May 16, 1939. L. SAHA 2,158,382

DRY EXPANSION UNIT

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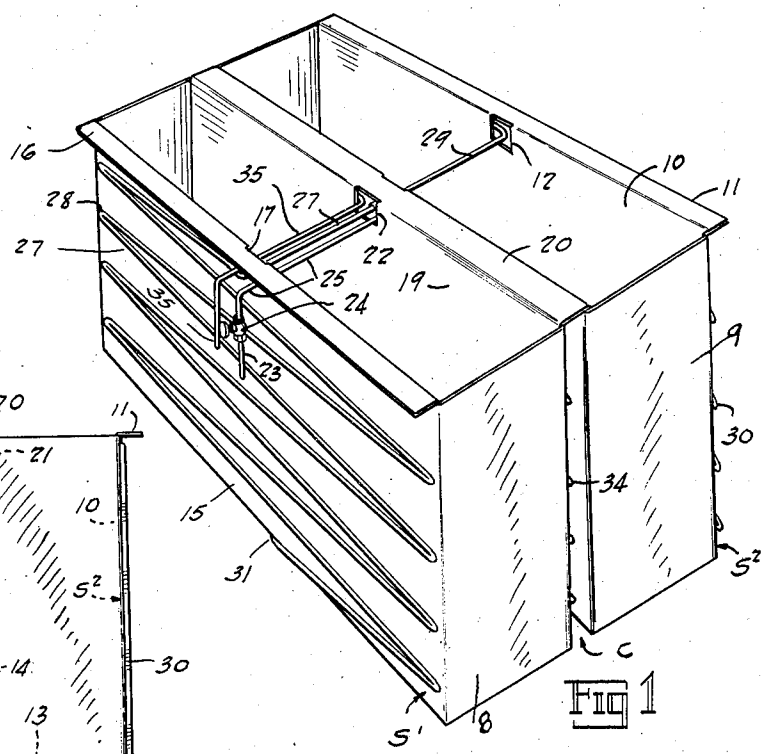


Fig 1

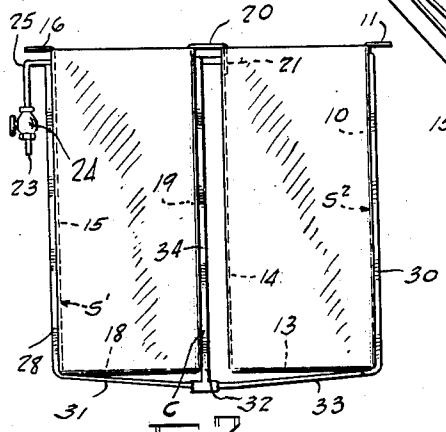


Fig 2

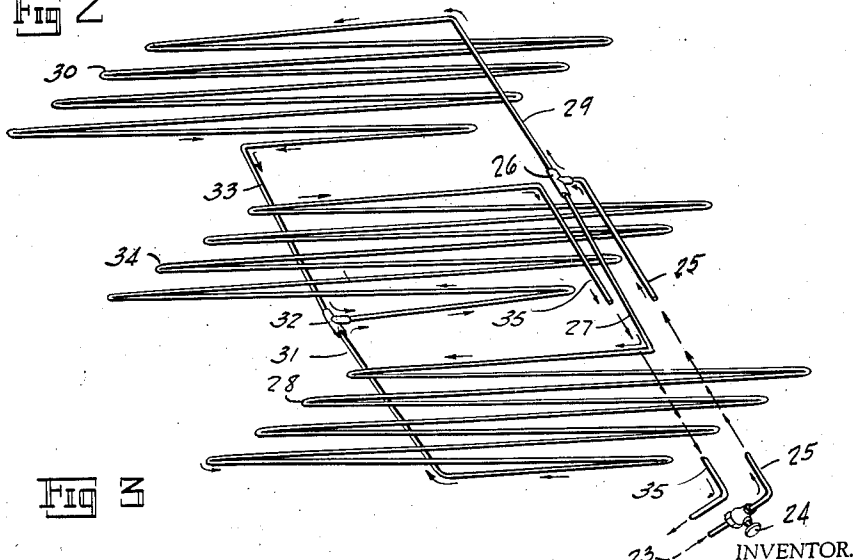


Fig 3

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DRY EXPANSION UNIT

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4 Claims. (Cl. 62—126)

This invention has to do with refrigerating apparatus and is concerned primarily with that type of evaporating system which is now known in the art as a dry expansion unit.

