

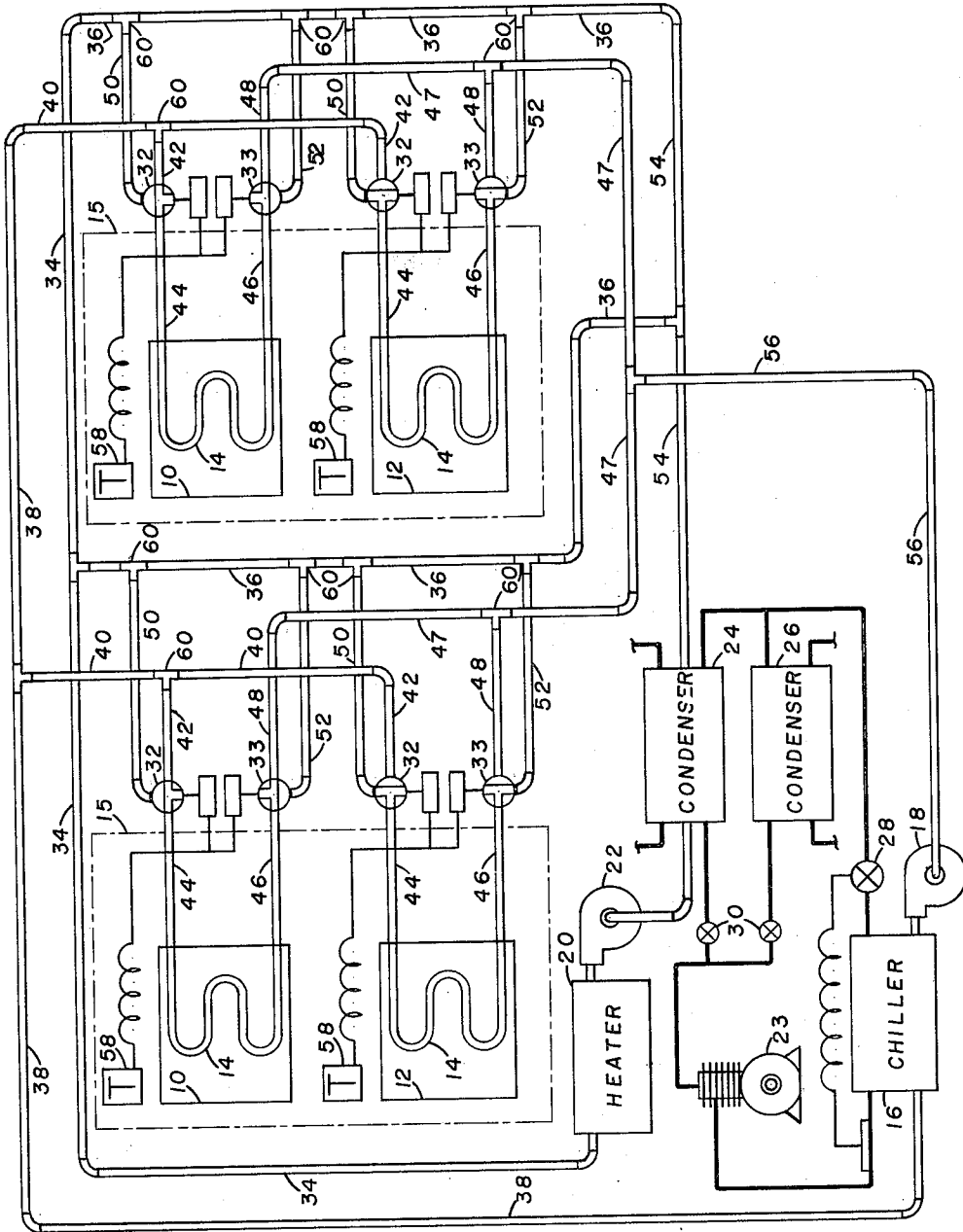
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C. L. RINGQUIST

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AIR CONDITIONING SYSTEM WITH ONE PIPE HEATING

Filed May 29, 1961



INVENTOR.

CLARENCE L. RINGQUIST

BY

Holmes & Andersen

ATTORNEYS

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AIR CONDITIONING SYSTEM WITH ONE PIPE HEATING

Clarence L. Ringquist, La Crosse, Wis., assignor to The Trane Company, La Crosse, Wis., a corporation of Wisconsin

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This invention relates generally to a combination heating and cooling air conditioning system and more specifically to an air conditioning system in which heated and chilled water is available to the heat exchange members at all times, if desired.

In recent years, the air conditioning industry has tended to provide air conditioning systems in which a supply of hot and cold water is provided simultaneously to the heat exchange units in the system. Prior to this invention a separate heat exchange coil for each source of water was provided in each heat exchange unit. In other words, each heat exchange unit normally would have two heat exchange coils, one for the hot fluid and one for the cold fluid.

It is therefore an object of this invention to provide an air conditioning system in which both hot and cold heat exchange fluid may be supplied simultaneously to a heat exchange unit and the heat exchange unit requires only a single heat exchange coil.

