

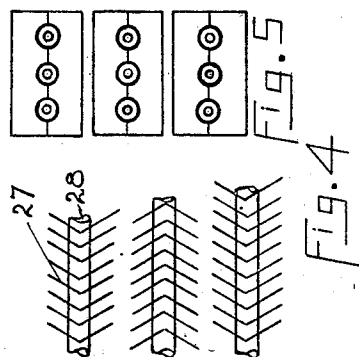
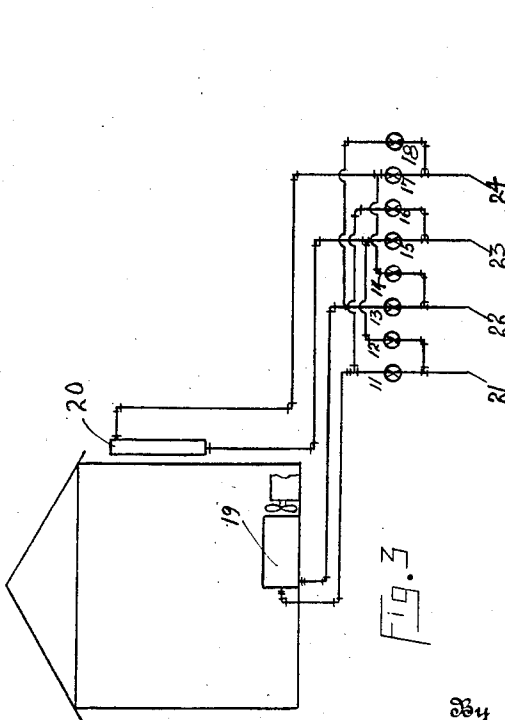
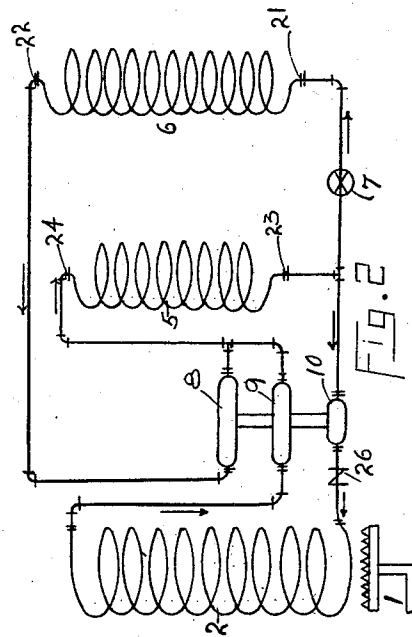
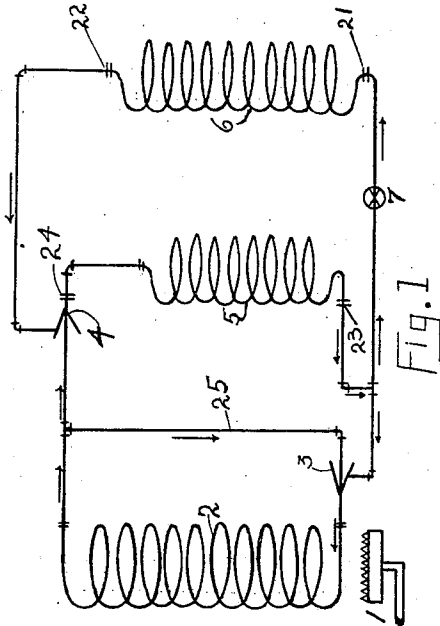
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AIR CONDITIONING SYSTEM

Filed Aug. 19, 1931



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AIR CONDITIONING SYSTEM

Application filed August 19, 1931. Serial No. 558,161.

The invention relates to air conditioning equipment for human dwellings or other places of human assembly whereby the atmosphere may be either warmed or cooled to bring it to the temperature best suited to human comfort.

The invention may be further defined as relating to heat exchanging systems and more specifically to a system whereby heat is absorbed from some source as a fire, part of the energy being carried directly to the space to be heated and part of it being used to operate a heat pump drawing heat from a point of lower temperature and delivering it to a point of higher temperature.

