Nov. 10, 1959 L. BUEHLER, JR 2,911,801

REFRIGERANT CONDENSING UNIT

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Fig. 1.

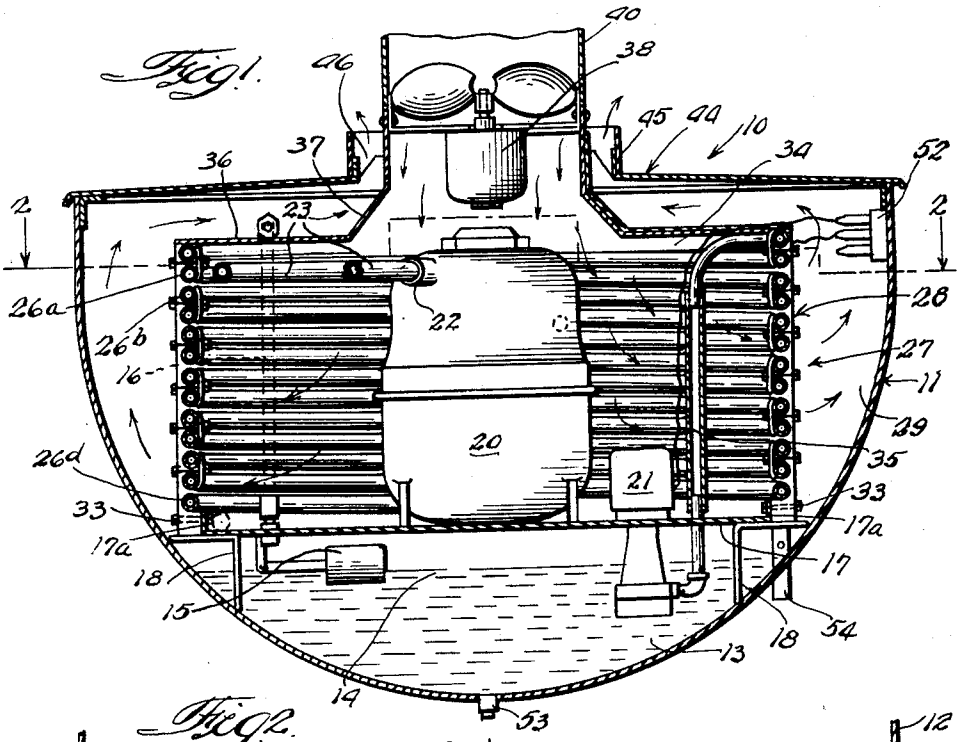
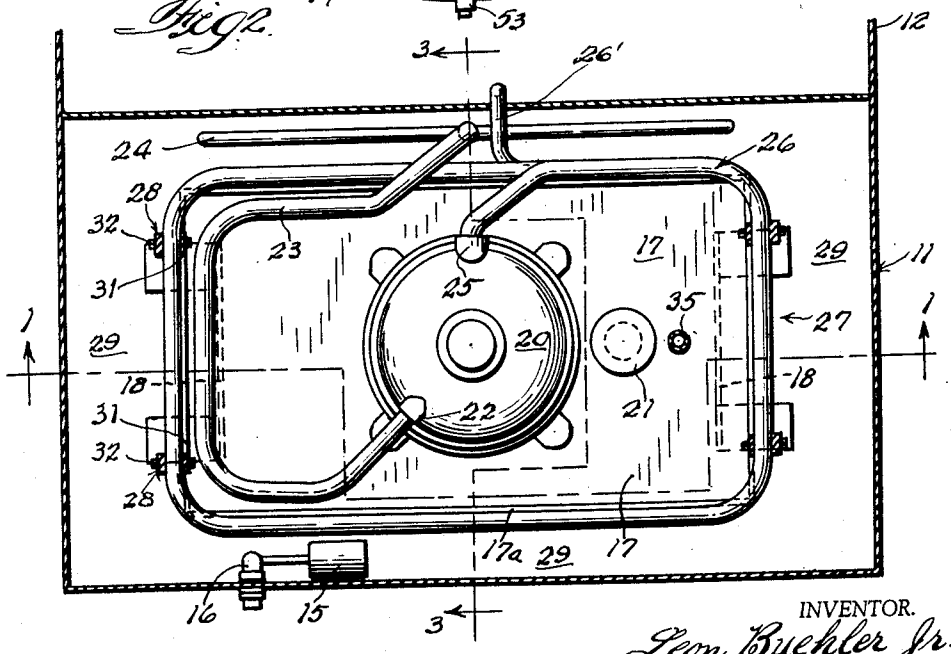


Fig. 2.



