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AIR CONDITIONING APPARATUS

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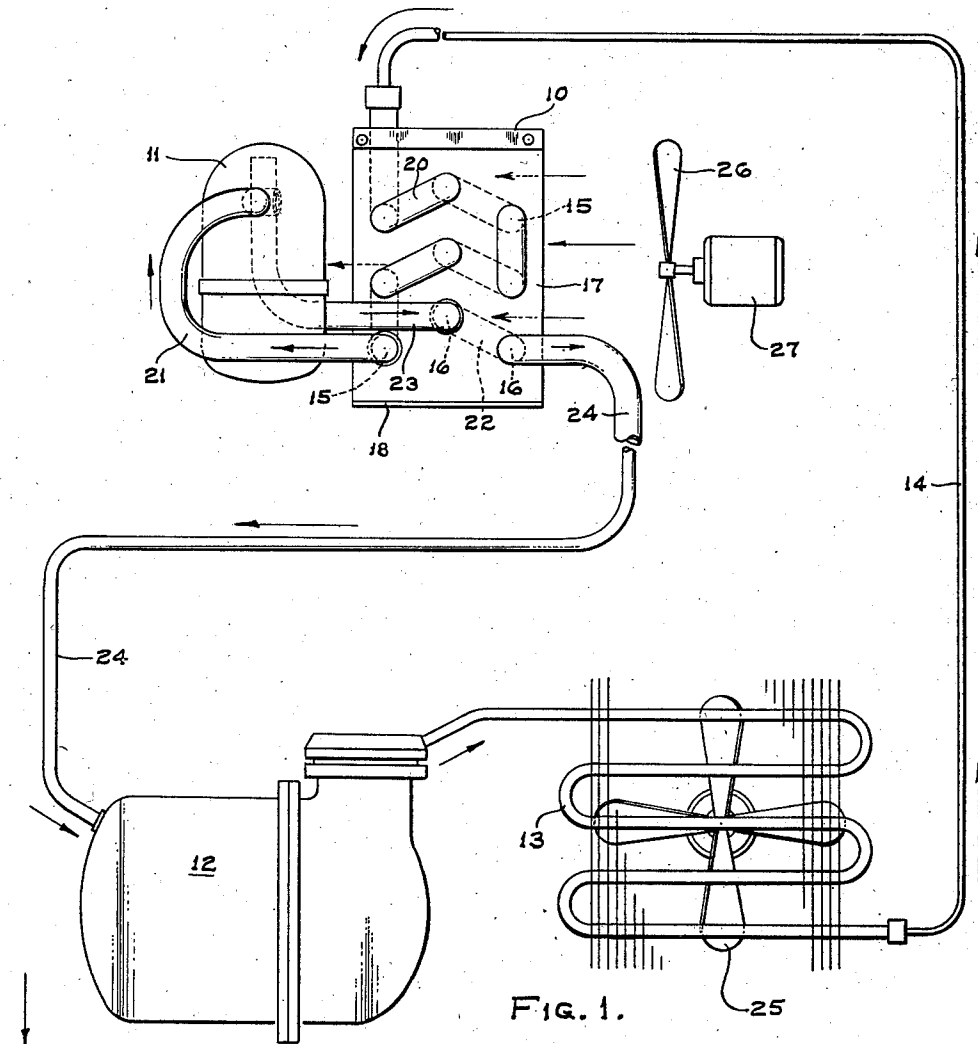


FIG. 1.

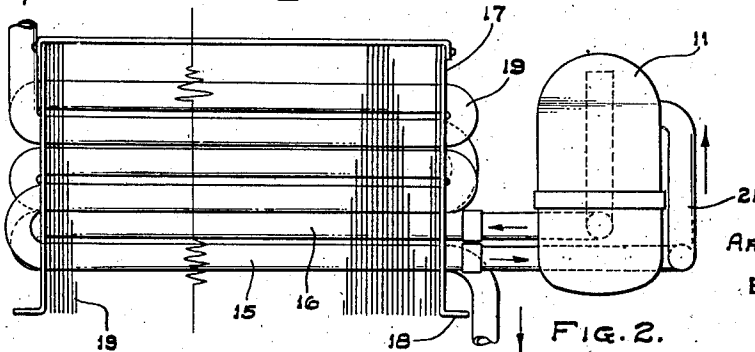


FIG. 2.

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AIR CONDITIONING APPARATUS

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2 Claims. (Cl. 62-129)

My invention relates to air conditioning apparatus. More particularly it relates to an air cooler including a reservoir or accumulator for separating out the liquid refrigerant from the vaporized refrigerant leaving the evaporator before the latter is conveyed to the compressor. It is desirable to superheat the vaporized refrigerant after it has left the accumulator, in order to evaporate all the liquid particles entrained in the refrigerant, so as to avoid liquid refrigerant entering the compressor.

The object of the present invention is to provide an improved apparatus for superheating the refrigerant discharged from the accumulator, a more particular object being to provide apparatus which may be made at reduced cost.