At the present time in certain fields, such as ice cream manufacturing, the use of dry expansion units as the evaporating system within refrigerating cabinets is becoming more and more widespread, and the present invention is made following this trend. While the instant invention is hereinafter illustrated and described as employed in conjunction with a refrigerating cabinet such as used by ice cream manufacturers, it is to be understood that the invention comprehends a wider use thereof as it can be used in the manufacturing, transporting, storing, dispensing and serving of food, including beverages, ice cream, confectionery and also such goods as flowers. The dry expansion unit of this system may also be used with air conditioning apparatus, and, in fact, any place where refrigeration is required.

A dry expansion unit of the type with which this invention is concerned is characterized as providing for the circulation of a refrigerating medium in a gaseous state throughout the system of the unit. As this gaseous medium circulates it expands, and thus draws heat from the surrounding atmosphere and structure. Included in the cycle of circulation is a compressor which returns expanded gas to a liquid form, but prior to introduction into the system proper of the unit an expansion valve is employed to change the refrigerating medium in its liquid form to a spray or mist.

The invention has in view, as its foremost objective, the provision of a dry expansion unit of the character above described which is designed to operate with a maximum efficiency under a minimum use of power, and which will be effective to maintain the refrigerating cabinet in which it is used at a uniform temperature therethroughout.

In attaining this objective this invention has in view a system of the unit which is characterized by the introduction of the refrigerating medium as a mist or spray, at the uppermost point of the system from which the medium flows under gravity action, to the lowest point in the system, and from this lowest point the medium in its partially expanded state is drawn upwardly by a compressor through another part of the system to pass through the outlet to the condensing unit. Thus the gravity action which is evidenced from the uppermost point to the lowermost point in certain parts of the system is rendered effective and enhanced by the action of the compressor.

More in detail this invention has in view the provision of a dry expansion unit of the character above described which is characterized as including a pair of spaced plates which carry conduits through which the refrigerating medium is designed to pass. The conduits on each of these spaced plates are connected at their upper end by a manifold, and also at the bottom by a manifold. The upper manifold is connected to the expansion valve which admits the medium in its changed form to the system, while the lower manifold is connected to a series of conduits carried by a central panel and which extend to the outlet and the condensing unit.

A further object of this invention is to provide a dry expansion unit of the character above described in which the conduits of the spaced plates, together with their manifolds, are arranged to provide a steady decline for the passage of the refrigerating medium under gravity action and the effect of a compressor to the lowest point of the system, and in a similar manner the conduits of the central panel are arranged to provide a steady upward incline.

From the foregoing it is apparent that the refrigerating medium passes downwardly through the conduits of the two outer plates at the same time, and is returned upwardly through the conduits of the central panel.

With this arrangement uniformity in the temperature within the cabinet is assured, and at the same time collection of oil, which is inevitably present in systems of this type because of coming from the compressor, is precluded from interfering with the circulation of the refrigerating medium. The only place where this oil may collect is at the lowermost point of the system, and when the compressor is shut off collection at this point does not interfere with circulation, and when the compressor is turned on the oil is immediately returned thereto. Thus the various conduits making up the system remain unobstructed.

The system above described presents a further advantage of eliminating the need for a heat exchanger, and at the same time assures that the expanded refrigerating medium will be returned to the compressor in a gaseous state. This feature is of extreme importance, as the return of any liquid refrigerant to the compressor is highly objectionable, as it causes knocking and overloading thereof.

It is notable that after the refrigerant has reached the lowest point of the system, and is in a partially expanded state, its return is upwardly through the central panel, and serves to draw additional heat from the interior of the cabinet to further expand the gas. It may be that during the travel of the refrigerating medium to its lowest point there will be some idle refrigerant, but on the drawing upwardly through the central panel this idle refrigerant is expanded and returned to the compressor in a gaseous state.

This arrangement of returning tne refrigerant through the central part of the cabinet is also important as it prevents the accumulation of any frost or liquid on the outside of the return line, which condition has a tendency to be created when there is idle refrigerant in the return line from the compressor.

The use of the system of this dry expansion unit presents the further advantage of insuring that the compressor will operate continuously without knocking and overloading. This is a desideratum of prime importance. Whenever liquid is present in the system there is a tendency for overloading of the compressor upon being started in operation. This is entirely eliminated by the present invention.