Another object of the invention is to provide an air conditioning system in which both hot and cold exchange fluid may be supplied simultaneously to a heat exchange unit with the hot heat exchange fluid system being a one-pipe system while the cold heat exchange fluid system is two-pipe.

A third object of the invention is to provide an air conditioning system in which hot and cold heat exchange fluid may be supplied simultaneously to a heat exchange unit and in which the cold fluid is conditioned by a refrigeration system and the hot fluid may partially or wholly be heated by the condenser of the refrigeration system.

A still further object of the invention is to provide an air conditioning system in which hot and cold heat exchange fluid may be supplied simultaneously to a heat exchange unit with only one heat exchange coil and in which the cold or chilled water system is a two-pipe or separate supply and return system while the hot water system is one-pipe.

Other objects and advantages of the invention will be clearly apparent as the specification proceeds to describe the invention with reference to the accompanying drawing in which:

The figure is a schematic view of the preferred form of an air conditioning system incorporating the principles of my invention.

Looking now to the figure, there is shown the preferred form of my invention. For the basis of a disclosure, a plurality of heat exchange units 10 and 12 with a single heat exchange coil 14 are located in a plurality of zones 15 (shown in dotted lines), the number of units and the number of zones depending upon the particular requirements of the enclosure to be conditioned. Heat exchange units 10 are shown in the position to receive cold heat exchange fluid and heat exchange units 12 are shown receiving hot heat exchange fluid.

Chilled water is supplied to each heat exchange unit from chiller 16 by chilled water pump 18. Hot water is supplied to each heat exchange unit from heater 20 by hot water pump 22.

A refrigeration system consisting of compressor 23, condensers 24 and 26, expansion means 28, and chiller 16 is employed to cool the returning chilled water and

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to heat the returning hot water. As is usual in refrigeration systems, hot gas is supplied from compressor 23 to either or both of condensers 24 and 26. The liquified condensed refrigerant from condensers 24 and 26 is then expanded through expansion means 28 into chiller 16 to cool the returning chilled water. Vaporized refrigerant is returned from chiller 16 to compressor 23 for compression and is re-cycled through the system. Valves 30 are provided so that all or part of the hot gas may be condensed in condenser 24 to heat the warm return water in order to utilize the heat normally rejected. Heater 20 is necessary under conditions when the amount of heat rejected by condenser 24 is not sufficient to heat the warm water to a high enough temperature to handle the heating requirements of the area to be conditioned.

Operation

The operation of only two units 10 and 12 in only one zone will be discussed keeping in mind that the other units in the zone and in other zones operate in the same manner. As pointed out previously, unit 10 is shown in the cold water receiving position and unit 12 is shown in the hot water receiving position. It being understood that in extreme weather conditions when either all heating or all cooling is required in the conditioned areas that either the refrigeration system or the heating system may be shut down in order to save operating expense.

Each heat exchange unit 10 or 12 is provided with a single heat exchange coil 14 with temperature responsive three-way valves 32 and 33 connected thereto with valve 32 connected at the inlet end and valve 33 at the outlet end. Hot water from conduit 34 is supplied to conduit 36 and cold water from conduit 38 is supplied to conduit 40.

Looking at heat exchange unit 10, cold water flows from conduit 40 through conduit 42, three-way valve 32, conduit 44, heat exchange coil 14, conduit 46, three-way valve 33, conduit 48 and into chilled water return 47 which is separate from the hot water return as will be described.

Heat exchange unit 12 conversely is being supplied hot water from conduit 36. Hot water flows from conduit 36 successively through conduit 50, three-way valve 32, conduit 44, heat exchange coil 14, conduit 46, three-way valve 33, and conduit 52 back into hot water conduit 36 where it mixes with the hot water being supplied to the other heat exchange units further down the line. This type of heating system is commonly referred to as a one-pipe heating system.

The hot and cold fluid in conduits 36 and 47 is returned to the heater 20 and the chiller 16 by way of conduits 54 and 56 respectively.

Thermostatic three-way valves 32 and 33 on each heat exchange unit operate simultaneously in response to the temperature sensed by the thermostat 58. When cooling is required by thermostat 58, both valves 32 and 33 place the heat exchange coil 14 in flow relation with the chilled water conduit 40 and chilled water return 47. When heating is required in the area sensed by thermostat 58, valves 32 and 33 are reversed and the heat exchange coil 14 is placed in flow relationship with the hot fluid conduit 36. The construction and operation of three-way valves is well known in the art and will not be discussed herein.

Pipe T's 60 are shown at the junction of the conduits supplying and receiving heat exchange fluid to and from the heat exchange coils 14. Such T's are only exemplary and it is within the scope of the invention to use any other suitable connecting means such as commercially available flow-fittings.

As herein described we have provided a new and novel

air conditioning system employing only a single heat exchange coil for each heat exchange unit in the system and at the same time supply the heat exchange coils with a conduit system which requires only three pipes but yet offers hot and cold fluid to each unit simultaneously.

Although I have described in detail the preferred embodiments of my invention, it is contemplated that many changes may be made without departing from the scope or spirit of my invention and I desire to be limited only by the claims.

