

May 16, 1944.

M. L. MUELLER

2,348,835

HEATING APPARATUS

Filed Sept. 2, 1942

3 Sheets-Sheet 1

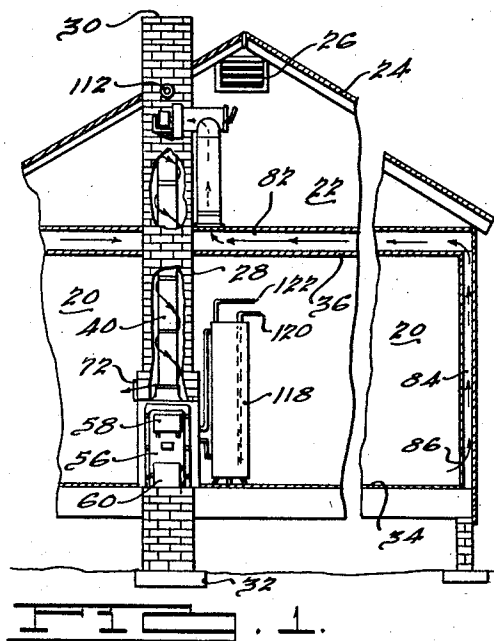


FIG. 2.

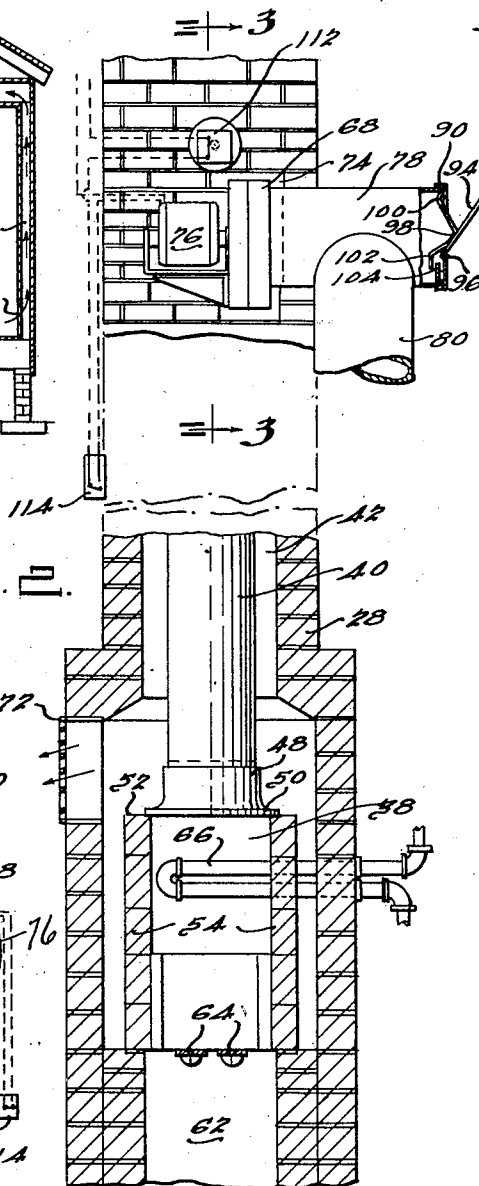


FIG. 3.

INVENTOR
Moritz L. Mueller
BY Edwin J. Balloff
ATTORNEY

May 16, 1944.