Various other more detailed objects and advantages of the invention will in part become apparent and in part be hereinafter stated, as the description of the invention proceeds.

The invention, therefore, comprises a dry expansion unit of the character above described which is characterized by including a pair of spaced plates each carrying a system of conduits which are connected at the top by a manifold and at the bottom by a manifold. Both the manifolds, as well as the conduits on the plates, are arranged to provide a gradual decline from the uppermost point of the system, which is at the central part of the manifold, to the lowermost part which is at the middle of the bottom manifold. From this lowermost point a series of conduits are carried by a central panel that is disposed between the spaced plates, and extends upward y in a gradual incline to the outlet which extends to the compressor. Particular features of the invention reside in the plate construction of the unit which defines the supporting structure for the various conduits.

For a full and more complete understanding of the invention reference may be had to the following description and accompanying drawing, wherein

Figure 1 is a perspective view of a dry expansion unit made in accordance with the precepts of this invention,

Figure 2 is a view in end elevation of the unit shown in Figure 1, and

Figure 3 is a perspective view of the various conduits making up the system. In this view the plate structure has been eliminated to more clearly bring out the arrangement of the conduits.

At this point it is well to note that the various conduits making up the circulating system of the units may be defined either by tubes, complemental corrugated plates, or any other construction which defines the desired conduits.

Referring now to the drawing, wherein like reference characters denote corresponding parts, a dry expansion unit such as contemplated by this invention is shown in Figure 1 as comprising a central panel referred to in its entirety by the reference character C, and two side plates which are referred to generally as S^1 and S^2. The side plate S^2 is defined by a sheet of metal designated **10** formed with an upper flange **11**. The upper part of the plate **10** is formed with a recess **12** for a purpose to be hereinafter described.

Preferably integrally connected to the plate **10** at the bottom thereof is a bottom plate member **13** that is intended to lie against the bottom of a refrigerating cabinet with which the unit is to be used, and this bottom plate **13** has integrally connected therewith a central wall **14** making up one side of the central panel C. The end edges of the plates **10** and **14** are connected by end walls designated **9**.

The side plate S^1 is defined by a plate member **15** that corresponds to the plate member **10** and which is formed at its upper edge with the flange **16**. The top portion of the plate **15** is formed with a recess **17** that corresponds to the recess **12**, and for a purpose which will be hereinafter pointed out.

A bottom plate member **18** is integrally connected at one side to the bottom edge of the plate **15**, and at its other side is integrally connected with a side wall **19** that forms a part of the central panel C. The end edges of the plates **15** and **19** are connected by end walls **8**.

The upper edge of the side wall **19** is formed with a top wall **20** that terminates in a depending flange **21** that overhangs the upper edge of the wall **14**. The upper portions of the walls **14** and **19**, as well as the flange **21**, are formed with a recess **22** for a purpose to be hereinafter described.

At this point it is well to note that the plate structure above described may be maintained assembled by suitable fastening elements (not shown) that are associated with the walls **14** and **19** of the central panel C. However, when the unit has been removed from the interior of the cabinet these fastening elements may be loosened so that the central panel C may be readily dissembled and access had to the tubular system contained therewithin.

A tubular member **23** is intended to be connected with the compressor of a conventional refrigerating system, and conveys a refrigerating medium in the liquid state to an expansion valve represented at **24**. From the expansion valve the refrigerating medium is intended to be introduced into the tubular system carried by the side plates S^1 S^2 and central panel C in a gaseous state. At this point it is well to note that any suitable refrigerating medium may be employed, such as sulphur dioxide.

From the expansion valve **24** a piece of tubing **25** extends to a T coupling member **26** (see Figure 3) and which coupling member is located within the recess **22** of the central panel C. A length of tubing **27** extends from the T coupling **26** outwardly on a slight decline to the side plate S^1, where it passes through the recess **17**, and this piece of tubing is continued to define a plurality of bends referred to as **28**, which are carried on the exterior of the side plate **15**. These bends **28** of the tubing may be anchored to the plate **15** in any preferred manner, such as by being soldered thereto.

Similarly a piece of tubing **29** extends from the T coupling **26** outwardly on a slight decline to the side plate S^2 on the other side, where it passes through the recess **12** and is continued as a plurality of bends referred to as **30**, and which bends

are anchored to the side plate 10 in any preferred manner, as by soldering.

