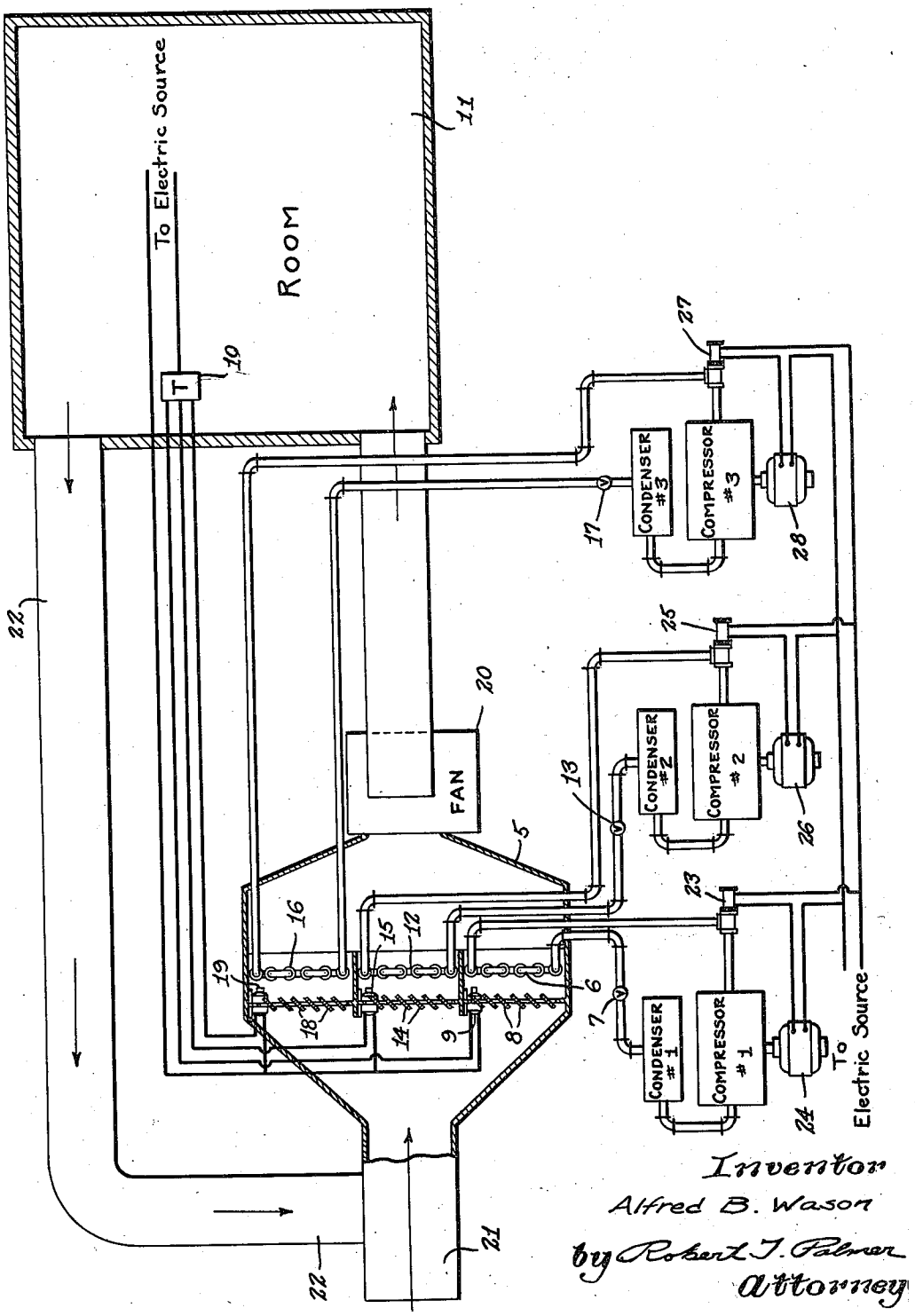
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AIR CONDITIONING APPARATUS

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AIR CONDITIONING APPARATUS

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This invention relates to heat exchange apparatus for the conditioning of air.