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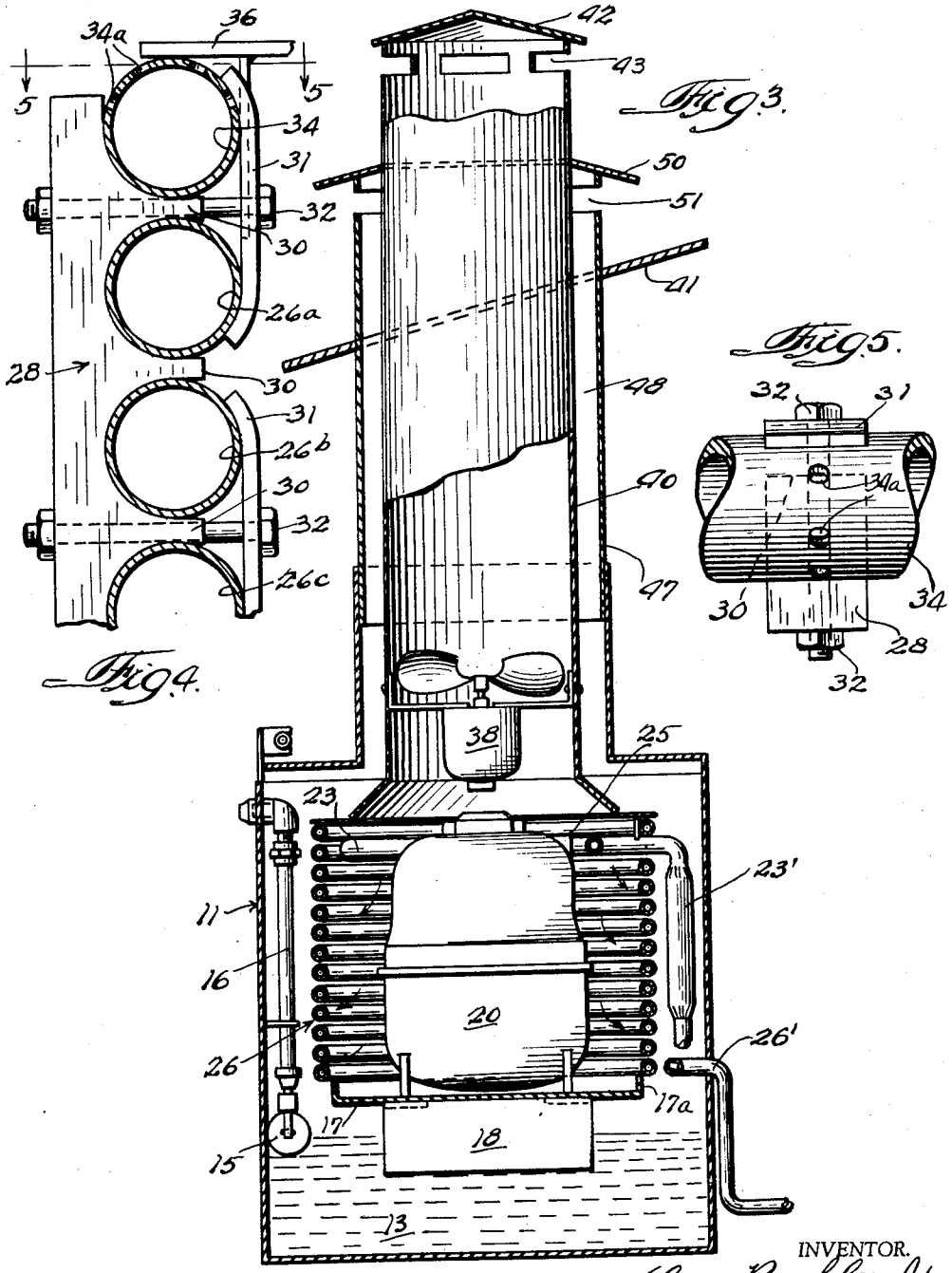


Fig. 4.