The apparatus in the preferred form is also adapted to be reversed, so that the heat pump or transfer device is used to remove heat from the dwelling or place of human assembly or occupation.

The object of the invention is to provide a single apparatus which is more efficient for heating in winter and more economical for cooling in summer, and greatly simplified as compared to any equipment for either or both purposes previously available.

One feature of the system is the arrangement of the prime mover turbine, centrifugal compressor and boiler feed pump, all enclosed within a single casing for facilitating the sealing of the system by eliminating packing glands, though the invention may be embodied in apparatus otherwise arranged.

Another feature of this system is the utilization of a small heating boiler similar to domestic heating or small power boilers now in common use.

A further feature of the system is the use of the heat conveying medium in carrying the heat from its source to the point of dissipation.

Another feature of the system consists in the use of a battery or series of valves or equivalent means for reversing the connections of the heat dissipating or refrigerating element and the low temperature heat absorbing element, thus making possible the automatic reversal of the system, so that it may be changed instantaneously from a heating to a cooling system and vice versa.

Still another feature of the system is the use of extended fin-surface radiation or heat-exchanging surface, the fins of which are formed to serve the combined purpose of heat-exchanging surface and entrained moisture eliminators, thus preventing condensed moisture from being carried from the heat-exchanging elements by the air stream when operating as a cooler.

Another feature of the system is the location of the two main heat-exchanging elements other than the boiler, one in the space to be cooled or heated and the other out of doors at a point where waste heat is discharged when the interior space is to be cooled, and where heat is taken up at a low temperature when the interior space is to be heated. This is not essential to the operation of the invention, as the apparatus may be otherwise arranged.

Another feature of the system is the possibility of using the heat conveying medium both as a means for conveying heat and as a source of energy of operating medium.

These and other features of my invention will appear from the description in connection with the accompanying drawing, in which—

Figure 1 is a diagrammatic sketch of the system in which a jet compressor is used as a heat pump and a jet boiler feed pump is used to maintain liquid in the boiler.

Figure 2 is a diagram of the same system in which a turbine and a turbo-compressor are substituted for the jet compressor of Figure 1, and a rotary or centrifugal boiler feed pump driven by the turbine is substituted for the jet boiler feed pump.

Figure 3 is a diagrammatic sketch of the reversing mechanism shown as comprising a battery of valves.

Figure 4 is a side elevation of the combined radiating fins and eliminators.

Figure 5 is an end elevation of the same.

Referring to the drawing by numerals, Figure 1 being a diagrammatic sketch of the system shows a jet compressor 4 used as a heat pump and a jet boiler feed pump 3 used to maintain liquid in the boiler. In this system heat is supplied to the liquid heat-con-

veying medium in the boiler 2 from the source of heat 1, which may be a furnace or any suitable type of burner. The vaporized heat conveying medium at high pressure passes from the boiler to the jet compressor 4, supplying vapor at a reduced pressure to the heat dissipating member or condenser coil 5, and drawing vapor at a low pressure from the heat absorbing member 6, which vapor is also passed into the heat dissipating member 5.

As the heat is removed from the heat conveying medium in the heat dissipating coil 5, it condenses this medium, some of which passes through the boiler feed jet pump to the boiler which draws its operating high pressure vapor through the by-pass connection 25 from the boiler. The remainder of the condensed liquid from the heat dissipating coil 5 passes down through the pressure reducing valve 7 into the heat absorbing element 6 where it is vaporized by the heat absorbed. This latter operation takes place under a reduced pressure. The vapor from absorbing element 6 is then picked up by the jet compressor 4 and the liquid supplied the boiler is again vaporized and the cycle is repeated.

Figure 2 represents a diagrammatic sketch of the same system in which a turbine 9 and a turbo-compressor 8 are substituted for the jet compressor 4 of Figure 1, and a rotary or centrifugal boiler feed pump 10 driven by the same turbine 9 is substituted for the jet boiler feed pump of Figure 1. The advantage of this substitution is that any glands as on jet boiler feed pump valve operating mechanism is eliminated and the unit may be started by merely applying the source of heat 1. As soon as the vapor pressure in the boiler starts to rise, the turbine begins to operate, which operates the boiler feed pump 10, starts to operate delivering liquid to the boiler through the check valve 26, and at the same time the turbo-compressor 8 draws vapor from the heat absorbing member 6 and the cycle of Figure 1 is in operation.