In many buildings where the cooling of air is desired, the cost of a central conditioning plant of the air washer type is not considered justified especially where the buildings were constructed without provision for the air conditioning apparatus.

In such buildings, it is the practice to use one or more sets of cooling coils, each set being supplied with refrigeration by its own individual compressor-condenser combination. The air to be conditioned may be passed by a single fan over all the sets of coils when the cooling load is great and one or more sets of coils may be cut out of service when the cooling load decreases. This arrangement permits the apparatus to be disposed in any convenient place in an old building.

Where a single fan or series of fans moves the air to be cooled over all of the coils in the system; when one or more sets of coils are idle, i. e., are not supplied with refrigeration, the fan load is greater than is necessary with undue consumption of power.

According to a feature of this invention, the air moved by the fan or fans is routed around the coils which are not acting to cool the air.

According to another feature of this invention, thermostatically controlled shutters are placed before the air cooling coils. As the cooling load decreases, the shutters before first one and then another set of coils are automatically closed and at the same time the compressors, serving each set of coils thus relieved from cooling duty are shut down.

An object of the invention is to provide an efficient air conditioning system of the unit type.

Another object of the invention is to save fan power in an air conditioning system.

Another object of the invention is to prevent the passage of air over the surfaces of the coils to be relieved from cooling duty.

Another object of the invention is to close off the air passing coils to be relieved from cooling duty and to automatically shut down the refrigeration equipment supplying such coils.

Other objects of the invention will be apparent from the following description taken together with the drawing.

The invention will now be described with reference to the drawing which illustrates diagrammatically an air conditioning system with controls, according to this invention.

In the embodiment of the invention illustrated, three sets of evaporator coils which act as air cooling coils are arranged in a single air conditioning compartment 5. One set of coils 6 is supplied with any suitable refrigerant which is compressed in the compressor #1, condensed in condenser #1, and expanded through expansion valve 7. The shutters 8 before the coils 6 are opened and closed by the electric motor 9, controlled by the thermostat 10 in the room 11 or other space to be supplied with cooled air.

The second set of coils 12 is supplied with refrigeration from the compressor #2, condenser #2 and expansion valve 13. The shutters 14 before these coils are adjusted by the motor 15, also controlled by the thermostat 10.

The third set of coils 16 is supplied with refrigeration from the compressor #3, condenser #3 and expansion valve 17. The shutters 18 are adjusted by the motor 19 under control of the thermostat 10.

The fan 20 draws outside air through the duct 21 and recirculated air through the duct 22, passes it over the coils in service and into the room 11.

The thermostat 23 is exposed to the refrigerant at the suction side of the compressor #1 and operates, when the temperature of the vapor falls to a predetermined point, to open the circuit of the compressor driving motor 24.

The thermostat 25 is exposed to the refrigerant vapor at the suction side of the compressor #2 and operates, when the temperature of the vapor falls to a predetermined low point, to open the circuit of the compressor driving motor 26.

The thermostat 27 is exposed to the vapor at the suction side of the compressor #3 and operates, when the temperature of the vapor falls to a predetermined point, to open the circuit of the compressor driving motor 28.

In operation, when the conditions within the enclosure 11 are such as to require the equipment to be operated at or near capacity in order to provide the necessary cooling and dehumidification, the thermostat 10 acts to hold the shutters before all of the air cooling coils open and all of the compressors operate to supply the necessary refrigerating effect.

When the conditions within the space 11 approach those desired, requiring less cooling of the air by the cooling coils, the thermostat 10 operates to cause the motor 9 to close the shutters 8 associated with the coils 6.

Following the closing of the shutters 8 and due to the coils 6 being relieved from cooling duty, the temperature of the refrigerant vapor is low and this low temperature causes the thermostat

23 to automatically open the electrical circuit to the motor 24, thus shutting down the compressor #1, serving the coils 6, when refrigeration to the coils 6 is not required.

As less and less cooling of the air supplied to the space 11 is required, the thermostat 10 next acts to cause the motor 15 to close the shutters 14 associated with the coils 12 and then finally to cause the motor 19 to close the shutters 18 before the coils 16.