Fig. 3.

Fig. 5.

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United States Patent Office 2,911,801
Patented Nov. 10, 1959

2,911,801

REFRIGERANT CONDENSING UNIT

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Application February 20, 1958, Serial No. 716,407

6 Claims. (Cl. 62—305)

This invention relates to a refrigerant condensing unit and, more particularly, to one employing an evaporative-type condenser.

The term "condensing unit" is hereinafter intended to cover a combination of one or more power-driven compressors, condensers, liquid refrigerant receivers (when required), and the customary accessory equipment.

Various evaporative-type condensers have heretofore been provided which, however, are not suitable for use in the manner hereinafter disclosed, because of their space and height requirements. Furthermore, in instances where such condensers have been combined with compressors, the latter and their associated parts, by reason of their relative disposition, are subjected to a high rate of corrosive deterioration.

Thus, it is one of the objects of this invention to provide a condensing unit which is highly compact and capable of being built into a unitary refrigerating system such, for example, as utilized in a bulk farm cooling tank disclosed in United States Patent No. 2,740,269.

It is a further object of this invention to provide a refrigerant condensing unit which has a high refrigerating capacity and is readily capable of being factory-assembled and sealed within a refrigerating system and thus requiring only water and electrical power sources, and drain connections.

It is a still further object of this invention to provide a refrigerant condensing unit in which motors and power-driven parts of such unit are disposed in a moisture-free section of the unit and thus materially reducing corrosive deterioration thereof.

It is a still further object of this invention to provide a refrigerant condensing unit which is simple and sturdy in construction, effective in operation, and requiring a minimum of maintenance and service.

Further and additional objects will appear from the description, accompanying drawings, and appended claims.

In accordance with one embodiment of this invention, a refrigerant condensing unit is provided comprising a reservoir in which a predetermined amount of liquid is accumulated. Spaced above the accumulated liquid in a refrigerant compressor. Connected to the discharge side of the compressor is one end of a condensing coil, the latter being formed into an upright air-pervious partition, disposed in spaced, encircling relation with respect to the compressor and also spaced above the level of accumulated liquid. Cooperating with the accumulated liquid and the coil is a means for effecting recirculation and distribution of the liquid over the exposed surfaces of the air-pervious partition. Air-impelling means is provided for directing air into the space delimited by said partition from which such air passes through the air-pervious partition.

For a more complete understanding of this invention, reference should be made to the drawings, wherein:

Figure 1 is a fragmentary vertical sectional view of

the improved refrigerant condensing unit taken along line 1—1 of Fig. 2.

Fig. 2 is a fragmentary sectional top view taken along line 2—2 of Fig. 1.

Fig. 3 is a fragmentary sectional view taken along line 3—3 of Fig. 2.

Fig. 4 is an enlarged fragmentary vertical sectional view of the air-pervious partition formed by the condensing coil.

Fig. 5 is a fragmentary top plan view of Fig. 4.

Referring now to the drawings and, more particularly, to Fig. 1, an improved refrigerant condensing unit 10 is shown which, in this instance, is illustrated as being assembled and forming a part of a bulk farm tank of a type similar to that disclosed in United States Patent No. 2,740,269. It is to be understood, however, that the invention is not intended to be limited to this particular combination.

