

[54] **COMBINED BOILER AND HEAT EXCHANGER FOR AN ABSORPTION REFRIGERATION UNIT OPERATING ON INDIFFERENT GAS**

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[56]

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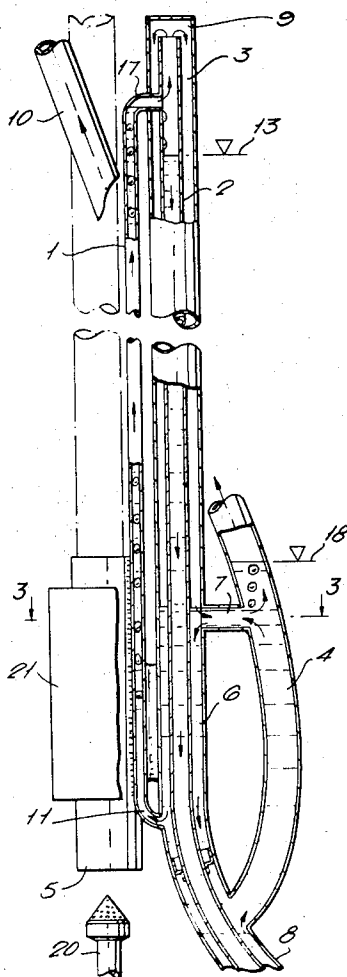
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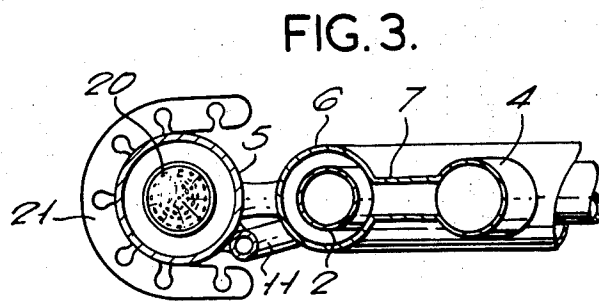
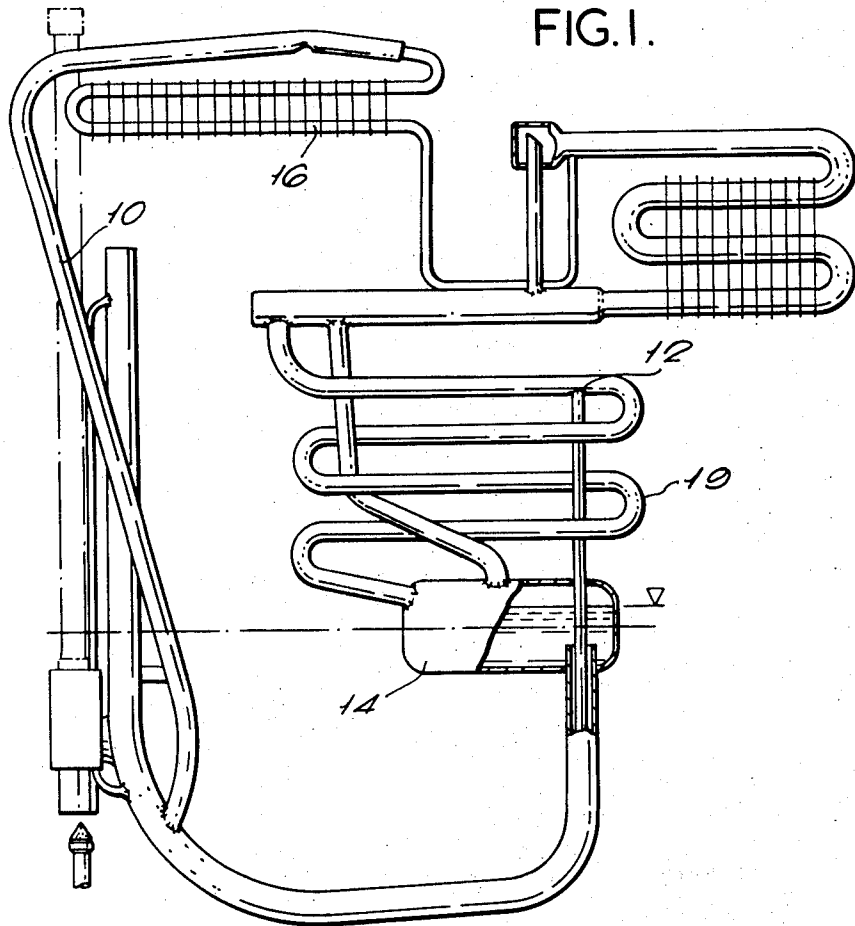
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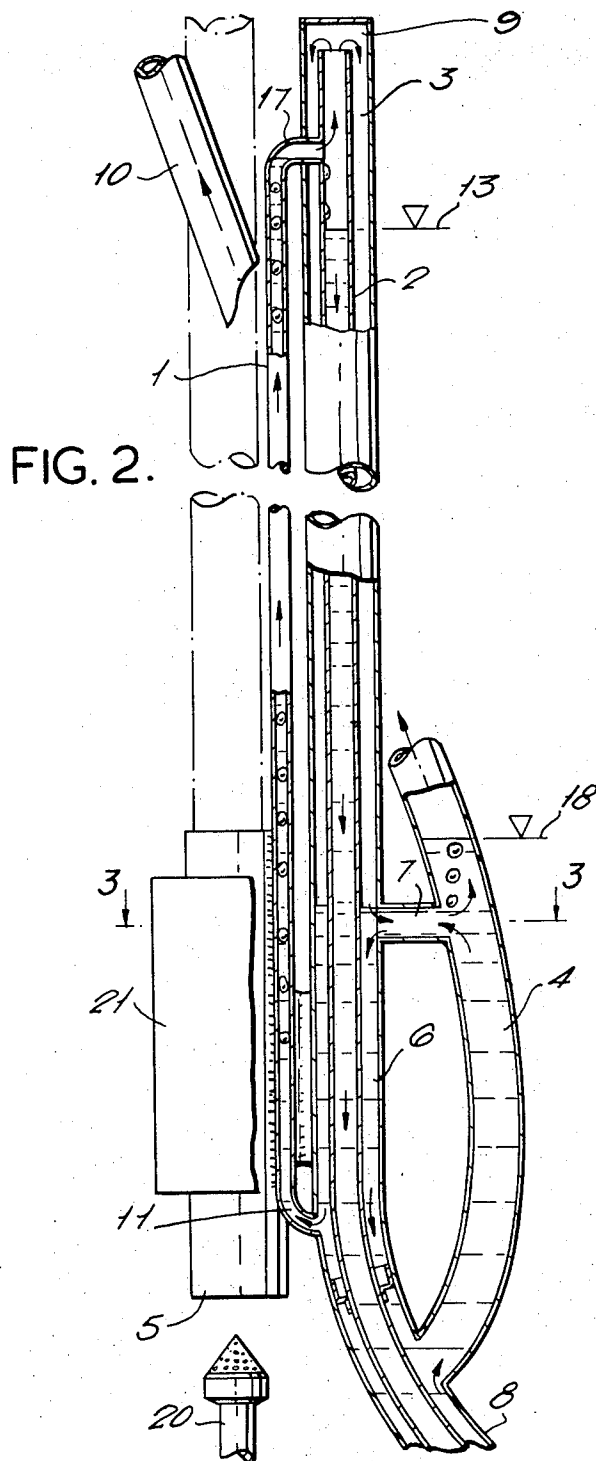
ABSTRACT