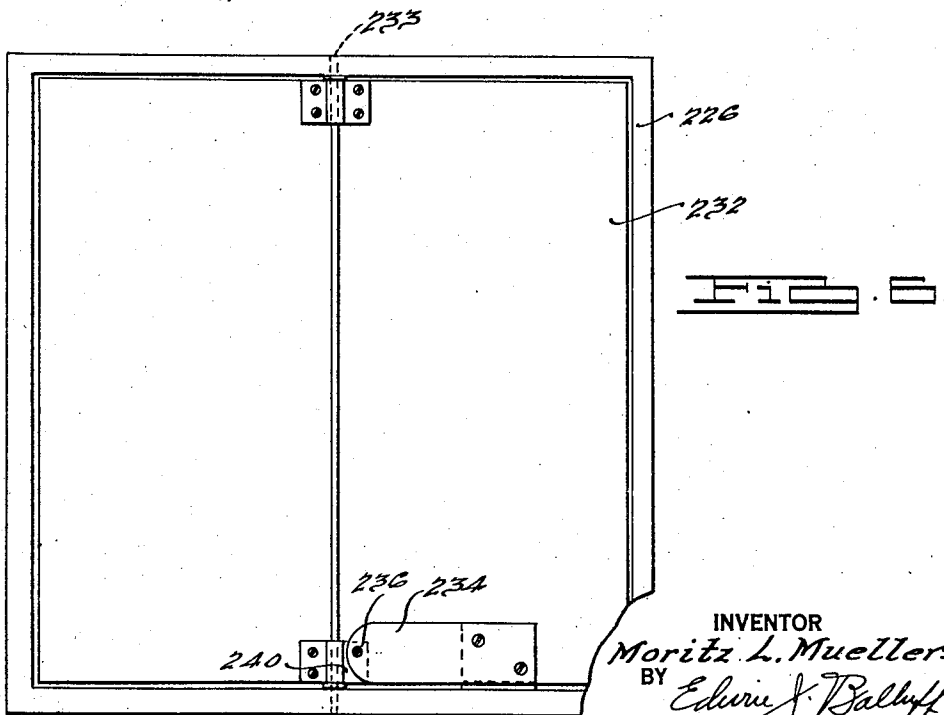
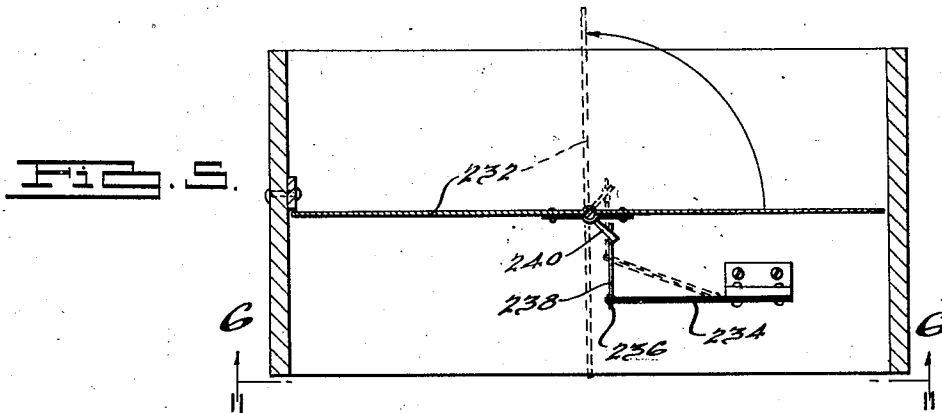
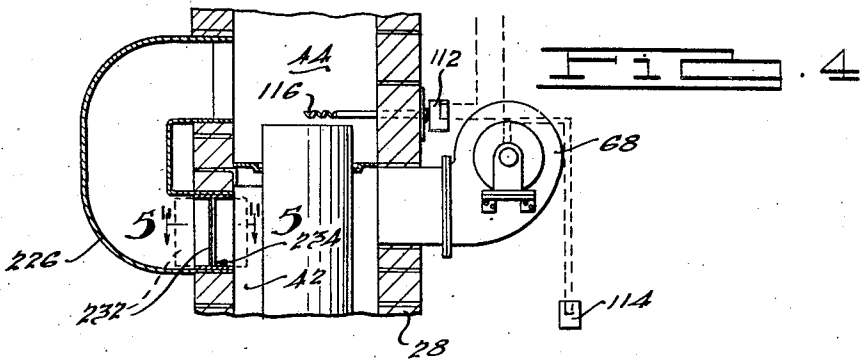
M. L. MUELLER

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HEATING APPARATUS

Filed Sept. 2, 1942

3 Sheets-Sheet 2



INVENTOR
Moritz L. Mueller.
BY *Edwin J. Bally*
ATTORNEY

May 16, 1944.

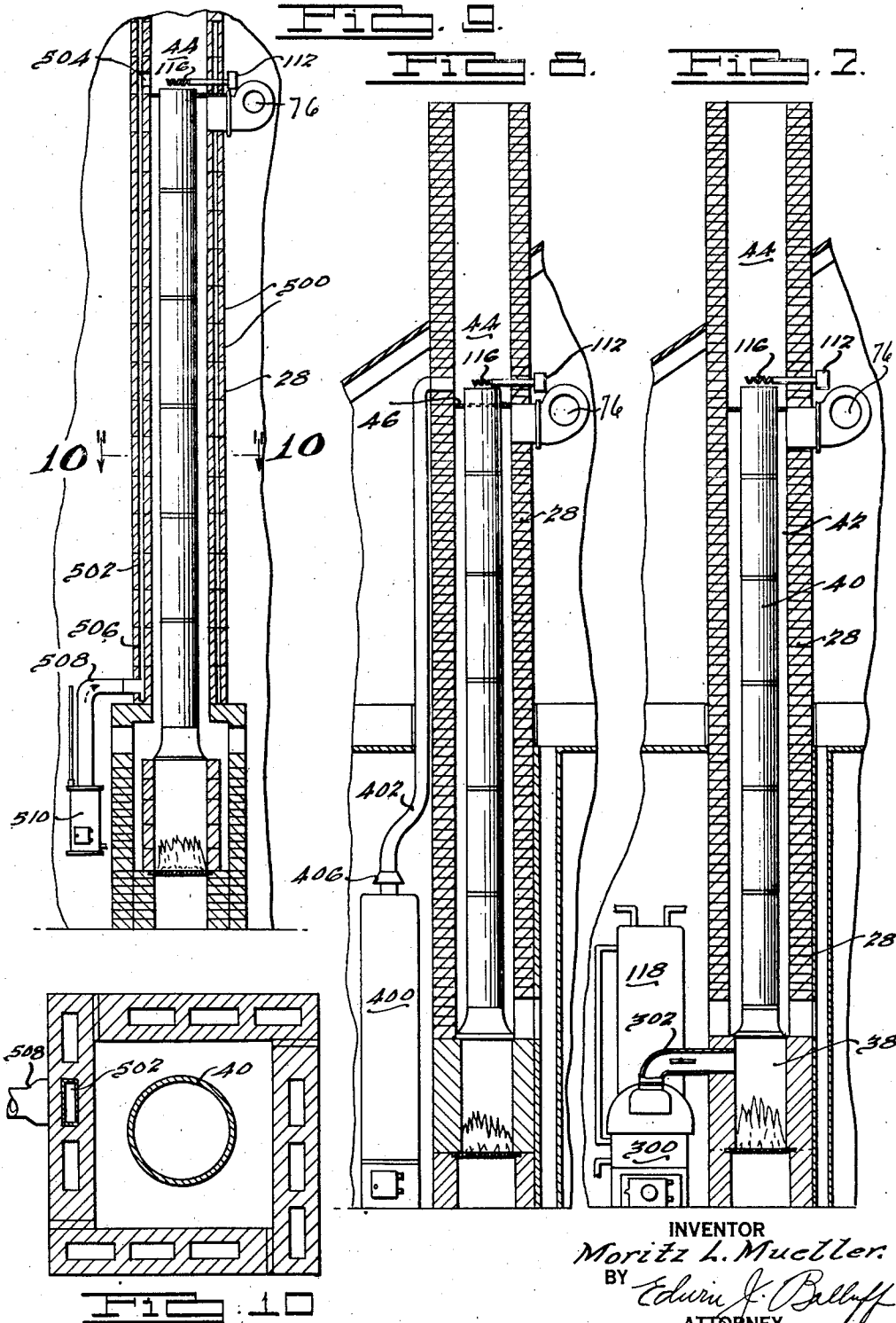
M. L. MUELLER

2,348,835

HEATING APPARATUS

Filed Sept. 2, 1942

3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,348,835

HEATING APPARATUS

Moritz L. Mueller, Seattle, Wash., assignor, by
mesne assignments, to Moritz L. Mueller and
John H. Mueller, Seattle, Wash., as joint
tenants

Application September 2, 1942, Serial No. 457,065

22 Claims. (Cl. 237-2)

This invention relates to heating apparatus and has particular reference to an apparatus or system wherein heated products of combustion are generated and utilized for heating air and for other purposes, such as heating water: the system being provided with means for supplying such heated air to a space in a building to be occupied by and for the comfort of human beings and such system also being constructed and arranged so that the heated products of combustion may be utilized for other purposes, such as heating water, simultaneously with or independently of the supplying of heated air to said space.

A principal object of the invention is to provide a heating apparatus having fuel burning means for generating heated products of combustion with a heat exchanger for heating air, and another heat exchanger for utilizing such heated products of combustion for another purpose, such as heating water, together with means for dissipating the heat from the air heat exchanger at such time as it is desired to utilize the other heat exchanger without supplying heated air to the space in the building with which the heating apparatus is operatively associated.

Another object of the invention is to provide the hereinafter disclosed improvements upon the chimney furnace type of heating system disclosed in my Patent No. 2,274,341, issued February 24, 1942, for "Heating apparatus."

Other objects and advantages of the invention will be apparent from a consideration of the following specification taken in conjunction with the accompanying drawings, of which there are three sheets and wherein:

Fig. 1 is a vertical cross section through a part of a house illustrating one form of heating apparatus embodying the invention;

Fig. 2 is an enlarged fragmentary view partially in elevation and partially in section of the heating apparatus;

Fig. 3 is an enlarged vertical sectional view of the upper part of the heating apparatus with certain parts being shown in elevation and taken generally along the line 3-3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a view similar to Fig. 3 and illustrating a modification thereof;

Fig. 5 is a horizontal sectional view taken in a plane along the line 5-5 of Fig. 4, looking in the direction of the arrows;

Fig. 6 is a view taken along the line 6-6 of Fig. 5, looking in the direction of the arrows;

Fig. 7 is a fragmentary vertical sectional view

similar to Fig. 1 and illustrating a modification thereof;

Fig. 8 is a fragmentary vertical sectional view similar to Figs. 1 and 7 and illustrating a modification thereof;

Fig. 9 is a fragmentary vertical sectional view similar to Figs. 1 and 7 and illustrating a modification thereof;

Fig. 10 is a horizontal sectional view taken along the line 10-10 of Fig. 9, looking in the direction of the arrows.

Referring now to Figs. 1 to 3, there is illustrated, somewhat diagrammatically, a house having one or more rooms 20 with an attic space 22 formed thereabove and below the roof 24 of the building. The attic space may be ventilated by one or more louvered openings such as that indicated at 26. A heating apparatus embodying the invention and of the type disclosed in my aforesaid patent is provided for heating the space in the rooms 20 and for heating hot water, and in general comprises a chimney 28 which extends upright to and above the roof 24 of the building and is provided with an atmospheric discharge 30 external of the space in the house. The chimney, as illustrated, may be of masonry construction and is erected upon a footing 32 disposed below the level of the floor 34 of the house. The chimney 28 preferably is located inside of the side walls of the house and extends upwardly through suitable openings formed in the floor 34, ceiling 36, and roof 24 of the house.

The heating apparatus in addition includes a combustion chamber 38 having fuel burning means operatively associated therewith and located in the lower part of the chimney 28, preferably so as to be accessible from the floor 34. An air heat exchanger member 40 comprising a pipe or tubular member is vertically arranged in the space in the chimney 28 and is adapted to divide the space therein into a path or passageway 42 for air and a path or passageway within the member 40 for the upward flow under natural draft of the products of combustion, generated in the combustion chamber 38 to the atmospheric discharge 30. The heat exchanger member 40 extends from the combustion chamber 38 to a point short of the upper end of the chimney, and as illustrated in Figs. 1 and 3, may terminate just below the roof 24 of the building. The length and diameter of the heat exchanger member 40 of course will determine the heat exchange surface for heating air and should be correlated with the heating requirements of the house.

The upper end of the air path 42 is separated

from the flue passageway 44 above the heat exchanger member 40 by a plate 46 arranged transversely of the space between the heat exchanger member 40 and the inside of the chimney 28, and which space forms a seal between the two passageways.

The lower end of the heat exchanger member 40 terminates in a base casting 48 having a laterally extending flange 50 which is adapted to seat upon an upper ledge or seat 52 provided by the walls 54 which define the combustion chamber 38. The walls 54 which define the combustion chamber may be formed of fire brick and may, as illustrated, be slightly spaced from the outside walls of the chimney 28. One face of the chimney, as illustrated in Fig. 1, may be provided with an opening which is closed by a metal panel 56, such panel being provided with openings normally closed by doors 58 and 60, which provide access to the combustion chamber 38 and ash pit 62 respectively, the latter being disposed below the grates 64 of the fuel burning means which, in the particular embodiment illustrated, is adapted for burning hard fuel such as coal so as to generate heated products of combustion. The door 60, of course, is provided with suitable adjustable means (not shown) for admitting air into the combustion chamber to efficiently support combustion therein. I also contemplate that other forms and arrangements of fuel burning means may be used, such for example as those illustrated in my co-pending applications Ser. No. 427,734, filed January 22, 1942, for "Heating apparatus," and Ser. No. 435,813, filed March 23, 1942, for "Heating apparatus."

A second heat exchanger member 66 and which may comprise a water heating coil is arranged in the combustion chamber 38 so as to be heated during such time as the fuel burning means are operative. The heat exchanger member 40 is spaced from the inside wall of the chimney 28 so as to provide the air passageway 42 therebetween through which air is circulated in countercurrent heat exchange relationship with the combustion products. Air under pressure is delivered to the upper end of the air passageway 42 by a blower 68, the discharge 70 of the blower being arranged in a suitable opening in the upper portion of the chimney 28 immediately below the plate 46 and delivering air into the air passageway 42 in such a way that it tends to spiral downwardly through the passageway 42 and around the heat exchanger member 40.

The lower end of the air passageway 42 is provided with one or more warm air outlets 72 which may comprise grilled openings formed in the chimney wall 28 opposite the lower end of the exchanger 40 and which are adapted to deliver warm air laterally and/or downwardly into the space in the rooms 20 to be heated.

The blower 68 comprises a pressure type of blower and may be mounted upon a plate 74 secured to the upper portion of the chimney around the opening through which the discharge 70 extends. The blower 68 is driven by an electric motor 76 suitably supported in operative relation with the blower wheel of the blower 68. A pipe 78 is adapted to supply air to the intake of the blower 68, the pipe 78 being connected to a vertical conduit 80, the lower end of which communicates with a duct 82 which may be formed between the ceiling joists of the house. The duct 82 communicates with one or more vertical ducts 84 formed between the wall studding, the ducts 84 having return air inlets or openings 86 at their lower end communicating with the space in the rooms 20.

Thus air from the space to be heated is circulated through the ducts 84, 82, and 80 and is delivered through the pipe 78 to the blower which forces such air through the heating apparatus and particularly the air passageway 42 thereof and such air after being heated is delivered by the warm air outlets into the space in the rooms 20.

The end of the pipe 78 opposite the intake to the blower 68 is provided with a relief vent which is closed whenever the blower is operating but which is adapted to open during the operation of the fuel burning means if the blower fails to operate. Such end of the pipe 78 is provided with a cap 90 having an opening or vent therein adapted to be closed by a damper 94 pivoted at 96. A bracket 98 is fixed to the inside face of the opening so as to limit the opening movement of the damper 94, as illustrated in Fig. 2.

The bracket 98 is also provided with another leg 102 which is adapted to be engaged by a thermostatic element 104 carried by the cap 90 and exposed to the temperature of the air inside of the pipe 78. As the thermostatic element 104 heats up, it engages the leg 102 of the bracket 98 and exerts a force in a clockwise direction on the pivot 96 of the damper 94 when the same is in its closed position. This force exerted by the thermostatic element 104 will move the damper 94 sufficiently about its pivot 96 so as to cause it to fall by gravity to the open position in which it is illustrated in Figs. 1 and 2. If the fuel burning means are generating heated products of combustion, such will pass upwardly under natural draft through the interior of the heat exchanger member 40 and the chimney thereabove to atmosphere through the opening 30 in the upper end of the chimney, and as a result thereof the heat exchanger member 40 and the air in the passageway 42 will become heated.