The unit, as shown in Fig. 1, comprises a housing 11 which, in this instance, is semi-cylindrical in cross-section and conforms substantially to the cross-sectional shape of the outer jacket 12 of the farm tank with which it is assembled. The lower portion of housing 11 functions as a reservoir 13, in which is accumulated a predetermined amount of liquid 14, the latter customarily being water. The level of the liquid in the reservoir 13 may be controlled in any suitable manner, such, for example, by a conventional type float valve 15. Valve 15 is connected to a water feed pipe 16 which, in turn, communicates with a suitable water supply, not shown.

Mounted within housing 11, and spaced above the level of the liquid 14, is a panel or baffle member 17 which is maintained in a substantially horizontal position by a pair of anchor brackets 18, the latter being secured to the interior surface of housing 11. Panel 17 is air-impervious and functions as a support for a refrigerant compressor 20, which is preferably spring mounted thereon. Panel 17 is provided with an opening to accommodate a motor and pump assembly 21, the function of which will be discussed more fully hereinafter. The periphery of panel 17 is spaced from the interior surface of housing 11 and is provided with an upturned flange 17*a*.

Connected to the intake side 22 of compressor 20 is a conduit section 23 which communicates with a return header 24 for the expansion chamber (not shown) of the farm tank. The discharge or high pressure side 25 of compressor 20 is connected to one end of a condenser coil 26 which is deformed into a substantially helical configuration to define a substantially upright air-pervious partition 27, which is spaced above the level of liquid 14 and encompasses in spaced relation compressor 20. As seen in Fig. 1, partition 27 is also spaced from the interior surface of housing 11. Included within the space delimited by partition 27 is the motor of assembly 21.

The bottom coil turn 26*d* of condenser coil 26 is connected by a conduit section 26' directly to the intake side of the expansion chamber (not shown) of the farm tank with which it is assembled. In some installations, however, section 26' might be connected to a liquid receiver (not shown).

The various turns, 26*a*, 26*b* and 26*c* of the helically deformed coil 26 are maintained in vertically spaced relation with respect to one another by a plurality of vertically disposed brackets 28 (see Fig. 4), which extend substantially the full height of the partition and are provided with a plurality of longitudinally spaced projections 30 which are disposed between adjacent turns of the coil. Cooperating with each bracket 28 are a plurality of clamp plates 31 which are secured thereto by bolt assemblies 30. The lower end of each bracket

28 is secured by an anchor bolt assembly 33 to the vertically extending peripheral flange 17*a* formed on panel 17 (see Fig. 1) and is maintained in relatively fixed position within the housing 11.

The spacing 29 between partition 27 and the interior surface of housing 11 defines an air discharge manifold, the function of which will be described more fully hereinafter.

Mounted on the upper side of partition 27 and forming a part thereof, is a perforated header 34 which is disposed in substantially coincident relation with respect to the upper turn 26*a* of coil 26. As seen in Fig. 4, perforations 34*a* are formed in the upper portion of header 34 and are adapted to permit flow of the liquid 14 therethrough, whereupon the liquid will gravitate over the exposed surfaces of the coil turns to the reservoir 13. The header 34 is connected by a conduit section 35 to the discharge side of motor and pump assembly 21, whereby the liquid accumulated in the reservoir is continuously recirculated from the reservoir through header 34. The exposed surfaces of the coil turns are formed of a material having a high coefficient of heat transfer, thereby resulting in a highly efficient operation.

Overlying header 34 is a second baffle member 36, which is air-pervious except for a substantially centrally disposed raised apertured portion 37. Baffle member 36 is of a shape corresponding substantially to the area delimited by header 34. Mounted within apertured portion 37 is a power-driven fan assembly 38, which is adapted to direct air downwardly, as indicated by the arrows, into the space delimited by partition 27. Because of the air-impervious character of baffle members 17 and 36, the air within the space delimited by partition 27 is caused to flow outwardly through partition 27 into the air discharge manifold 29. It should be noted that the compressor 20 is aligned with respect to the fan assembly 38, thereby resulting in the air flowing past the compressor 20 prior to passing through the partition, thus eliminating the possibility of corrosive deterioration of the compressor due to the recirculated liquid. The motor of the pump assembly 21 is also disposed within the path of the air flow and on the dry side of partition 27. Where it is desired to obtain the incoming air directly from the outside, a vertically extending duct section 40 may be mounted on and secured to apertured portion 37 of baffle member 36. The upper portion of duct section 40 projects through a suitable opening formed in the roof 41 of the building in which the unit is located, and is provided with a cover shield 42. A plurality of vents 43 are formed in the upper end of duct 41, beneath shield 42 through which fresh air is admitted into the duct.