A combined boiler and heat exchanger for an absorption refrigeration unit operating with indifferent gas, in which a circulation pump transports vapour admixed with liquid to a stand pipe in a vapour tube, and vapour through the vapour tube and a rectifier outside the boiler to the condenser of the unit.

1 Claim, 3 Drawing Figures







COMBINED BOILER AND HEAT EXCHANGER FOR AN ABSORPTION REFRIGERATION UNIT OPERATING ON INDIFFERENT GAS

The invention relates to a combined boiler and heat exchanger for an absorption refrigeration unit operating with indifferent gas, where the vapour admixed with liquid, transported by the circulation pump of the unit, is passed to a stand pipe which is arranged within the vapour tube of the unit.

It is previously known in absorption refrigeration units to form the boiler as a casing disposed around the heat source, optionally the chimney, the thermo-syphon pump of the unit being, in general, introduced into the upper part of said casing. Apparatus of this type have also been adapted such that the thermo-syphon pump has been placed partially or entirely within the boiler.

Units are also known where heat is supplied to the boiler from the heating source of the apparatus through a chimney pipe, located outside the boiler and connected thereto in heat conducting manner, the thermo-syphon pump of the unit being also heat conductively connected to the chimney located outside the boiler.

Further, units are known where the necessary heat for boiling of the cooling medium is supplied to the boiler exclusively by means of a thermo-syphon pump mounted in the unit.

Experience has shown that, by means of these various units, advantages have been achieved which are of great significance in those areas it was intended to improve. In some cases, a much better cooling effect has been achieved, in other cases improved economy in regard to the technique of heating and, in other cases, the advantages have been greater certainty and tolerance in the production.

In absorption units operating with indifferent gas, ammonia NH_3 is in general used as cooling medium. Ammonia has a relatively low boiling point and is extremely volatile.

The basic teaching of the invention is that the unit parts which must operate at elevated temperatures should be disposed within the apparatus parts operating at lower temperatures, so that heat exchange may be utilized.

In previously known units having dephlegmators and rectifiers located outside the boiler, the boiler is formed from the stand pipe of the unit, i.e., the pipe which forms the column which forces the weak solution back to the absorber.

Upon reduced voltage to the electric heating element of the heating source, or reduced heat supply in general, a previous disadvantage has been that the weak solution leaves the pump unit while this is at its highest temperature and heat content, and even an effective heat exchange with the rich solution has, in such cases, been disadvantageous since the excess heat is supplied to the rectifier so that a weaker solution resulting therefrom has decreased the working conditions of the pump so that the pump has been unable to carry out its intended operation.

The purpose of the invention is to eliminate this disadvantage, in that a transference of the excess heat from the boiled, weak absorption solution, and the heat to the boiler liberated by rectification of the vapour, expels volatile cooling medium of a rich absorption solution so that the concentration of the solution is sub-

stantially reduced before it is passed to the thermo-syphon pump for further boiling and transport to the stand pipe of the unit.

In accordance with the invention, this is achieved in that the lower part of the vapour tube forms the boiler, and the supply chamber of the pump where the vapours flowing to the condenser of the unit are forced over to a rectifier located outside the boiler by means of the heat in the vapour from the pump, by the excess heat from the weak solution in the stand pipe and by the heat from direct communication between the boiler and the primary heating source via the chimney.

In this manner, the excess heat from the vapour, from the stand pipe and the actual heating source are at all times conveyed to the pump via the boiler which acts as pre-heater for the pump. The heat exchange takes place such that the temperature during the various conditions is sufficiently high to maintain the action of the pump and the balance between boiler and pump. The rising temperature in the boiler, which reduced pump action entails, will in this case be supplied to the pump instead of being returned directly via the stand pipe. The result is a stabilizing of the pump action which gives optimum exchange and final boiling prior to the solution being conveyed to the vapour separating chamber (the stand pipe) where the weak solution, via the stand pipe, is conveyed to the absorber of the unit and where the rich ammonia vapour, via the vapour tube, is passed through the boiler, the rectifier and the dephlegmator to the condenser of the unit. A relatively large amount of the cooling medium necessary in the evaporator may thereby be conveyed past the pump and boiler of the unit, and thus not unnecessarily load the functions thereof.

An embodiment example of the invention is further explained in the following with reference to the drawing.

FIG. 1 illustrated in diagram an absorption refrigeration unit having a combined boiler and heat exchanger in accordance with the invention.

FIG. 2 illustrates in longitudinal section a combined boiler and heat exchanger according to the invention.

FIG. 3 is a section along the line 3—3 in FIG. 2.

In the embodiment example, a combined heating source consisting of a gas burner 20 and an electric heating element 21 is illustrated which may be used independently; however, the unit is usually provided with only one heating source. The heating source transfers its heat to the chimney 5 which is directly connected in heat-conducting manner to the thermo-syphon pump 1 and to the boiler 6 along a common generatrix.

The pump 1 conveys the solution up from the bottom of the boiler 6 through a tube piece 11 and out through an opening 17 into the stand pipe 2 and maintains here a liquid column of weak solution up to the level indicated by 13, which is sufficiently high to permit the weak solution of itself to run into the stand pipe 2 through the boiler 6 and the outer tube 9, FIG. 1, of the heat exchanger and into the absorber 19 at 12.

It is of importance both for the economy, initiation and operation of the pump unit that the part of the chimney (the heat distributing tube) 5 and the boiler 6, which transfer heat to the circulation pump 1, has an optimal length and is disposed such with respect to a level 18, at which the liquid in the pump 1 is in communication with the liquid level in the rectifier 4 and the

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absorption container 14 (FIG. 1), that it is possible by minimum supply of heat to maintain a sufficiently high temperature for a stable exchange in the pump.

At the high temperature imparted to the pump 1, a plurality of vapour bubbles are formed which cause a mixture of cooling medium and absorption liquid to rise and pass into the stand pipe 2. The vapour of the cooling medium then rises through the upper part of the stand pipe, the vapour separating chamber 9 and, via the vapour tube 3, is conveyed downwards to the boiler 6 and further, via the tube 7, into the rectifier 4 and up through the dephlegmator 10 to the condenser 16, the heavy, weak solution sinking in the stand pipe 2.

As illustrated in FIG. 2, the stand pipe 2 is passed through the boiler 6 and the supply chamber to the pump, so that the excess heat from the weak solution benefits both boiler and pump.

In that all the heating sources are forced, in this manner, to pass the boiler and the supply chamber, an advantageous effect is achieved in the pump even with very low heat supply.

If the exchange of the pump should decrease, this will cause a greater part of the heating source, by direct contact, to be transferred to the supply chamber so that the exchange of the pump is at all times stabilized at a

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determined relation to the effect aimed at.

As already stated hereinabove, and as will be seen from the Figures, the assembly of certain parts of the refrigeration unit in accordance with the invention has made it possible to utilize to a substantial degree the heat from parts which operate at elevated temperature.

Having described my invention, I claim:

1. A combined boiler and heat exchanger for an absorption refrigeration unit, comprising a thermo-siphon pump and a vapor tube and a chimney disposed upright and in direct heat exchange with each other, means to heat the chimney, a standpipe disposed within the vapor tube, the lower end of the thermo-siphon pump communicating with the vapor tube outside the standpipe and the upper end of the thermo-siphon pump communicating with the inside of the standpipe, and a rectifier disposed outside the vapor tube but communicating with the vapor tube at the level of liquid in the vapor tube so that vapors are forced through the rectifier by means of heat in the vapor from the pump and by excess heat from liquid in the standpipe and by direct heat exchange between the vapor tube and the chimney.

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