Jan. 13, 1925. 1,522,914

J. SCHUMACHER

FURNACE

Filed May 23, 1921 3 Sheets-Sheet 1

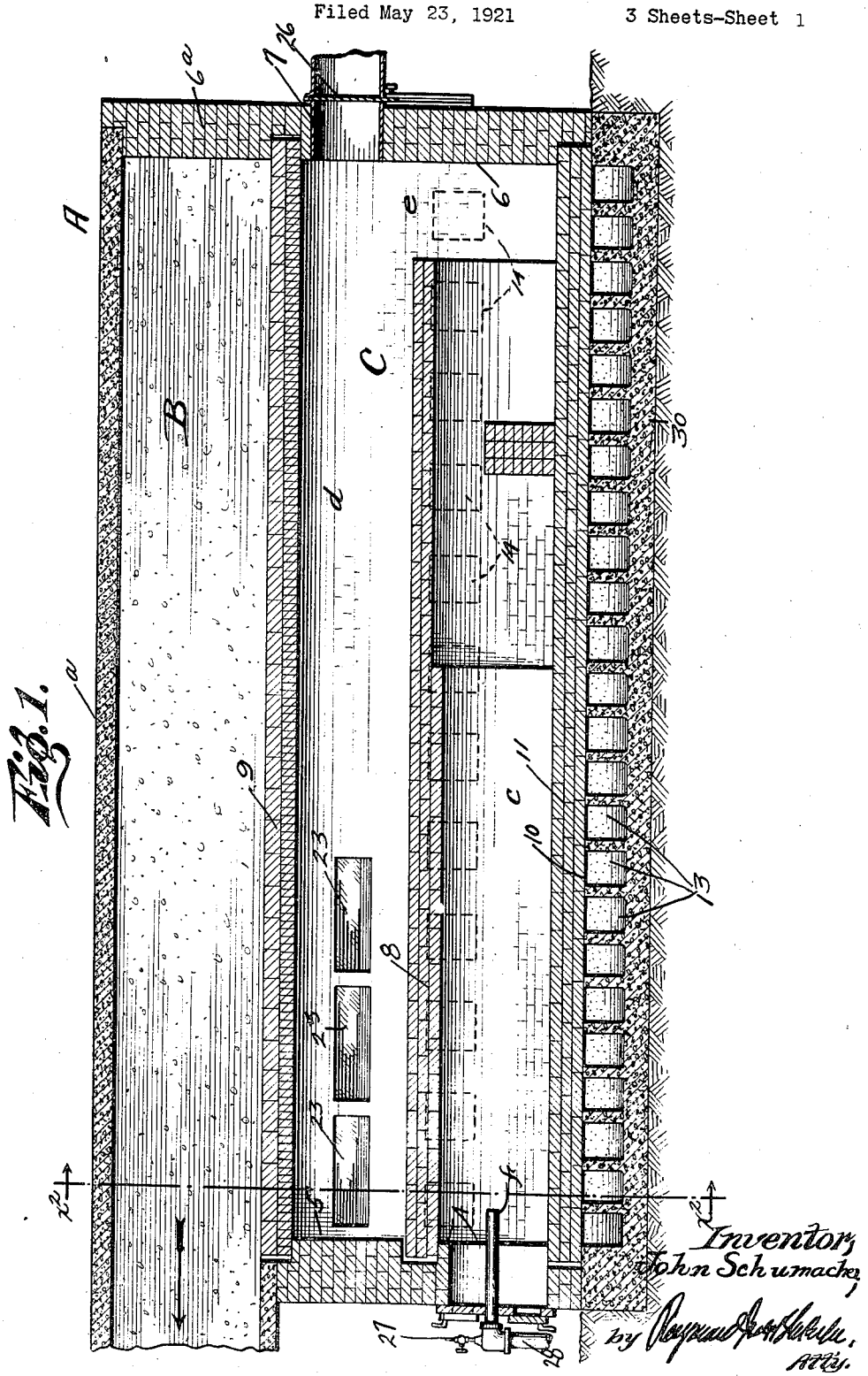


Fig. 1.