In accordance with my invention, the vaporized refrigerant discharged from the accumulator is passed through one or two superheater tubes which are so arranged that the stream of air flowing over the evaporator tubes also flows over the superheater tube or tubes to superheat the refrigerant flowing therethrough. In the preferred embodiment of my invention, the superheater tube or tubes are incorporated in the evaporator coil structure.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a diagrammatic view of air cooling apparatus incorporating my invention;

Fig. 2 is a front elevation of the evaporator coil structure.

Referring to the drawing in detail, I show a refrigerating system which is adapted for cooling air and which incorporates my invention. I desire it to be understood that this refrigerating system may be incorporated in a portable self-contained unit, as is well known in the art. The refrigerating system comprises generally an evaporator structure 10, a reservoir or accumulator 11, a motor-compressor unit 12, a condenser 13, and an elongated tube 14 of restricted bore, commonly referred to as a capillary tube.

Referring in greater detail to the evaporator structure 10, it is of the cross-finned serpentine coil type. In the illustrated embodiment, it comprises nine straight tubes—seven evaporator tubes 15 and two superheater tubes 16—extending between and supported by end plates 17. The latter are formed with flanges 18, whereby the evaporator structure is suitably mounted in the air-cooling unit. Plates or fins 19 provide

extended heat transfer surfaces for the tubes 15 and 16. In the illustrated embodiment, the plates 19 are common to all nine tubes, each plate having nine openings through which the tubes extend.

As shown in Fig. 1, the seven evaporator tubes 15 are connected in series by means of U-bends 20, and these tubes constitute the evaporator of the refrigerant circuit. The outlet end of the last evaporator tube is connected through a conduit 21 to the inlet of the reservoir or accumulator 11. The two superheater tubes 16 are connected in series by means of a U-bend 22, and a conduit 23 connects the accumulator 11 with the inlet end of the first of the two superheater tubes. The outlet end of the second superheater tube is connected to a suction conduit 24 which extends to the motor-compressor unit 12.

The remainder of the refrigerating system may be of conventional character. The condenser 13 may be an air-cooled cross-finned coil, in which case a fan 25 is preferably provided for circulating any suitable cooling air, such as outdoor air, over the surfaces of the condenser. A fan 26, preferably driven by an electric motor 27, circulates the air to be cooled over the surfaces of the plates 18 and the outer surfaces of the tubes of the evaporator coil structure 10. The flow of air over the evaporator coil structure 10, as seen in Fig. 1, is from right to left, so that the two superheater tubes are contacted by the relatively warm air.

Operation

The refrigerant is compressed by the motor-compressor unit 12 and discharged to the condenser 13, wherein it is condensed by the air circulated thereover by the fan 25. The condensed refrigerant enters the capillary tube 14, wherein it is expanded and its pressure reduced. From the tube 14, the expanded refrigerant flows through the seven evaporator tubes 15 in series, and as it flows through the same, the liquid refrigerant is vaporized by the heat extracted from the air flowing over the evaporator structure. The vaporized refrigerant is then conveyed by the conduit 21 to the accumulator 11. By this time, most of the refrigerant is vaporized. However, it usually contains some fine liquid particles entrained in the vaporized refrigerant, and also larger particles of liquid may be carried into the accumulator during change in the operating conditions. Any liquid particles of substantial size are retained within the accumulator 11. However, the finer liquid particles remain entrained

in the vaporized refrigerant and are conveyed through the conduit 23 to the superheater tubes 16. In the latter, these liquid particles are fully vaporized and the vaporized refrigerant is superheated by the relatively warm air circulated over the superheater tubes 16 by the fan 26. The superheated refrigerant vapor then flows through the suction conduit 24 to the motor-compressor unit 12 to be recompressed.

By superheating the vaporized refrigerant and fully vaporizing any liquid particles in the superheater tubes, the possibility of any liquid refrigerant entering the motor-compressor unit 12 is eliminated. Furthermore, condensation of moisture on the suction conduit 24 is substantially or completely eliminated.

While it is not new to superheat the vaporized refrigerant leaving the accumulator, I believe it to be new to do so by means of a tube or tubes in the evaporator structure by heat extracted from the air flowing over the evaporator structure. This arrangement may be provided at lower cost than arrangements previously known.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a unit air cooler, the combination of a compressor, a condenser, a constantly-open expansion device of constant restriction comprising a capillary tube, an evaporator of the dry type comprising a plurality of tubes, said tubes being connected in series and in such manner that the refrigerant flows therethrough at substantial velocity and but once before returning to the compressor, a reservoir or accumulator connected to the outlet end of the evaporator to receive the refrigerant leaving the same and being adapted to retain therein any liquid particles of substantial size, a superheater tube or tubes connected to said reservoir or accumulator and receiving the vaporized refrigerant and fine liquid particles of refrigerant entrained therein, and means for effecting flow of a common stream of air over the evaporator tubes and said superheater tube or tubes, said superheater tube or tubes serving to vaporize said fine liquid particles of refrigerant entrained in the vaporized refrigerant and to superheat said vaporized refrigerant.

2. A unit air cooler as set forth in claim 1, wherein said evaporator tubes and said superheater tube or tubes are incorporated in a unitary coil structure.

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