I claim.

1. An air conditioning system for a space having a plurality of areas with similar heating and cooling requirements, a compressor, an evaporator, and a condenser interconnected to provide a refrigeration system, a first conduit for conducting hot fluid from said condenser to said areas, a second conduit for conducting cold fluid from said evaporator to said areas, a third conduit for conducting hot fluid from said areas back to said condenser, a fourth conduit for conducting cold fluid from said areas back to said evaporator, at least one heat exchange unit in each of said areas, said heat exchange unit having a coil therein, a fifth conduit connected to said first conduit and said third conduit, a sixth conduit connected to said second conduit, a seventh conduit connected to said fourth conduit, first conduit means connected to said fifth conduit to conduct hot fluid from said fifth conduit through said coil and back into said fifth conduit, second conduit means connected to said sixth and seventh conduits to conduct cold fluid from said sixth conduit through said coil and into said seventh conduit, and valve means operably connected to said first and second conduit means to selectively control the flow of hot and cold fluid via said first and second conduit means respectively, to and from said coil in response to load conditions in said area.

2. An air conditioning system for a space having a plurality of zones with each zone having a plurality of areas with similar heating and cooling requirements, a source of hot fluid, a source of cold fluid, a first conduit for conducting hot fluid from said source of hot fluid to said zones, a second conduit for conducting cold fluid from said source of cold fluid to said zones, a third conduit for conducting hot fluid from said zones back to said source of hot fluid, a fourth conduit for conducting cold fluid from said areas back to said source of cold fluid, at least one heat exchange unit in each of said areas, said heat exchange unit having a coil therein, a fifth conduit connected to said first conduit and said third conduit, a sixth conduit connected to said second conduit, a seventh conduit connected to said fourth conduit, first conduit means connected to said fifth conduit to conduct hot fluid from said fifth conduit through said coil and back into said fifth conduit, second conduit means connected to said sixth and seventh conduits to conduct cold fluid from said sixth conduit through said coil and into said seventh conduit, and valve means operably connected to said first and second conduit means to selectively control the flow of hot and cold fluid via said first and second conduit means respectively, to and from said coil in response to load conditions in said area.

3. An air conditioning system for a space having a plurality of areas with similar heating and cooling requirements, a source of hot fluid, a source of cold fluid, a first conduit for conducting hot fluid from said source of hot fluid to said areas, a second conduit for conducting cold

fluid from said source of cold fluid to said areas, a third conduit for conducting hot fluid from said areas back to said source of hot fluid, a fourth conduit for conducting cold fluid from said areas back to said source of cold fluid, at least one heat exchange unit in each of said areas, said heat exchange unit having a coil therein, a fifth conduit connected to said first conduit and said third conduit, a sixth conduit connected to said second conduit, a seventh conduit connected to said fourth conduit, first conduit means connected to said fifth conduit to conduct hot fluid from said fifth conduit through said coil and back into said fifth conduit, second conduit means connected to said sixth and seventh conduits to conduct cold fluid from said sixth conduit through said coil and into said seventh conduit, and valve means operably connected to said first and second conduit means to selectively control the flow of hot and cold fluid via said first and second conduit means respectively, to and from said coil in response to load conditions in said area.

4. The structure of claim 2 wherein said valve means are thermostatically operated valves.

5. The structure of claim 4 wherein said thermostatically operated valves are three-way valves, each with one port operably associated with said heat exchange coil, a second port connected to said first conduit means, and a third port connected to said second conduit means.

6. An air conditioning system for a space having a plurality of areas with similar heating and cooling requirements, a source of hot fluid, a source of cold fluid, a first conduit for conducting hot fluid from said source of hot fluid to said areas, a second conduit for conducting cold fluid from said source of cold fluid to said areas, a third conduit for conducting hot fluid from said areas back to said source of hot fluid, a fourth conduit for conducting cold fluid from said areas back to said source of cold fluid, at least one heat exchange unit in each of said areas, said heat exchange unit having a heat exchange coil therein, a fifth conduit connected to said first and third conduits, a sixth conduit connected to said second conduit, a seventh conduit connected to said fourth conduit, a first thermostatically operated valve means connected to said fifth and sixth conduits and to the inlet side of said coil, a second thermostatically operated valve means connected to said fifth and seventh conduits and to the outlet side of said coil, and control means to place said heat exchange coil in fluid communication with said fifth conduit when the temperature of the conditioned space is below a certain predetermined temperature and to place said heat exchange coil in fluid communication with said sixth and seventh conduits when the temperature of the conditioned space is above a certain predetermined temperature.

7. The structure of claim 6 wherein said first and second thermostatically operated valve means are three-way valves with one port operably associated with said heat exchange coil, the other two ports of one of said valves being connected to said fifth and sixth conduits and the other two ports of the other of said valves being connected to said fifth and seventh conduits.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,127,928

April 7, 1964

Clarence L. Ringquist

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 20, for the claim reference numeral "2"
read -- 3 --.

Signed and sealed this 18th day of August 1964.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents