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Anderson et al.

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[54] **AIR CONDITION APPARATUS WITH REFRIGERANT SUPER COOLER**

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[51] **Int. Cl.**.....**F25b 47/00**

[58] **Field of Search**.....62/277, 288, 289, 279, 280

[56] **References Cited**

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[57] **ABSTRACT**

An air conditioning apparatus having an evaporator for conditioning air flowed in heat exchange relationship therewith. The evaporator is cooled by refrigerant fluid delivered thereto through an expansion means from a supply duct leading from a condenser of the refrigeration system. The refrigerant in the supply duct is supercooled by means of heat exchange relationship thereof, with condensate resulting from the condensation of the moisture in the air being conditioned by the evaporator being collected in a suitable receiver. The heat exchange relationship of the refrigerant to the condensate is such that the condensate is heated to vaporization for improved heat withdrawal from the refrigerant.

10 Claims, 2 Drawing Figures

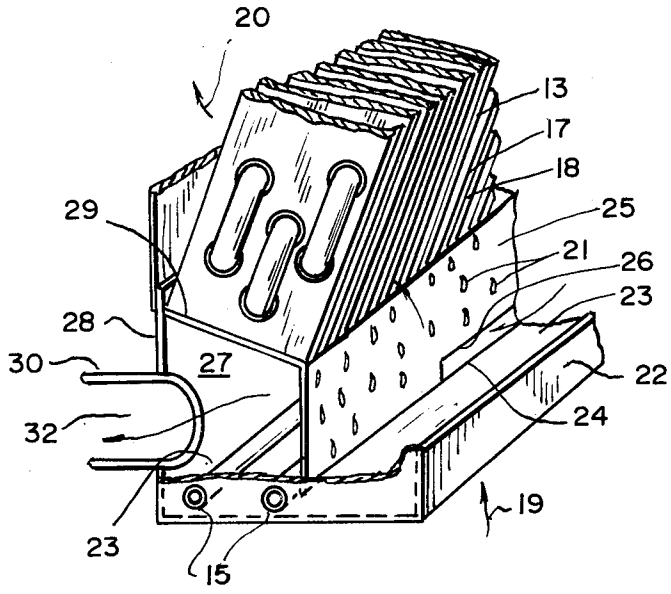


FIG. 1

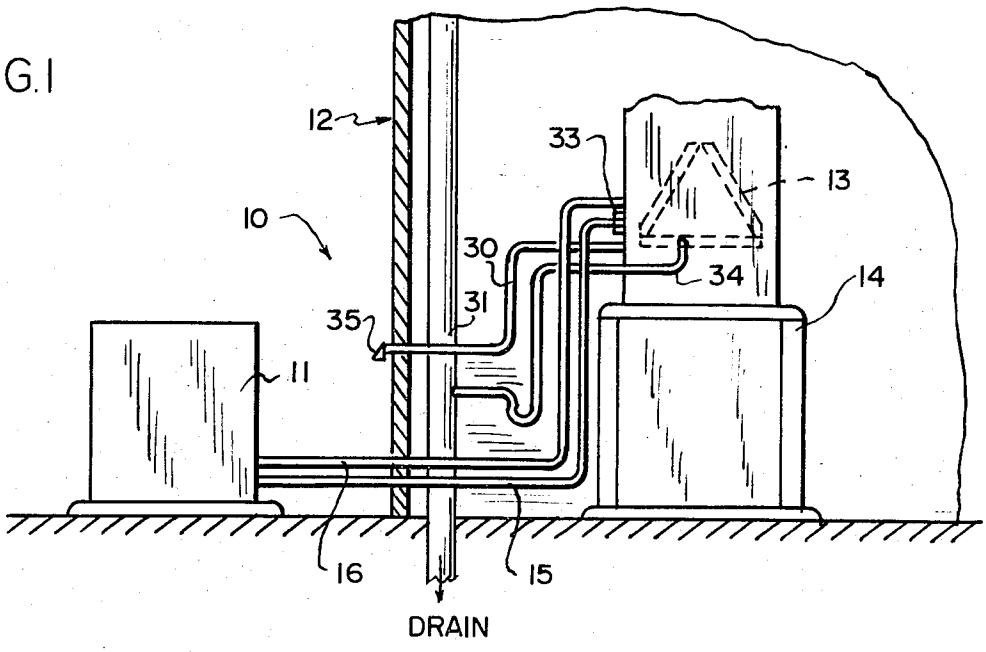
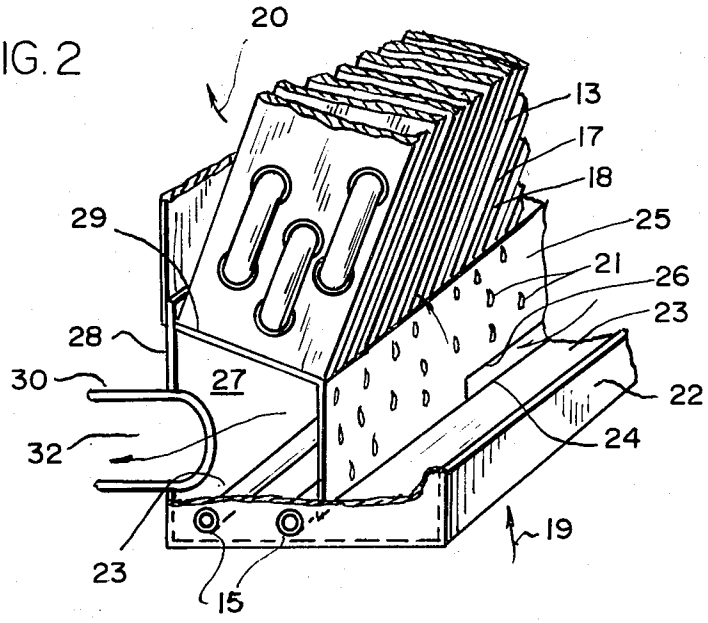


FIG. 2



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AIR CONDITION APPARATUS WITH REFRIGERANT SUPER COOLER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to refrigeration apparatus and in particular to air conditioning apparatus utilizing refrigerant fluid vaporized in an evaporator for cooling air flowed in heat exchange relationship with the evaporator.

2. Description of the Prior Art

In conventional air conditioning apparatus utilizing an evaporator for providing heat exchange with the air to be conditioned, refrigerant fluid is delivered to the evaporator from a condenser through a transfer duct. An expansion means is provided in the transfer duct at the inlet to the evaporator whereby the expanding refrigerant fluid absorbs heat from the air to be conditioned as the fluid flows through the evaporator. The refrigerant fluid is cooled to a limited degree in the condenser but is conventionally at a relatively high temperature as it is conducted to the expansion means. Thus, the efficiency of the refrigeration system is limited by the relatively high temperature condition of the refrigerant fluid.

SUMMARY OF THE INVENTION

The present invention comprehends an improved air conditioning apparatus wherein the refrigerant fluid delivered from the condenser is supercooled prior to the flow thereof through the expansion means thereby to substantially improve the efficiency of the refrigeration system by providing decreased temperature of the refrigerant fluid in the evaporator for increased thermal transfer efficiency relative to the air being conditioned.

More specifically, the invention comprehends collecting the condensate resulting from condensation of moisture in the air being conditioned as it impinges on the relatively cold evaporator surfaces. The condensate is collected in a suitable pan and the duct carrying the refrigerant fluid is arranged in heat exchange relationship with the collected condensate for effecting supercooling of the refrigerant fluid prior to the delivery thereof to the expansion means and evaporator.

The heat exchange relationships of the system are preselected so that the collected condensate is caused to vaporize as a result of the heat transfer thereto from the refrigerant fluid in the duct thereby substantially increasing the efficiency of supercooling by utilization of the latent heat of vaporization of the condensate.

The vaporized condensate is discharged suitably to avoid reintroduction of the moisture into the air being conditioned.

BRIEF DESCRIPTION OF THE DRAWING

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIG. 1 is a fragmentary elevation of an air conditioning system provided with refrigerant fluid supercooling means embodying the invention; and

FIG. 2 is a fragmentary enlarged perspective view of a portion of the refrigeration system illustrating the supercooling means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the exemplary embodiment of the invention as disclosed in the drawing, an air conditioning apparatus generally designated **10** is shown to comprise a split system wherein the condenser **11** is installed outdoors relative to a building such as residence **12** with the evaporator **13** of the apparatus **10** being installed within the residence such as on a conventional forced air furnace **14**. The air conditioning apparatus **10** may generally comprise a conventional refrigeration apparatus as is well known to those skilled in the art and no further description of the constituent elements thereof need be provided herein.

Condenser **11** is connected to evaporator **13** by means of a duct **15** for providing condensed refrigerant fluid through a suitable expansion means **33** to the evaporator **13**. A suction line **16** returns the vaporized refrigerant fluid from the evaporator to the compressor (not shown) portion of the refrigeration system. The present invention comprehends the provision of means for supercooling the refrigerant fluid being delivered through duct **15** so as to maximize efficiency of the operation of the air conditioning apparatus by reducing the temperature of the refrigerant fluid being delivered to the evaporator.

Referring now more specifically to FIG. **2**, the evaporator **13** is shown to include a plurality of fins **17** defining flow passages **18** through which air is flowed to be in heat exchange relationship with the fins **17** for cooling of the air. The incoming air at arrow **19** is relatively moist, warm air and the conditioned air at arrow **20** is relatively cool, dehumidified air resulting from the heat transfer with the refrigerant fluid in the evaporator.

The moisture of the incoming air is condensed on the evaporator plates **17** and falls in the form of droplets **21** into a subjacent collecting pan **22** which retains a body **23** of the condensate having an upper level **24**. A vertical baffle **25** extends downwardly from one edge of the evaporator and is provided with suitable openings **26** permitting air to flow inwardly into a space **27** defined by a rear wall **28**, the lower wall **29** of the evaporator, and the upper level **24** of the condensate body **23** rearwardly of the baffle **25**. Rear wall **28** is provided with an outlet duct **30** for conducting air flowed from opening **26** and through space **27** to a suitable discharge zone remote and physically separated from the conditioned zone, such as an outdoor vent **35** as shown in FIG. **1**. Excess condensate not vaporized by the hot refrigerant from the condenser **11** is carried to a drain by duct **34**. Duct **34** connects the condensate collecting pan **22** with a drain such as shown in FIG. **1**. Standpipe **31** may comprise a conventional sewer system standpipe leading from duct **34** to a drain.

