

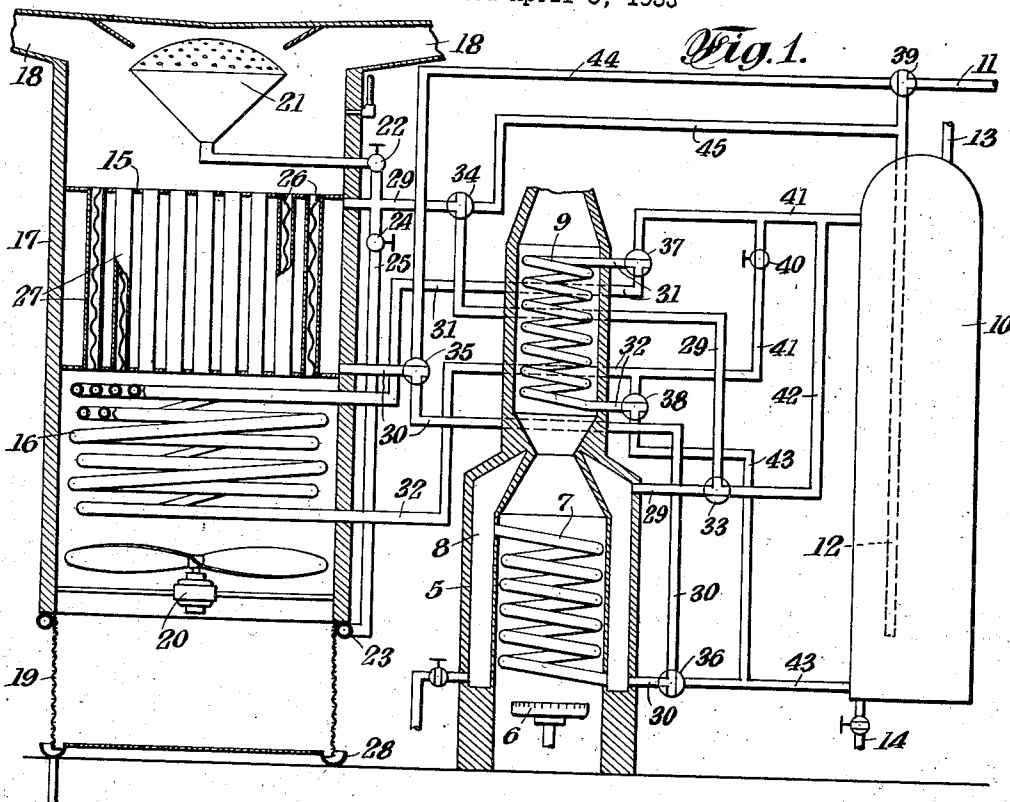
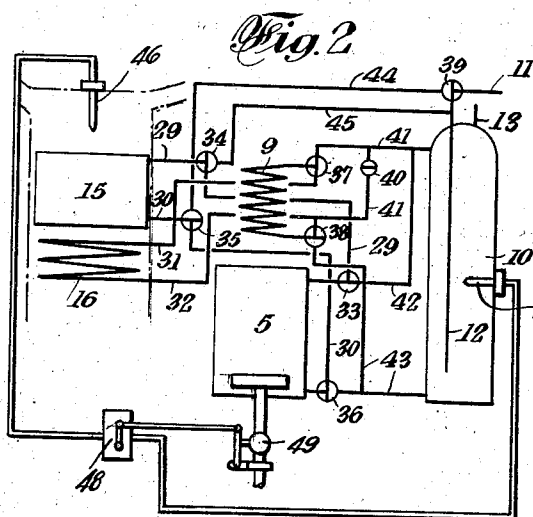
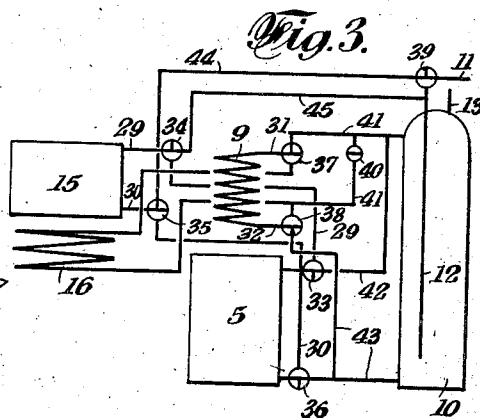
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AIR CONDITIONER AND WATER HEATING SYSTEM

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AIR CONDITIONER AND WATER HEATING SYSTEM

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7 Claims. (Cl. 257—8)

The objects of this invention are to combine in a single unitary system all the several functions of air conditioning, house heating for winter service, cooling for summer service and supplying hot water necessary for use both winter and summer and to accomplish all this in a simple, practical and relatively inexpensive way, using largely standard pieces of apparatus.

