply connection with the lower portion of said tank for supplying refrigerant under pressure in excess of said suction pressure, said evaporator also having a refrigerant return connection to the upper portion of said tank for the return to said tank of refrigerant under reduced pressure, conduit means for flowing refrigerant under pressure in excess of said suction pressure from said compressor to and through said condenser to said jet pump, a refrigerant pressure control orifice in said jet pump immediately preceding a jet nozzle for receiving the refrigerant from said conduit means and conducting the refrigerant into said jet nozzle of said pump, a laterally ported and cylindrical suction chamber and a cylindrical Venturi passage element axially aligned in the order mentioned with said nozzle in said jet pump, and means detachably mounting said jet pump and having one end thereof extending outwardly through an opening in the wall of said surge tank so as to be readily removable from said surge tank through the opening in the wall thereof, said jet pump traversing the interior of the lower portion of said tank to establish communication between said conduit means and said refrigerant supply connection and the interior of the lower portion of said tank for supplying to said evaporator under a pressure in excess of said suction pressure the refrigerant from said conduit means and entrained refrigerant from said tank.

13. A chilling apparatus comprising, in combination, an evaporator, a refrigerant storage receptacle from which refrigerant is supplied to said evaporator and to which refrigerant is returned from said evaporator, jet pump means housed in the lower portion of said receptacle and having an aspiration port communicating with the lower portion of said receptacle, means detachably mounting said jet pump means and having one end thereof extending outwardly through and opening in the wall of said surge tank so as to be readily removable from said surge tank through the opening in the wall thereof, refrigerant supply connection means for supplying refrigerant under pressure to a jet nozzle of said jet pump means, conduit means for receiving from said jet pump means the refrigerant supplied to said nozzle together with entrained refrigerant withdrawn from the lower portion of said receptacle by said jet pump means and for supplying all such refrigerant to said evaporator, pressure regulating orifice means in said jet pump means immediately ahead of said jet nozzle and within said receptacle, said orifice having an opening bearing a critical relation to the capacity of said supply means and being formed with said jet nozzle as a unitary and easily detachable element in said jet pump means, said detachable element being

arranged for interchangeable association of said jet pump means with other of said detachable elements having a different size orifice for varying the operating characteristics of said chilling apparatus.

14. A chilling apparatus comprising, in combination, an evaporator, a refrigerant storage receptacle from the lower portion of which refrigerant is supplied through a conduit to said evaporator, jet pump means housed in the lower portion of said receptacle and having an aspiration port communicating with the lower portion of said receptacle, said jet pump having a cylindrical casing supportingly telescoped snugly into spaced hanger elements having cylindrical openings for receiving said cylindrical pump casing, one end of said pump and the hanger element into which it is telescoped extending out of said receptacle through a wall thereof to make said pump readily accessible and readily demountable, supply conduit means for supplying refrigerant to said pump, compressible seal means for sealing said pump to said last mentioned hanger element, and a single coupling means for coupling said supply conduit means to said pump and for coupling said pump to said last mentioned hanger element and for compressing said seal means into sealing position intermediate said pump and said last mentioned hanger element.

15. In apparatus of the character described, a refrigerant supply tank having a cylindrical supply inlet connection for refrigerant aligned with a cylindrical supply outlet connection for refrigerant, a cylindrical jet pump having at one end thereof a coaxial and cylindrical jet nozzle and having a cylindrical aspiration chamber at its mid section and having a restricted coaxial Venturi element forming a discharge throat at its opposite end whereby said nozzle communicates with said supply inlet and said discharge throat communicates with said supply outlet, said supply inlet connection extending through the wall of said tank and said cylindrical jet pump being telescopically fitted snugly into said supply inlet connection and into said supply outlet connection with the inlet end of said pump extending out of the wall of said tank through said inlet connection to provide a readily demountable pump arrangement, seal means for sealing said pump to said supply inlet connection, and a single coupling and compressing means for coupling said pump to said inlet connection and for compressing said seal into sealing position intermediate said pump and said inlet connection and for locating said pump axially with respect to said inlet connection and with respect to said outlet connection.

16. In apparatus of the character described, a refrigerant separating and supply tank having a refrigerant supply inlet and a refrigerant supply outlet and having at its upper end a refrigerant return inlet and a refrigerant return outlet, a refrigerant evaporator connected at its opposite operative ends with said supply outlet and said return inlet for receiving refrigerant from and for returning refrigerant to said tank, a jet pump connecting said supply inlet and said supply outlet and having an aspiration port in the lower portion of said tank, said aspiration port being positioned downwardly from and to the opposite side of said tank from said refrigerant return inlet, whereby oil and scale and other foreign matter entrained with the refrigerant returned to said tank from said evaporator will precipitate to the bottom of said tank without passing unduly close to said aspiration port.