A cover or lid 44 is provided for the upper end of housing 11. The lid is air-impervious except for a centrally disposed, raised apertured portion 45. The diameter of the aperture in portion 45 is greater than the outer diameter of apertured portion 37 of baffle member 36; thus, a discharge passageway 46 is formed which communicates with manifold 29. Where it is desired to vent the exhaust or discharged air directly to the outside, a second duct section 47 may be secured directly to portion 45 of lid 44. The inside diameter of duct section 47 is greater than the outside diameter of duct section 40 and thus provides a discharge passageway 48. The upper end of duct section 47 extends through the opening in roof 44 and is capped by a shield 50 disposed a substantial distance beneath vents 43 of duct section 40. A plurality of vents 51 are also formed in the exposed portion of section 47 adjacent shield 50, so as to provide ports for the discharge of air flowing upwardly through passageway 48.

As seen in Fig. 1, a control panel 52 may, if desired, be mounted within the discharge manifold for the purpose of controlling the operation of the compressor 20, fan 38, and motor and pump assembly 21. It is to be understood, of course that the location of such control panel will be dependent upon convenience.

In order to permit periodic cleanout of reservoir 13, a plugged opening 53 is provided at the lower portion of housing 11. Furthermore, as a safety feature against the possibility of float valve 15 sticking in an open position, an overflow drain 54 is provided in the lower portion of housing 11.

As noted in Fig. 3, conduit section 23, connecting header 24 to the inlet side 22 of compressor 20 may, if desired, be provided with a dryer section 23'.

Thus, it will be seen that a refrigerant condensing unit has been provided which is of compact construction, yet has a high refrigerating capacity. Furthermore, the location of the compressor as well as the pump motor in a dry environment materially reduces or eliminates completely deleterious corrosive effects. Factory-sealing of the various components comprising the improved unit renders the latter substantially self-contained, requiring only a water and electrical power supply.

While a particular embodiment of this invention is shown above, it will be understood, of course, that the invention is not to be limited thereto, since many modifications may be made and it is contemplated, therefore, by the appended claims, to cover any such modifications as fall within the true spirit and scope of this invention.

I claim:

1. A refrigerant condensing unit comprising a housing having substantially upright side sections and a bottom section cooperating with one another to form a liquid reservoir in a lower portion of said housing, means for maintaining a predetermined level of liquid within said reservoir, a refrigerant condensing coil disposed within said housing above the liquid level in said reservoir and forming an upright air-pervious partition spaced from said housing side sections, air-impelling means for directing the flow of air into the upper portion of said housing in substantially one direction through said partition into the spacing between said partition and said housing side sections, means cooperating with said reservoir to effect distribution of the liquid accumulated therein onto the exposed surfaces of said coil, and a refrigerant compressor disposed above the liquid level and intermediate said air impeller and said partition and communicating with one end of said coil.

2. A refrigerant condensing unit comprising a housing having substantially upright side sections and a bottom section cooperating with one another to form a liquid reservoir in the lower portion of said housing in which a predetermined amount of liquid is accumulated, conduit means within said housing and through which a compressed refrigerant circulates in substantially one direction, said conduit means having exposed heat transfer surfaces and defining an upright air-perivous partition spaced from said housing side section and forming an air discharge manifold on one side of said partition, air-impelling means disposed on the opposite side of said partition and directing the flow of air in substantially one direction through said partition into said discharge manifold, means cooperating with said reservoir to effect recirculation and distribution of the liquid accumulated therein onto the exposed heat transfer surfaces of said conduit, and a refrigerant compressor within said housing and disposed on the same side of said partition as said air impelling means, said compressor being positioned above the level of the accumulated liquid and in the flow path of the air impelled by said means toward said partition.