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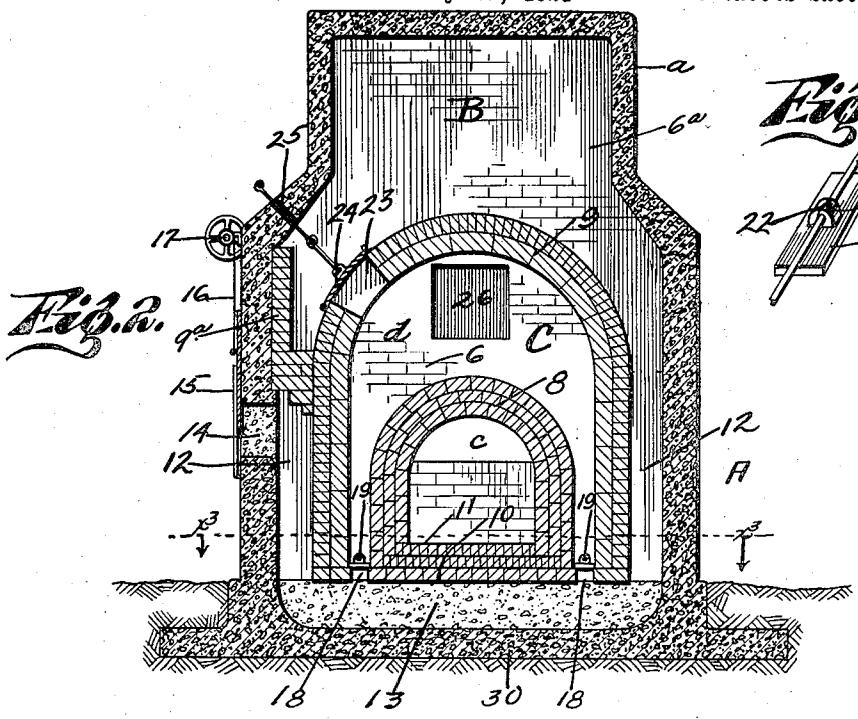


Fig. 2.

Fig. 4.

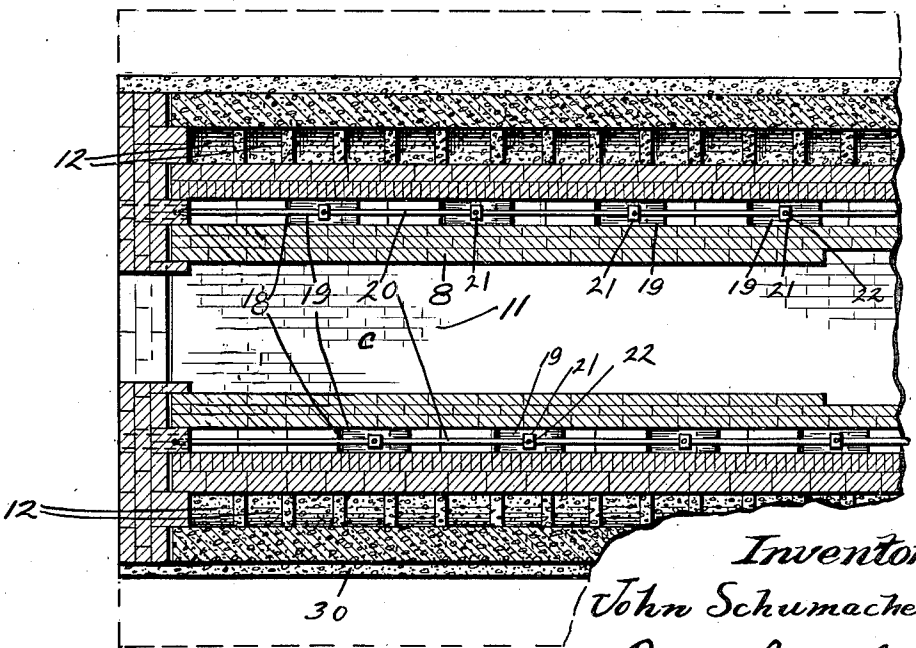


Fig. 3.

Inventor;
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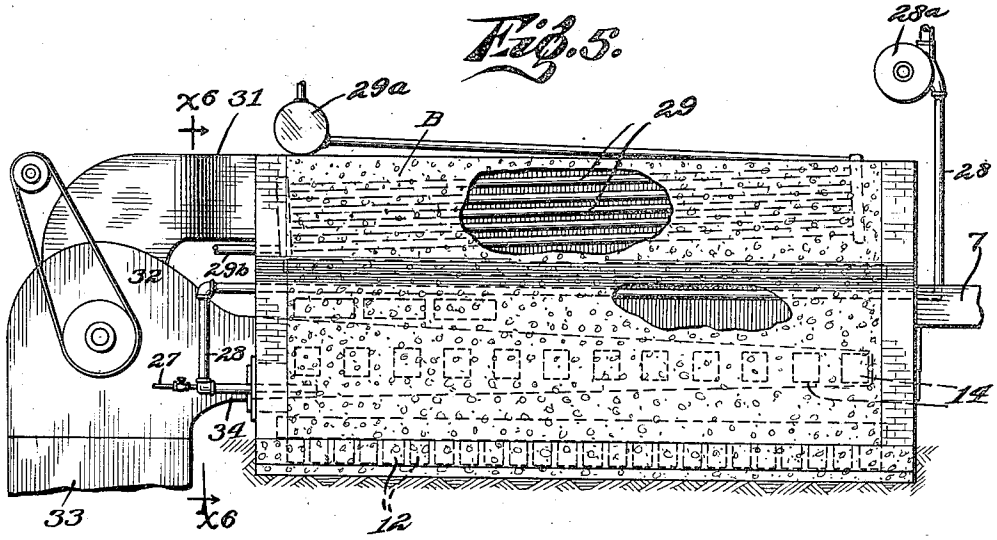
Jan. 13, 1925. 1,522,914

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FURNACE

Filed May 23, 1921 3 Sheets-Sheet 3

Fig. 5.