The foregoing and other desirable objects are attained by the novel features of construction, combinations and relations of parts hereinafter disclosed, broadly covered in the claims and illustrated in the accompanying drawing.

The drawing illustrates in somewhat diagrammatic form, a typical embodiment of the invention, it being understood that the actual physical structure may vary, within wide limits, to meet different requirements and conditions, all within the true intent and broad scope of the invention.

Fig. 1 is a broken, sectional and partly diagrammatic view of an installation of the invention with the parts indicated as arranged for day time winter heating purposes.

Fig. 2 is a diagrammatic illustration of the same parts arranged for night time winter heating operations.

Fig. 3 is a diagrammatic representation showing the system as set for summer time house cooling and water heating purposes.

In the illustration, a heater or boiler is indicated at 5, fired by suitable fuel, such as a fuel oil or gas burner at 6.

For purposes of greater fuel economy, this boiler is shown as having a coil 7, in the combustion chamber of same, connected across low and higher level portions of the water space 8, and in the stack portion of the boiler, a waste heat absorbing coil is indicated at 9. This boiler may be a suitable hot water boiler of a standard or accepted type, with the special features described incorporated therein.

At 10, a hot water storage tank is indicated, which may be of standard construction, having a service connection 11, extending down into the lower region of the tank at 12, and provided with a hot water outlet 13, at the top and drain 14 at the bottom.

For house heating purposes, a heat exchanger system is shown consisting of an upper, tubular, heat exchanger unit 15, and a lower coil exchanger unit 16, mounted one above the other in an airway or air box 17, shown as having branches 18, at the top to different rooms.

At the bottom, this vertical air conduit has a

screened air inlet 19, and a motor driven fan is indicated at 20, in the foot of the column above the air inlet for positively forcing air up through the heat exchanger units. This fan may be automatically or manually controlled, in accordance with the circulation desired or required.

The air circulated may be moistened, or chemically, or otherwise treated. Thus, in the illustration, a spray head is shown at 21, in the top of the air chamber above the upper heat exchange unit controlled by valve 22, and a spray pipe is shown at 23, positioned to discharge down over the air inlet screen and controlled by a valve 24 in the piping 25.

The upper heat exchanger is shown as of the air tube type with retarders 26, in the vertical air tubes 27, of the same and the lower heat exchanger is shown as made up of "pancake" or flat spiral coils successively connected one to the other and arranged preferably with the convolutions of one coil offset from the convolutions of the adjoining coil to force the air to follow a circuitous path.

When the spray pipe is in use, any drip from the screen may be carried off by the circular drain trough 28.

The upper, tubular heat exchange unit, which may usually be the more efficient unit of the two, is shown herein as connected in on the boiler and the lower coil form of heat exchange unit is shown as connected in on the waste heat utilizer coil 9. The relation of these parts however, may be reversed or otherwise changed and other forms of heat exchangers be used. Also, a single heat exchange unit or more than two may be employed, in accordance with requirements.

For winter time service, all the heat from both heat exchange units may be required. At such time therefore, they may be connected as illustrated in Fig. 1, where the top of the boiler is shown connected by piping 29, with the top of the main exchange unit, which latter has a return line connection 30, to the bottom of the boiler; the waste heat utilizer 9, at such time, being connected at the top by piping 31, with the top of the lower heat exchanger, the latter having return connection by piping 32, with the lower end of waste heat coil 9, by way of piping 41, tank 10, line 43 and valve 38.

This day time winter heating circulation is under the control of two three-way valves 33, 34, in the upper boiler connection 29, and two three-way valves 35, 36, in the boiler return 30, for the upper heat exchanger and two three-way valves

37, 38, in the waste heat supply and return connections 31, 32, for the lower heat exchanger, these so-called three-way valves being set as indicated in Fig. 1. Also, at such time, the three-way valve 39 in the cold water supply line is turned as shown to pass feed water down through the tank inlet 12 and the shut-off valve 40, is left open in a by-pass line 41, from return line 32, so as to leave the lower end of the bottom heat exchanger open to the hot water tank through line 41 and valve 40, for hot water heating purposes. Similarly, at such time, the three-way valve 33 leaves an expansion line 42, open into the top of the boiler for expansion and hot water heating purposes. Accordingly, with the connections of the valve settings illustrated in Fig. 1 and described above, the main heat exchanger 15 will be supplied with heat from the boiler, the secondary heat exchanger 16 will receive heat from the waste heat utilizing coil 9, and the tank will serve as an equalizer for the heat exchange units and take sufficient heat from both for heating the water for domestic or other purposes. The connection 43 from the bottom of the boiler through three-way valve 38, to the bottom of waste heat coil 9, serves at this time to maintain proper water heating circulation in the tank.

At night time, in cold weather, when so much heating of the water in the tank is not required, the waste heat coil may be shut off from the bottom of the boiler and be connected in a closed circuit with the lower heat exchanger, after the manner indicated in Fig. 2, where three-way valve 38 is shown turned to shut off the bottom tank connection 43 from the waste heat coil and valve 40 is shown closed to shut off the tank return 32, 41, from the bottom of the lower heat exchange unit 16. Also, in this view, three-way valve 37 is indicated as given a quarter turn to the right from the position shown in Fig. 1, to give the waste heat coil an expansion connection to the top of the boiler.

Thus in the situation indicated in Fig. 2, the boiler and the waste heat utilizer will both be throwing heat into the house heating system and the hot water tank will receive heat in more indirect fashion, desirable conditions for night time, winter heating.

The boiler may be automatically controlled so as to furnish just the required heat under different situations described, or the same may be manually controlled, if desired.

For summer time operations, the requirements may be completely or at least partly reversed, heat being then only or mainly required for hot water purposes and the heat exchange system being then desired for cooling rather than for heating purposes.

Accordingly, for summer service, the system may be controlled as indicated in Fig. 3, that is with three-way valve 39 in the feed line 11, turned to pass cold water through line 44, to three-way valve 35, which then is turned a half revolution from its former position to direct cold water into the bottom of the main heat exchange unit 15, which water acquiring heat from air passing up through the air chamber, rises and flows through top connection 29 and three-way valve 34, which has been given a quarter turn to pass this more or less pre-warmed water through piping 45, into the tank service inlet 12. Thus domestic use of water from the hot water storage tank 10 induces the flow of water that cools the air and, a cooling of the air in the house system is effected and at the same time, a warming of

the water supplied to the tank. This heat exchanging relation may be expedited by use of the fan 20 and the air may be further conditioned by use of either the spray head 20, or the spray screen, or both. The water warmed by cooling the circulating air and fed into the tank as described is, by the turning of the lower three-way valve 36, left-handedly, a quarter turn, directly supplied through piping 43, to the bottom of the boiler and the top boiler three-way valve 33, at such time, is turned a half revolution to shut off the line 29 to the main heat exchanger and put the top of the boiler in direct communication with the top of the tank through piping, 42. Also, in these summer hot water heating conditions, the waste heat utilizer is cut off from the secondary heat exchange unit 16, and directly connected in on the tank by giving the three-way valve 37, a quarter right hand turn and the valve 38, a half turn to put the top of the waste heat coil in connection with the top of the tank through pipe 41, and the bottom of such coil in connection with the bottom of the tank by piping 32, 43. Consequently, for summer service, all heat from the boiler including that from the waste heat coil is used for heating water and the main heat exchange unit may be utilized for cooling the house circulating air and for exchanging heat from such air to the hot water tank.

The heater may be either a steam or a hot water boiler and the heating system instead of being of the hot air type as illustrated, may be either hot water, steam or vapor, in which cases, the heat exchange units may be in the nature of "radiators" located in the rooms or wall spaces. The expressions "heat exchanger" and "heat exchange units" are to be construed accordingly as suitable units for accomplishing the desired heating purposes. Similarly, other expressions are herein used generally in a broad sense, such as the term "three-way valve", which is meant to include any suitable valving mechanism on the order of what are known as three-way valves for switching from one line of connections through another line of connections.