3. A refrigerant condensing unit comprising a housing having substantially upright side sections and a bottom section cooperating with one another to form a liquid reservoir in the lower portion of said housing in which a predetermined amount of liquid is accumulated, a refrigerant compressor within said housing and spaced above the level of the liquid accumulated in said reservoir, con-

duit means within said housing and through which a compressed refrigerant circulates in substantially one direction, said conduit means having one end thereof connected to the discharge side of said compressor and provided with an exposed heat transfer surface, said conduit means including a tortuous section forming a substantially upright air-pervious partition spaced above the liquid level in said reservoir and in spaced encompassing relation with said compressor, said partition being spaced from said housing side sections to form an air discharge manifold means cooperating with said reservoir to effect recirculation and distribution of the liquid accumulated therein onto said conduit means exposed heat transfer surface, air-impelling means above said partition and substantially centrally thereof to effect flow of air into the space delimited by said compressor-encompassing conduit means and outwardly through said air-pervious partition into said discharge manifold, and baffle means overlying the space delimited by said conduit means tortuous section and being provided with an opening communicating with said air-impelling means

4. The unit recited in claim 1, wherein the liquid-distributing means comprises a perforate header overlying said upright air-pervious partition and from which the liquid accumulated in said reservoir is caused to gravitate over the exposed surface of said condensing coil back to said reservoir.

5. A refrigerant condensing unit comprising an upright housing having a reservoir formed in the bottom portion thereof for accumulating a predetermined amount of liquid therein, a refrigerant compressor mounted within said housing and spaced above the level of liquid accumulated within such reservoir, a refrigerant condensing coil having one end thereof connected to the discharge side of said compressor and being deformed into an air-pervious upright partition encompassing in spaced relation said compressor and spaced above the level of the accumulated liquid, said partition being spaced from the interior upright surfaces of said housing and forming therewith an air discharge manifold, a substantially air-impervious first baffle means subtending and supporting said compressor and disposed above said accumulated liquid, the periphery of said first baffle means being spaced from the interior surfaces of said housing to form a passageway interconnecting said discharge manifold and said reservoir; header means disposed within said reservoir and overlying said partition to effect distribution of the liquid over the exposed surface of said coil partition,

pump means disposed within said housing and communicating with said reservoir and said header means to effect recirculation of the accumulated liquid through said header means, air-impelling means disposed above said compressor for effecting the flow of air into the space delimited by said partition, past said compressor, and then out through said partition into said discharge manifold, and a second baffle means overlying the space delimited by said coil partition and being provided with an opening communicating with said air-impelling means.

6. A refrigerant condensing unit comprising an upright housing having a reservoir formed in the bottom portion thereof for accumulating a predetermined amount of liquid therein, a refrigerant compressor mounted within said housing and spaced above the level of liquid accumulated within said reservoir, a refrigerant condensing coil having one end thereof connected to said compressor and disposed in spaced, encircling relation with respect to said compressor, said coil forming an upright air-pervious partition spaced above the level of liquid accumulated within said reservoir and spaced from the interior surfaces of said housing and cooperating with the latter to form an air discharge manifold, a substantially air-impervious first baffle means mounted within said housing and in supporting and subtending relation with respect to said compressor and underlying the space delimited by said coil; means mounted within said housing and cooperating with the liquid accumulated within said reservoir to effect recirculation and distribution of such liquid on the exposed surfaces of said coil partition, a second substantially air-impervious baffle means overlying said coil partition and disposed in substantially superposed relation with respect to said first baffle means and provided with an enlarged opening, air-impelling means, conduit means for said air-impelling means communicating with the enlarged opening in said second baffle means to effect directing of air into the space delimited by said coil, and a substantially air-impervious cover for said housing provided with an enlarged opening encompassing the periphery of said conduit means; said cover cooperating with said second baffle means to form a passageway communicating with said air discharge manifold.

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