If the blower 68 fails to operate as it should, due to current failure for example, when the heat exchanger member 40 is heated there will be no air movement through the passageway 42 under the influence of blower 68. The air in the interior of the pipe 78 communicating through the blower 68 and the discharge 70 will at such time be heated and in turn will heat the thermostatic element 104 which will act as previously described to unbalance the damper 94 and thereby open the same, thereby venting the upper end of the air path or passageway 42 through the blower discharge 70, the blower 68, the intake thereof, the pipe 78, and opening in the end of the pipe 78 to the attic space 22, as a result of which air will flow into the air passageway 42 through the opening 72, upwardly due to gravity through the air passageway 42, and through the blower and pipe 78 into the attic 22. From the attic the heated air may be vented, for example by the louvered openings 26. In this way the heat generated in the heating apparatus will be dissipated therefrom and from the building if the blower 68 does not operate.

The motor 76 for the blower 68 is supplied with current by a wiring circuit diagrammatically indicated at 110, and which wiring circuit has arranged therein a thermostatically controlled blower switch 112 and a manually operated switch 114. The thermostatic switch 112 includes a thermal element 116 which is arranged inside of the chimney 28 immediately above the heat exchanger member 40 in the path of the flue gases so as to be responsive to the temperature thereof, and preferably is set so as to close the blower motor circuit when the flue gas temperature at such point reaches for example 225° F. and to

open the motor circuit when the flue gas temperature at such point falls for example to 125° F. In this way the blower is cut in after the heat exchanger member 40 is heated and is effective for circulating air over the heat exchange surface thereof and into the space to be heated, as previously described. When the flue gas temperature decreases to 125° F. the blower is cut out. The switch 114 should be closed during the heating season so that the operation of the blower will be controlled by the thermostatic switch 112.

The water heating coil 66 is operatively connected to a water storage tank 118, the intake side of the coil 66 being connected to the lower part of the tank 118 and the upper part of the coil 66 being connected to the upper part of the tank 118 which in a conventional manner is connected into the water system of the house by cold water pipe 120 and hot water pipe 122. The operation of the fuel burning means will, in addition to heating the air which is supplied to the house during the heating season as previously described, also function to heat the water in the tank 118. The water from the tank 118 will circulate through the coil 66 when heated, as well understood in the art.

The heating apparatus is so constructed that water may be heated as previously described but without supplying heated air to the space in the house, and this is accomplished by preventing the operation of blower 68 so as to dissipate the heat from the heat exchanger and the air passageway through the relief vent as previously described. When the relief damper 94 is open, as previously described, air will circulate upwardly through the path 42 and dissipate heat from the heat exchanger 40 and the heated air will then be vented through the opening into the attic 22 and from thence through the louvered openings 26 to the outside of the house.

In order to prevent the operation of the blower 68 during such time as it is not desired to have the space in the house supplied with heated air, the manually operated switch 114 may be opened, thereby cutting the blower motor out of operation, and when the thermostatic element 104 of the relief damper apparatus becomes heated, the relief damper 94 will open. While the relief damper 94 functions primarily as a safety device for dissipating heat from the heating apparatus in the event of the failure of the blower to operate, it may be relied upon to dissipate heat from the apparatus during such time as only the heating of water is desired by opening the switch 114. It is contemplated, however, that at such time as only the heating of water is desired than an additional or optional manner of dissipating heat from the apparatus may be used, and this comprises a by-pass 126 between the end of the air passageway 42 and the flue passageway 44 and around the plate 46. This by-pass may take the form of a conduit, one end 128 of which communicates through a suitable opening in the wall of the chimney with the upper end of the air passageway 42 and the other end 130 of which communicates with the flue passageway 44 above the plate 46 through a suitable opening in the wall of the chimney 28.

During the heating season the by-pass 126 is closed by a damper 132 which is adapted to be manually adjusted or moved by a handle 134 arranged externally of the passageway 126, which is shown in section in Fig. 3. During the season that no heat is required in the house the

damper 132 may be open, the open position being illustrated in dotted lines in Fig. 3, thereby opening the by-pass 126 and permitting air from the passageway 42 to pass through the by-pass 126 into the flue passageway 44 and thence through the outlet 30 to the exterior of the house. With the switch 114 open the blower 68 will not operate and at such time fuel may be burned in the combustion chamber 38 for the purpose of heating the coil 66 for the purpose of heating water and without having heated air supplied to the space in the house. Also it will be noted that the entire heat generated in the heating apparatus except that absorbed by the water will be dissipated through the chimney 28 to atmosphere.

In the embodiment of the invention illustrated in Figs. 4, 5, and 6, the construction is the same as that illustrated in the preceding figures except in the following particulars. In this case the by-pass 226, which is arranged the same as the by-pass 126, is provided with a damper 232 which is adapted to be automatically opened when the temperature of the air at the upper end of the air path 42 reaches a predetermined degree (preferably higher than that at which the switch 112 closes) as will happen when the operation of the blower 68 is cut out by opening of the switch 114. The damper 232 is mounted upon a vertical pivot 233 and when closed is adapted to obstruct the by-pass 226.