Figure 3 is a diagrammatic sketch representing the reversing valves for the heat exchanging media 19 indoors and 20 out of doors. Considering Figures 2 and 3 and considering the pipe lines 21, 22, 23 and 24 of the two figures, to substitute 19 and 20 of Figure 3 for 5 and 6 of Figure 2 for winter operation valves 11, 13, 15, 17 will be closed, and valves 12, 14, 16 and 18 will be opened, and for summer operation these will be reversed as 11, 13, 15, 17 will be opened and 12, 14, 16 and 18 will be closed.

Figure 4 illustrates the arrangement of combined radiating fins and eliminators, 27 representing the fins and 28 the tube carrying the heat conveying liquid, gas or vapor. These heat exchanging media being used in the unit 19 of Figure 3.

It will be noted that this system is a combination heating and cooling system so com-

bined as to obtain maximum value in all respects. In the case of heating, all heat energy represented by the losses of the prime mover are delivered to the heat dissipating media, and the useful work generated by said prime mover is utilized in operating the compressor which when considered as a heat pump is a very highly efficient mechanism, delivering several times the amount of heat energy as that required for its elevation.

It will further be noted that in the case of cooling, the same equipment is used and a comparatively cheap source of energy is used as compared with electrically driven apparatus.

While I have shown and described what I now consider to be the best embodiments of my invention and its several features, it will of course be understood that these are merely illustrative and that the invention may be variously modified in its many details, within the scope of the appended claims, and that one or more of the features may be used without the others, without departing from the spirit or sacrificing the advantages thereof.

What I claim as new and desire to secure by Letters Patent is:

1. The combination in a heating and cooling system for dwellings or places of human assembly of a power generating means of the fluid expansion type, a boiler, a condenser and a boiler feed pump therefor together with refrigerating means consisting of a compressor driven by said power generating means, and delivering to the same condenser as the power generating means an evaporator and a pressure reducing valve of suitable type, said condensing element and evaporating element having mutually interconnecting means including change-over valves so that their respective functions in the system may be mutually interchanged or reversed.

2. The combination in a heating and cooling system for dwellings or places of human assembly of power generating means consisting of a prime mover of the fluid expansion type, a boiler, a condenser and a boiler feed pump and a refrigerating part consisting of a compressor driven by said power generating part, an evaporator and an expansion valve, said condensing element and evaporating element having mutual interconnecting means including change-over valves whereby their respective functions in the system may be mutually interchanged or reversed, said power generating means and refrigerating means delivering to one and the same condenser in order that the heat dissipated therein may be greater than that delivered to the prime mover by the boiler by the amount of that absorbed by the evaporator less useful work and losses.

3. The combination in a heating and cooling system for dwellings or places of human assembly of power generating means con-

sisting of a jet compressor, a condenser, a boiler feed device, a boiler and a source of heat together with refrigerating means connected to draw its liquid refrigerant from the said condenser and an expansion or pressure reducing valve through which the refrigerant is drawn to said refrigerating means and connections causing it to deliver its heat containing vapor from its evaporator to the jet compressor of the power generating part, said vapor delivered to the condenser containing the heat supplied by the boiler in addition to the heat drawn from the evaporator, the total heat supplied to the condenser being greater than that delivered by the boiler by the amount of that drawn from the evaporator less useful work and losses, said condenser and evaporator having mutual interconnections including change-over valves so that their respective functions in the system may be mutually interchanged or reversed.

4. The combination in a heating and cooling system for dwellings or places of human assembly, of a boiler for generating vapor, a condenser, an evaporator, means for feeding liquid from said condenser to said boiler, power means actuated by vapor drawn from the boiler for compressing vapor drawn from said evaporator, means for delivering both the compressed vapor and the vapor delivered from the power means to said condenser, a connection having an expansion valve therein between said condenser and evaporator, said condenser and evaporator having mutually interconnecting means including change-over valves so that their respective functions in the system may be mutually interchanged or reversed.

Signed by me at Baltimore, Maryland, this 18th day of August, 1931.

ARTHUR B. STEUART.