The spray for humidifying the air is shown as a matter of convenience as taken direct from piping 29, connected with the top of the main heat exchanger, but it will be appreciated that the same may be connected elsewhere in the system. Automatic control may be employed for regulating temperature, humidity, forced or natural air circulation and the like. Thus as indicated at 46 and 47 in Fig. 2, thermostats or the like may be provided in the air passage and at the domestic hot water supply tank controlling a motor device 48, for the burner valve 49, to automatically control the heater for both or either air heating and water heating requirements. The air used for heating and ventilating is filtered where it enters the system through screen 19 and further cleansed when the spray is used on the screen. The provision of the fan for forced air circulation enables an efficient heater of reasonable size to serve for winter heating purposes, without being too large for simply the water heating service of summer. The fan or blower being located at the cooler, air inlet end of the air shaft is not injuriously affected by the heat transfer. The heater is economical in the use of fuel, as the coil 7 occupying a greater portion of the combustion chamber form, an effective baffle for the burner and the secondary coil above, picks up heat which

otherwise would pass out the stack. The spray head above the heat exchangers and the spray coil below the same and separately usable, enable a choice of humidifying and heating and cooling effects. Standard parts may be used to a large extent throughout the system, making the installation relatively inexpensive for what it accomplishes and the operation of the system is economical and the control simple enough to be readily understood.

What is claimed is:

1. A combined heating, cooling and hot water furnishing system comprising a heater, a hot water storage tank, an air circulation conduit, a heat exchanger in said air circulation conduit and regulatable flow connections for connecting said heater direct to said heat exchanger for air heating service and for connecting said heater and said heat exchanger to said water storage tank for air cooling and water heating service, and a waste heat utilizing coil in said heater connected to heat water in the storage tank while the heater is connected to the heat exchanger in the first described relation.

2. A combined heating, cooling and hot water furnishing system comprising a heater, a hot water storage tank, an air circulation conduit, a heat exchanger in said air circulation conduit, regulatable flow connections for connecting said heater direct to said heat exchanger for air heating service and for connecting said heater and said heat exchanger to said hot water storage tank for air cooling and water heating service and a second heat exchanger connectible and disconnectible from the heater independent of the first heat exchanger.

3. In apparatus of the character disclosed, an air box having a screened air inlet, a blower for forcing air therethrough, a heat exchanger in said air box, a heater, a hot water storage tank and flow connections controllably to send heating fluid from the heater through said heat exchanger or cold water through the heat exchanger to the storage tank, a circulation from said storage tank through the heater and means for supplying a spray to said screened air inlet.

4. In combination, a water heater, a hot water storage tank, an air shaft having an air inlet at the bottom and air discharge means at the top, a heat exchanger unit in said air shaft, a blower for forced air circulation through said air shaft, means for variously connecting said heat exchanger with said heater and storage tank for air heating or for air cooling purposes and means

for automatically controlling said heater for air heating and water heating requirements.

5. In combination, a water heater, a hot water storage tank, an air shaft having an air inlet at the bottom and air discharge means at the top, a heat exchanger unit in said air shaft, a blower for forced air circulation through said air shaft, means for variously connecting said heat exchanger with said heater and storage tank for air heating or for air cooling purposes, means for automatically controlling said heater for air heating and water heating requirements and a second heat exchange unit in said air shaft and connectible with and disconnectible from said heater independently of the first exchange unit.

6. A combined heating, cooling and hot water furnishing system, comprising a boiler, a hot water storage tank, a heating unit or units and regulatable connections variable to send all the heat from said boiler to said heating unit or units, or to send the heat from the boiler partly to said heating unit or units and partly through a heating circuit for said hot water storage tank, or to send all the heat from said boiler to said hot water storage tank, said regulatable connections including feed water connections for the hot water storage tank, variable to send cold water directly therein or to pass said cold water through a heating unit before entering the hot water storage tank.

7. A combined heating, cooling and domestic hot water furnishing system comprising a heater, a hot water storage tank for storing hot water for domestic use and provided with a changeable service connection for cold water, and an outlet through which hot water for domestic use may be withdrawn as required, an air circulation conduit, a heat exchanger in said air circulation conduit and regulatable flow connections for connecting said heater direct to said heat exchanger for air heating service and for connecting said heater and said heat exchanger to said hot water storage tank for air cooling and water heating service and including connections by which cold water from a service line will flow through said heat exchanger into the domestic hot water storage tank as hot water is withdrawn from said tank for domestic hot water use and connections by which circulation of warmed water from the heat exchanger induced by domestic use of hot water will be automatically effected from said domestic hot water storage tank directly through said heater and back into said tank.

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