When the shutters 14 before the coils 12 are closed the falling temperature in the refrigerant vapor causes the thermostat 25 to open the circuit of the motor 26, thus shutting down the compressor #2 and finally the closing of the shutters 18 before the coils 16 causes the thermostat 27 to open the circuit of the motor 28, thus shutting down the compressor #3.

As the temperature or humidity or both within the space 11 increases to a point requiring cooling of the entering air, the thermostat 10 acts to open first one and then another of the sets of shutters and as the air cooling coils become heated, the increased temperature of the refrigerant therein, causes the compressor motor controlling thermostats to close the electrical circuits to the compressor driving motors causing each compressor to start operations following the opening of the shutters before its associated set of air cooling coils.

Obviously, the single thermostat 10 could be a plurality of thermostats or hydrostats and could be placed in any suitable location including the recirculated air duct 22.

Whereas one embodiment of the invention has been described for the purpose of illustration, it should be understood that the invention should not be limited to the exact arrangement described as many departures will suggest themselves to those skilled in the art after having had access to this disclosure.

What is claimed is:

1. Heat exchange apparatus for supplying conditioned air to a space to be served comprising a plurality of sets of air cooling coils, means for passing from a predetermined source air to be conditioned simultaneously in contact with all of said sets of coils, separate means for supplying refrigerant to each of said sets of coils and automatically controlled means for shunting one of said sets of coils out of the path of the air from said source and for discontinuing the supply of refrigerant thereto when conditions within said space do not require the use of said one set of coils.

2. Heat exchange apparatus for supplying conditioned air to a space to be served comprising a plurality of sets of air cooling coils, means for supplying a refrigerant to said sets of coils, means for passing from a predetermined source air to be conditioned over all of the sets of coils, means responsive to conditions within the space to be served for shunting the air from said source around one of said sets of coils, and means responsive to the temperature of the refrigerant returned from said one set of coils for controlling the supply of refrigeration thereto.

3. Heat exchange apparatus for supplying conditioned air to a space to be served comprising a plurality of sets of air cooling coils, means for supplying a refrigerant to said sets of coils, means for passing from a predetermined source air to be conditioned simultaneously over all of the sets of coils, means responsive to conditions within the space to be served for shunting the air from said source around one of said sets of coils, and means responsive to the temperature of the refrigerant returned from said one set of coils for controlling the supply of refrigeration thereto.

4. Heat exchange apparatus for supplying conditioned air to a space to be served comprising a plurality of sets of air cooling coils, a refrigerant compressor for each of said sets of coils for supplying a refrigerant to be evaporated therein, means for passing from a predetermined source air to be conditioned in contact with all of said sets of coils and into said space, means for shunting the air from said source around one of said sets of coils, and means responsive to the temperature of the refrigerant returned from said one set of coils for shutting down the compressor associated therewith.

5. Heat exchange apparatus for supplying conditioned air to a space to be served comprising a plurality of sets of air cooling coils, a refrigerant compressor for each of said sets of coils for supplying a refrigerant to be evaporated therein, means for passing from a predetermined source air to be conditioned simultaneously in contact with all of said sets of coils and into said space, means for shunting the air from said source around one of said sets of coils, and means responsive to the temperature of the refrigerant returned from said one set of coils for shutting down the compressor associated therewith.

6. Heat exchange apparatus for supplying conditioned air to a space to be served comprising a plurality of sets of air cooling coils, a refrigerant compressor for each of said sets of coils for supplying a refrigerant to be evaporated therein, means for passing from a predetermined source air to be conditioned in contact with all of said sets of coils and into said space, means responsive to conditions within said space for shunting the air from said source around one of said sets of coils, and means responsive to the temperature of the refrigerant returned from said one set of coils for shutting down the compressor associated therewith.

7. Heat exchange apparatus for supplying conditioned air to a space to be served comprising a plurality of sets of air cooling coils, a refrigerant compressor for each of said sets of coils for supplying a refrigerant to be evaporated therein, means for passing from a predetermined source air to be conditioned simultaneously in contact with all of said sets of coils and into said space, means responsive to conditions within said space for shunting the air from said source around one of said sets of coils, and means responsive to the temperature of the refrigerant returned from said one set of coils for shutting down the compressor associated therewith.

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