A thermostatic element 234 exposed to the air at the upper end of the air path 42 has its movable end 236 connected by a link 238 to an arm 240 affixed to the damper 232. Upon heating up of the thermostatic element 234 the same will through the link 238 and arm 240 shift the damper 232 to its open position, or otherwise stated, will move the damper 232 from the position shown in full lines to the position shown in dotted lines in Fig. 5. With the damper 232 open the air from the air path 42 will be free to flow through the by-pass 226 into the flue passageway 44 and escape through the chimney 28 to atmosphere. Also at such time air may escape from the air path 42 through the relief vent at the end of pipe 78 as illustrated in Figs. 1-3, although this relief vent may, in this embodiment, be omitted if desired. When the temperature of the air in the path 42 falls, due to the reduction of heat generated in the combustion chamber, the thermostatic element 234 will shift the damper 232 back to its closed position. Thus, when the system is modified in accordance with the disclosures of Figs. 4, 5 and 6, it will be necessary to open the blower motor circuit, as by opening the switch 114 in order to eliminate the supply of heated air to the space in the house and to permit the operation of the heating apparatus for the purpose of heating water only.

In the modification disclosed in Fig. 7, the construction and operation is the same as that illustrated in either of the foregoing embodiments except as modified by the following. A heater or stove 300 comprising a combustion chamber having fuel burning means operatively associated therewith, adapted, for example, to burn coal, is provided, in addition to the fuel burning means associated with the combustion chamber in the chimney 28, and the flue gases generated by the burning of fuel in the combustion chamber of heater 300 are vented by a damper controlled smoke pipe 302 into the combustion chamber 38 and from thence are vented

through the heat exchanger 40 and the flue passageway 44 thereabove to atmosphere through the opening in the upper end of the chimney. Stove 300 may be of any suitable type and includes a heat exchanger of the jacket type for heating water. A water storage tank 118 may be operatively associated with the heat exchanger of the heater 300 in a manner similar to that in which the coil 66 is connected to the tank 118 as illustrated in Figs. 1 and 2. As the flue gases from the heater 300 are conducted to atmosphere through the chimney 28 and the heat exchanger member 40, the heat which will be absorbed from such flue gases by the member 40 and the air in the passageway 42 may be dissipated by the means as illustrated in the previous embodiments of the invention, if it is not desired to utilize such heat for heating air to be supplied to the space in the house. The heater 300 may be operated independently of the fuel burning means in the combustion chamber 38 and at such time the heating system may function to heat water and/or to supply heat to the space in the building depending upon whether the motor blower circuit is open or closed as illustrated in connection with the previous embodiment. The fuel burning means in the combustion chamber 38 may be operated independently of the heater 300 if no hot water is desired, or simultaneously with the heater 300 if the required heat load for heating the house is in excess of that which can be provided by the heater 300.

In the modification disclosed in Fig. 8, a combined gas water heater and storage tank is indicated at 400 and may be disposed alongside the heating apparatus which is constructed and operates the same as that illustrated in any of the previously described embodiments of the invention except as modified by the differences hereinafter set forth. The flue gases from the heater 400 may be conducted by a smoke pipe 402 disposed externally of the chimney 28 and discharged into the flue passageway 44 above the plate 46 and opposite switch 112. The smoke pipe 402 where it is connected to the heater 400 may also have an air intake opening beneath the shield 406 so as to permit air to be drawn into the smoke pipe 402 along with the flue gases therein.

In the embodiment illustrated in Figs. 9 and 10, the construction and operation of the heating apparatus is the same as that illustrated in any of the foregoing embodiments except as modified by the following particulars. In this case the chimney 28 above the lower part thereof may be built of hollow tile so as to provide a vertical flue passageway 502 connected at its upper end 504 to the flue passageway 44 above the heat exchanger 40. The lower end 506 of the flue passageway 502 may have connected thereto a smoke pipe 508 from a side arm type of gas water heater 510. In this way the products of combustion generated during the operation of the heater 510 are vented through the pipe 508 and flue 502 to the upper part of the flue passageway 44 and hence like in the construction illustrated in Fig. 8 are not brought into contact with the heat exchanger 40 although the thermostatic switch 112 is positioned so that it may be affected by the temperature of the flue gases resulting from the operation of the water heater. The heater 510 of course may be conventionally connected to a hot water storage

tank such as 118 and may be operated either automatically or by manual control.

While the invention has been described with some detail, it is to be understood that the description is for the purpose of illustration only and is not definitive of the limits of the inventive idea. The right is reserved to make such changes in the details of construction and arrangement of parts as will fall within the purview of the attached claims.

I claim:

1. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path through which the products of combustion flow from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with at least a part of said combustion products path, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being arranged so as to be operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, and a relief vent at the upper end of said air path for automatically venting the same externally of said space so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heater air to said space.

2. A heating system for supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means which are constructed and arranged for burning fuel so as to generate heated products of combustion, a heat exchanger device arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path thorough which said products of combustion flow to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with said combustion products path, means including an air blower operable to supply from said space to the upper portion of said air path,

air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being arranged so as to be operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, and a relief vent at the upper end of said air path for automatically venting said air path externally of said space so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating said heat exchanger device without supplying heated air to said space.

3. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being arranged so as to be operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, and a relief vent at the upper end of said air path communicating with the atmosphere through said combustion products path for automatically venting said air path of atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space.

4. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial

portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate counter-current heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being arranged so as to be operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, and a by-pass between the upper end of said air path and said combustion products path for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space.

5. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said said blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a by-pass between the upper end of said air path and said combustion products path for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, and a damper for closing said by-pass when said air blower is operating.

6. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an at-

mospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate counter-current heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a by-pass between the upper end of said air path and said combustion products path for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, and a damper normally closing said by-pass and adapted for opening said by-pass when said air blower is not operating and water is being heated in said water heater by the operation of said fuel burning means.

7. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a by-pass between the upper end of said air path and

said combustion products path for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, a damper normally closing said by-pass and adapted for opening said by-pass when said air blower is not operating and water is being heated in said water heater by the operation of said fuel burning means, and a manually operable control for said damper.

8. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a by-pass between the upper end of said air path and said combustion products path for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, a damper normally closing said by-pass and adapted to open said by-pass when said air blower is not operating and water is being heated in said water heater by the operation of said fuel burning means, and thermostatic means responsive to the temperature adjacent the upper end of said heat exchanger member for opening said damper.

9. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger

member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a by-pass between the upper end of said air path and said combustion products path for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, a damper normally closing said by-pass and adapted to open said by-pass when said air blower is not operating and water is being heated in said water heater by the operation of said fuel burning means, and thermostatic means responsive to the air temperature at the upper end of said air path for opening and closing said damper.

10. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a relief vent at the upper end of said air path communicating with the atmosphere for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, and a damper for closing said vent when said air blower is operating.

11. A heating system for heating water and

supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a relief vent at the upper end of said air path communicating with the atmosphere for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, and a damper normally closing said vent and adapted to open said vent when said air blower is not operating and water is being heated in said water heater by the operation of said fuel burning means.

12. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber in the lower portion of said chimney, means associated with said combustion chamber and constructed and arranged for burning fuel under natural draft so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof and operatively connected to a hot water storage tank arranged outside of said chimney, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air moving device operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air moving device, said

air moving device normally being adapted to operate when the temperature of the combustion products at the upper end of said heat exchanger member attains a predetermined amount and to discontinue operation when the temperature of the combustion products at the upper end of said heat exchanger falls below a predetermined amount, means for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion, and a relief vent at the upper end of said air path for venting the same externally of said space so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space.

13. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, said air blower normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air blower as aforesaid without interfering with the generation of heated products of combustion, a relief vent at the upper end of said air path communicating with the atmosphere for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, and a damper normally closing said vent and adapted to open said vent when said air blower is not operating and water is being heated in said water heater by the operation of said fuel burning means, and thermostatic means responsive to the air temperature at the upper end of said air path for opening said damper.

14. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, a combustion chamber having means associated therewith which are constructed and arranged for

burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space during the operation of said air blower, an electric motor for operating said air blower when heated products of combustion are being generated at a substantial rate, an electric circuit for said motor including a thermostatic switch responsive to the temperature of the combustion products adjacent the upper end of said heat exchanger member, means for preventing the operation of said air blower as aforesaid including a manually operated switch on said circuit and without interfering with the generation of heated products of combustion, a relief vent at the upper end of said air path communicating with the atmosphere for venting said air path to atmosphere so as to dissipate from said heat exchanger member the heat absorbed thereby when said fuel burning means are operated for the purpose of heating water without supplying heated air to said space, and a damper normally closing said vent and adapted to open said vent when said air blower is not operating and water is being heated in said water heater by the operation of said fuel burning means.

15. Heating apparatus for heating water and supplying heated air to a space in a building comprising, a chimney having an atmospheric discharge, means providing a combustion chamber having means associated therewith which are constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater arranged to be heated by said fuel burning means during the operation thereof and operatively connected to a hot water storage tank arranged outside of said chimney, a heat exchanger providing at least part of a path through which the products of combustion flow from said combustion chamber to said atmospheric discharge, and a separate path for flow of air in intimate heat exchange relationship with the combustion products, means including an air moving device operable to supply from said space to one end of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the other end of said air path having an outlet for discharging heated air into said space, said air moving device normally being operated when heated products of combustion are being generated at a substantial rate, means for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion, and a relief vent at the upper end of said air path for venting the same externally of said space so as to dissipate from said heat exchanger member the heat absorbed thereby when it is desired to operate said fuel burning means for the purpose

of heating water without supplying heated air to said space.

16. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means associated with the lower portion of said chimney and constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater operatively connected to a hot water storage tank arranged outside of said chimney, fuel burning means thermally associated with said water heater, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, a flue connection between said water heater fuel burning means and said chimney and discharging into said combustion products path at one end of said heat exchanger member, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space, an electric motor for operating said air blower, an electric circuit for said motor including a thermostatic switch having a thermal element responsive to the temperature of the combustion products at the upper end of said heat exchanger member and means, including a manually operated switch in said circuit, for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion when it is desired to operate said water heater fuel burning means for the purpose of heating water without operating said air blower.

17. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means associated with the lower portion of said chimney and constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater operatively connected to a hot water storage tank arranged outside of said chimney, fuel burning means thermally associated with said water heater, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, a flue connection between said water heater fuel burning means and said chimney and discharging into said combustion products path at one end of said heat exchanger member, means including an air blower operable

to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space, an electric motor for operating said air blower, an electric circuit for said motor including a thermostatic switch having a thermal element responsive to the temperature of the combustion products at the upper end of said heat exchanger member, means, including a manually operated switch in said circuit, for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion when it is desired to operate said water heater fuel burning means for the purpose of heating water without operating said air blower, and a relief vent at the upper end of said air path for venting the same externally of said space.

18. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means associated with the lower portion of said chimney and constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater operatively connected to a hot water storage tank arranged outside of said chimney, fuel burning means thermally associated with said water heater, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, a flue connection between said water heater fuel burning means and said chimney and discharging into said combustion products path at the lower end of said heat exchanger member, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space, an electric motor for operating said air blower, an electric circuit for said motor including a thermostatic switch having a thermal element responsive to the temperature of the combustion products at the upper end of said heat exchanger member and means, including a manually operated switch in said circuit, for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion when it is desired to operate said water heater fuel burning means for the purpose of heating water without operating said air blower.

19. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means associated with the lower portion of said chimney and constructed and arranged for

burning fuel so as to generate heated products of combustion, a water heater operatively connected to a hot water storage tank arranged outside of said chimney, fuel burning means thermally associated with said water heater, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, a flue connection between said water heater fuel burning means and said chimney and discharging into said combustion products path at the upper end of said heat exchanger member, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space, an electric motor for operating said air blower, an electric circuit for said motor including a thermostatic switch having a thermal element responsive to the temperature of the combustion products at the upper end of said heat exchanger member and means, including a manually operated switch in said circuit, for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion when it is desired to operate said water heater fuel burning means for the purpose of heating water without operating said air blower.

20. A heating system for heating water and supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means associated with the lower portion of said chimney and constructed and arranged for burning fuel so as to generate heated products of combustion, a water heater operatively connected to a hot water storage tank arranged outside of said chimney, fuel burning means thermally associated with said water heater, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing a path for the upward flow of the products of combustion from said combustion chamber to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products, a flue connection between said water heater fuel burning means and said chimney and discharging into said combustion products path at one end of said heat exchanger member, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space, an electric motor for operating said air blower, an electric circuit for said motor including a thermostatic switch having a thermal element responsive to the temperature

of the combustion products at the upper end of said heat exchanger member and means, including a manually operated switch in said circuit, for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion when it is desired to operate said water heater fuel burning means for the purpose of heating water without operating said air blower, said chimney being formed in part of hollow tile and said flue connection being formed at least in part by said hollow tile.

21. A heating system for supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means associated with the lower portion of said chimney and constructed and arranged for burning fuel so as to generate heated products of combustion, a heat exchanger device arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing at least part of a path through which the products of combustion flow to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products path, means including an air blower operable to supply from said space to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space, an electric motor for operating said air blower, an electric circuit for said motor including a thermostatic switch having a thermal element responsive to the temperature of the combustion products at the upper end of said heat exchanger member and means, including a manually operated switch in said circuit, for preventing the operation of said air moving device as aforesaid without interfering with the generation of heated products of combustion when it is desired to operate said fuel burning means for the purpose of heating said heat exchange device without operating said air blower.

22. A heating system for supplying heated air to a space in a building to be occupied by and for the comfort of human beings comprising a chimney which forms part of the building and which extends upright to and above the roof of the building and has an atmospheric discharge external of the space, means associated with the lower portion of said chimney and constructed and arranged for burning fuel so as to generate heated products of combustion, a heat exchanger device arranged to be heated by said fuel burning means during the operation thereof, a heat exchanger member extending longitudinally of and for a substantial portion of the length of said chimney, said heat exchanger member and chimney providing at least part of a path through which the products of combustion flow to said atmospheric discharge and a separate path for flow of air in intimate countercurrent heat exchange relationship with the combustion products path, means including an air blower operable to supply from said space

to the upper portion of said air path, air to be heated and under a pressure greater than the pressure of the products of combustion, the lower end of said air path having an outlet for discharging heated air into said space, an electric motor for operating said air blower, an electric circuit for said motor including a thermostatic switch having a thermal element responsive to the temperature of the combustion products at the upper end of said heat exchanger member, means, including a manually operated switch in said circuit, for preventing the opera-

tion of said air moving device as aforesaid when without interfering with the generation of heated products of combustion it is desired to operate said fuel burning means for the purpose of heating said heat exchange device without operating said air blower, and means for dissipating heat from said heat exchanger member and externally of said space when said fuel burning means are operated for the purpose of heating said heat exchange device without supplying heated air to said space.

MORITZ L. MUELLER.

CERTIFICATE OF CORRECTION.

Patent No. 2,348,835.

May 16, 1944.

MORITZ L. MUELLER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 7, for "simialr" read --similar--; line 45, after "combustion chamber 38" insert a comma; page 3, first column, line 75, after "house" insert a comma; page 5, first column, line 56, claim 3, for "path of" read --path to--; page 11, second column, line 1, claim 22, strike out "when" and insert the same after "combustion", line 3, same claim; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of July, A. D. 1944.

Leslie Frazer

Acting Commissioner of Patents.

(Seal)