The hot refrigerant fluid delivered from condenser **11** in duct **15** is cooled by means of the condensate body **23** as the result of the passage of a portion of duct **15** through condensate body **23** in pan **22**. Heat energy transferred from the hot refrigerant fluid to the condensate causes the condensate to vaporize into space **27** so that the vapor **32** may pass outwardly from space **27** through duct **30** to a remote zone with the air flowed through space **27** from inlet opening **26**. Further, as shown in FIG. **2**, the level of the outlet duct **30** is

preselected so as to be above the upper level 24 of the condensate in pan 22. The level at which duct 34 is connected to pan 22 is selected so as to maintain the preselected upper level 24 of condensate in pan 22 by carrying excess condensate to the drain whenever the level rises above the preselected desired level.

Thus, not only is the refrigerant fluid in duct 15 cooled by heat transfer to the relatively cooler condensate liquid, but is highly effectively cooled by utilization of the heat of the vaporization of the condensate as a means for withdrawing substantial thermal energy from the refrigerant fluid. As the vapor 32 is discharged to the remote zone, away from the air discharge of the evaporator, the conditioned air, as at arrow 20, is maintained dehumidified and at the desired low temperature.

As condensate body 23 is caused to be at a relatively high temperature, maintained transfer of the collected condensate to the drain 31 via duct 34 is provided, avoiding problems of freeze-up and the like as found in conventional air conditioning apparatuses wherein the condensate liquid is merely drained from the subjacent collecting pan by conventional hose means.

The foregoing disclosure of specific embodiments is illustrative of the broad inventive concepts comprehended by the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an air conditioning system having an evaporator disposed in an evaporator space for conditioning moist warm air flowed in heat exchange relationship therewith, a condenser, and means for conducting condensed refrigerant fluid from said condenser to said evaporator for cooling the evaporator to absorb heat from said flowed air, means for cooling the conducted refrigerant for improved heat absorption efficiency in said evaporator comprising: container means subjacent said evaporator defining a space opening to the evaporator space for collecting condensate moisture condensed from the warm air as a result of the heat exchange with said evaporator; means for disposing the refrigerant fluid conducting means in heat exchange relationship with the collected condensate in said container means for transferring sufficient heat from the refrigerant fluid to the collected condensate to effect vaporization of the condensate; and fluid transfer means independent of said condenser for removing vaporized condensate to a discharge zone remote from the evaporator.

2. The air conditioning system cooling means of claim 1 including means for conducting air for movement over said collected condensate and to said discharge zone for removing the vaporized condensate.

3. The air conditioning system cooling means of claim 1 including means for conducting excess condensate collected in said container means to a drain to maintain a preselected maximum level of condensate in said container means.

4. The air conditioning system cooling means of claim 1 including means defining an enclosed space overlying said collected condensate for containing the vaporized condensate, and means for conducting the vaporized condensate from said space to said discharge zone.

5. The air conditioning system cooling means of claim 1 including means defining an enclosed space overlying said collected condensate for containing the vaporized condensate, and first duct means for conducting the vaporized condensate from said space to a discharge zone, and second duct means defining an inlet opening adjacent the collected condensate for conducting excess collected condensate to a drain to maintain a preselected maximum level of condensate in said container means.

6. The air conditioning system cooling means of claim 1 wherein said refrigerant fluid conducting means defines a portion submerged in said collected condensate.

7. The air conditioning system cooling means of claim 1 wherein the condensing of said refrigerant fluid is effected remotely from said evaporator.

8. In an air conditioning system having an evaporator for conditioning moist warm air flowed in heat exchange relationship therewith, and means for conducting condensed refrigerant fluid to said evaporator for cooling the evaporator to absorb heat from said flowed air, means for cooling the conducted refrigerant for improved heat absorption efficiency in said evaporator comprising: container means adjacent said evaporator for collecting condensate moisture condensed from the warm air as a result of the heat exchange with said evaporator; means for disposing the refrigerant fluid conducting means in heat exchange relationship with the collected condensate for transferring sufficient heat from the refrigerant fluid to the collected condensate to effect vaporization of the condensate; and means for removing vaporized condensate to a discharge zone, said evaporator defining a bottom wall superjacent said container means, and wall means being provided cooperating with said evaporator bottom wall and said container means for defining an enclosed space overlying said collected condensate for containing the vaporized condensate.

9. The air conditioning system cooling means of claim 8 wherein said wall means define openings for conducting air to and from said space for removing the vaporized condensate.

10. The air conditioning system cooling means of claim 8 further including means for maintaining a preselected minimum level of collected condensate in said container means.

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