The bends 28 of the plate 15 are continued to the bottom of the plate 15, where the tube extension 31 passes on the under side of the bottom plate 18 to a second T coupling member 32, and in a similar manner a tube extension 33 passes on the under side of the bottom plate 13 to connect the lower-most of the bends 30 with the T coupling 32. It is notable that the extensions 31 and 33 are inclined downwardly to the T coupling 32.

From the T coupling 32 a piece of tubing passes upwardly and takes the form of a plurality of bends identified as 34, and which are anchored to the wall 19 of the central panel C. These bends 34 are terminated at the upper end in an exhaust designated 35 which extends directly back to the compressor.

The circulation of the refrigerating medium in the above described system is believed to be obvious, but it may be briefly described by noting that the incoming refrigerating medium in the form of a spray or mist, immediately after being introduced through the valve 24, is conducted to the coupling 26, and from thence by the tubes 27 and 29 outwardly to the bends 28 and 30 and side plates S^1 and S^2 respectively.

The refrigerating medium then passes downwardly, under gravity action, through these bends 28 and 30 to the extensions 31 and 33 where it is passed to the coupling member 32 located in the central panel C. The refrigerating medium is then drawn upwardly through the bends 34 to the exhaust 35, from which it is returned to the compressor.

It is also notable that there are no places in the tubing in each of the side plates S^1 and S^2 or central panel C in which oil may collect which would interfere with the even circulation of the refrigerating medium.

Moreover, with the tubing arranged in the system illustrated in the drawing and described above, the entire interior of the cabinet is maintained at a uniform temperature; this being attributed largely to the fact that the inlet and exhaust are located closely adjacent to one another, and also to the fact that the gas is first passed downwardly through the side plates S^1 and S^2 and returned upwardly through the central panel C.

The particular relationship of the side plates 10 and 15 to the tube bends carried thereby is particularly important because with the bends 28 and 30 located on the exterior sides of the plates 15 and 10 the tendency is for the heat from the interior of the cabinet to be conducted by the plate structure to the tubes. It is to be remembered that the primary purpose in view is to maintain the interior of the cabinet at a required temperature.

While a preferred specific embodiment of the invention is hereinbefore set forth it is to be clearly understood that I am not to be limited to the exact construction illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

I claim:

1. A dry expansion unit of the character described comprising a pair of conduit systems spaced apart, said systems being connected at the top by a manifold and at the bottom by a manifold, an inlet for a refrigerating medium connected to the central part of said top manifold, and an outlet for the refrigerating medium connected to the central part of the bottom manifold, there being a gradual incline from the central part of the top manifold through the manifolds and systems of conduits to the central part of the bottom manifold.

2. A dry expansion unit of the character described comprising a central panel defined by a pair of side walls, a pair of side plates disposed on either side of the central panel and consisting of plate members that are integrally connected with the side walls of the central panel, tubing arranged in bends and anchored to the exterior of the side plates, and tubing anchored to one of the side walls on the interior of the central panel, the said side walls of the central panel being readily dissembled, and connections between the tubes on the side walls and central panel for connecting the same to a refrigerating system.

3. A dry expansion unit of the character described comprising a central panel defined by a pair of side walls and a top wall, there being a bottom wall integrally connected to each of the side walls in the lower edge thereof, a side plate at each side of the central panel and integrally connected to the respective bottom wall, a piece of tubing arranged in bends that are anchored to one of the side walls of the central panel and disposed therewithin, tubing arranged in bends and anchored to the exterior sides of the side plates, connections disposed beneath said bottom walls connecting the lower ends of the tubing on the side plates to the lower end of the tubing in the central panel, the tubing in said central panel terminating in an exhaust disposed intermediate the bends and at the upper part thereof, an inlet for a refrigerating medium disposed closely adjacent to the exhaust and at the middle of the upper part of the central panel, and connections between the said inlet and the upper ends of the tubes on the side plates.

4. A dry expansion unit of the character described comprising a pair of cooling chambers arranged in spaced side by side relationship and defined by metallic plate structures, each chamber including inner and outer side walls, a conduit system on the outer side wall of each chamber, and a conduit system interposed between the inner side walls of the chambers, a manifold connected to each of the conduit systems on the outer side walls at the top, connections at the bottom between each of the conduit systems on the outer side walls and the conduit system between the inner side walls, an outlet at the upper end of the conduit system between the inner side walls, and an inlet connected to said manifold.

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