17. In apparatus of the character described, a surge tank having in its lower portion a high pressure refrigerant inlet connection and an expanded refrigerant outlet connection and having in its upper portion an evaporated refrigerant inlet connection and an evaporated refrigerant outlet connection, said high pressure refrigerant inlet connection and said expanded refrigerant outlet connection being cylindrical and axially aligned, a refrigerant evaporator connected at one end to said expanded refrigerant outlet connection and connected at another end to said evaporated refrigerant inlet connection for receiving refrigerant from and returning refrigerant to said tank, refrigerant compressing and condensing means for receiving refrigerant to be compressed from said evaporated refrigerant outlet connection and compressing and condensing same and supplying high pressure refrigerant to said high pressure refrigerant inlet connection, a cylindrical jet pump having at one end thereof a coaxial and cylindrical jet nozzle element and having a cylindrical aspiration chamber at its mid section and having a restricted coaxial cylindrical Venturi passage element forming a discharge throat at its opposite end, said cylindrical jet nozzle element being telescoped into and communicating with said high pressure refrigerant inlet connection and said discharge throat being telescoped into and communicating with said expanded refrigerant outlet connection, and a cylindrical and coaxial refrigerant pressure control orifice in said jet pump intermediate said jet nozzle and said high pressure refrigerant inlet connection for controlling the pressure of the refrigerant entering said jet nozzle, said orifice having a critical relationship to the capacity of said compressor, said cylindrical jet pump being so constructed and arranged as to have one end thereof extending out of said tank through the high pressure refrigerant inlet connection and being readily removable through said connection from said tank.

18. A refrigeration unit comprising, in combination, a compressor, a condenser, a jet pump, a surge tank and refrigerant separator, an evaporator, a suction connection establishing communication between the upper portion of said tank and the suction inlet of said compressor for the return of refrigerant under suction pressure to said compressor, said evaporator having a refrigerant supply connection with the lower portion of said tank for supplying refrigerant under pressure in excess of said suction pressure, said evaporator also having a refrigerant return connection to the upper portion of said tank for the return to said tank of refrigerant under reduced pressure, conduit means for flowing refrigerant under pressure in excess of said suction pressure from said compressor to and through said condenser to said jet pump, a refrigerant pressure control orifice in said jet pump for receiving the refrigerant from said conduit means and conducting the refrigerant into a jet nozzle of said pump, a laterally ported and cylindrical suction chamber and a cylindrical Venturi element axially aligned in the order mentioned with said nozzle in said jet pump, said jet pump traversing the interior of the lower portion of said tank to establish communication between said conduit means and said refrigerant supply connection and the interior of the lower portion of said tank for supplying to said evaporator under a pressure in excess of said suction pressure the refrigerant from said conduit means and entrained refrigerant from said tank, said jet pump being provided with a ported closure element of relatively heavy construction for one end of said pump, said ported closure including said orifice and being formed integrally with said jet nozzle, said orifice being of a size to have a critical relationship to the capacity of said compressor, said ported closure element being interchangeable with similar closure elements having orifice means of a different size.

19. A refrigeration unit comprising, in combination, a compressor, a condenser, a jet pump, a surge tank and refrigerant separator, an evaporator, a suction connection establishing communication between the upper portion of said tank and the suction inlet of said compressor for the return of refrigerant under suction pressure to said compressor, said evaporator having a refrigerant supply connection with the lower portion of said tank for supplying refrigerant under pressure in excess of said suction pressure, said evaporator also having a refrigerant return connection to the upper portion of said tank for the return to said tank of refrigerant under reduced

pressure, conduit means for flowing refrigerant under pressure in excess of said suction pressure from said compressor to and through said condenser to said jet pump, a refrigerant pressure control orifice in said jet pump for receiving a refrigerant from said conduit means and conducting the refrigerant into a jet nozzle of said pump, a laterally ported and cylindrical suction chamber and a cylindrical Venturi element axially aligned in the order mentioned with said nozzle in said jet pump, said jet pump traversing the interior of the lower portion of said tank to establish communication between said conduit means and said refrigerant supply connection and the interior of the lower portion of said tank for supplying to said evaporator under a pressure in excess of said suction pressure the refrigerant from said conduit means and entrained refrigerant from said tank, said jet pump being provided with a ported closure element of relatively heavy construction for one end of said pump, said ported closure including said orifice and being formed integrally with said jet nozzle, said orifice being

of a size to have a critical relationship to the capacity of said compressor, said ported closure element being interchangeable with similar closure elements having orifice means of a different size and being snugly telescoped into a housing for said pump, said housing being snugly telescoped into holder means in the wall of said tank, whereby the refrigerating effect of the initial expansion of the refrigerant while flowing from said orifice is promptly absorbed by said closure and said housing and said holder and said tank thereby to prevent the congealing onto said nozzle of moisture which may be present in the refrigerant.

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