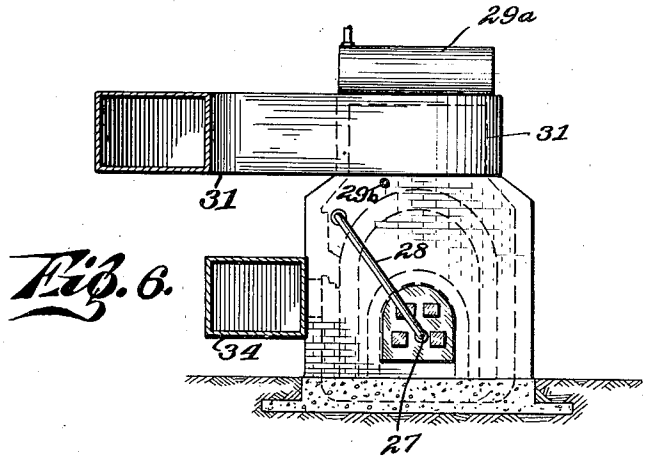


Fig. 6.

INVENTOR,
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Patented Jan. 13, 1925. 1,522,914

UNITED STATES PATENT OFFICE.

JOHN SCHUMACHER, OF LOS ANGELES, CALIFORNIA.

FURNACE.

Application filed May 23, 1921. Serial No. 471,778.

To all whom it may concern:

Be it known that I, JOHN SCHUMACHER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Furnaces, of which the following is a specification.

This invention relates to furnaces, and it has for its object to provide improvements in furnaces adaptable to general uses, and particularly adaptable for use in a furnace for delivering heated air for heating, drying or other purposes. The invention has for further objects the provision of an improved furnace in which the heat units will be thoroughly and effectively conserved, and wherein losses by radiation, convection and conduction, as well as heat losses through the chimney or stack, will be minimized or approximately eliminated.

In accordance with the invention, the combustion chamber is partially or entirely surrounded, as at bottom and sides, by an air passage or air passages leading to the hot-air chamber, and this passage or these passages receive air from the exterior of the furnace, which air when heated in this passage or these passages is directed to the hot-air chamber, after receiving the heat generated in the combustion chamber. This heated air is withdrawn from the hot-air chamber and directed as may be required or desired for purposes of heating or drying. The stack communicates with the combustion chamber, and after the operation of the furnace has been commenced air may be drawn down through the stack and into the combustion chamber, which latter chamber may likewise communicate with the hot-air chamber, so that the air thus received within the combustion chamber may, when heated, be directed to the hot-air chamber and commingled with the heated air therein.

Further means of communication are provided between the combustion chamber and the said passage or passages which in part or entirely surround the heating chamber, so that heated air may be withdrawn from such combustion chamber into such passage or passages and directed into the hot-air chamber.

The various passages and communications referred to are controlled by suitable dampers and the operation of the furnace may be carried on subject to regulation by said dampers and in order to produce the degree or kind of heat or qualifications of heated fluid which are best adapted or most desirable for the purposes in view.

Boiler tubes or other heat consuming elements may be installed in or in connection with the furnace or the hot-air chamber thereof, and the furnace may thus be adapted to many varying uses and for many varying purposes; and part of the heated fluid may be directed back to the hot-air chamber, or, the furnace, in pre-heated condition.

When the combustion chamber is in communication with the hot-air chamber, either directly or through the passages which in part or in whole surround the combustion chamber, certain of the products of combustion pass from the heating chamber to the hot-air chamber, instead of passing through the stack. But this is not objectionable in many furnace uses, particularly where a clean fuel, such as hydro-carbon oil, is employed to support combustion, and in uses of the furnace pertinent to maintenance of drying currents.

The invention has for further and particular objects the provision of an improved furnace of the general character stated which will be superior in point of relative simplicity and inexpensiveness of construction and organization, taken in conjunction with compactness in structure, durability, facility in control and operation, economy in fuel and general efficiency and serviceability of performance.

With the above and other objects in view, the invention consists in the novel and useful provision, formation, construction, combination, association and relative arrangement of parts, members and features, all as hereinafter described, shown in the drawings, and finally pointed out in claims.

In the drawings:

Figure 1 is a central vertical longitudinal sectional view of a furnace constructed in accordance with the invention, parts being shown in elevation;

Figure 2 is a transverse vertical sectional view taken upon the line x^2—x^2, Figure 1, and looking in the direction of the appended arrows;

Figure 3 is a fragmentary horizontal transverse sectional view taken upon the line x^3—x^3, Figure 2, and looking in the direction of the appended arrows;

Figure 4 is a detail perspective fragmentary view of a damper and damper operating means which may be utilized in controlling the operation of the furnace;

Figure 5 is a view similar to Figure 1, illustrating a modified form of construction; and,

Figure 6 is a detail vertical sectional view taken upon the line x^6—x^6, Figure 5, and looking in the direction of the appended arrows.

Corresponding parts in all the figures are designated by the same reference characters.

Referring with particularity to the drawings, the improved furnace is shown as comprising an outside furnace wall A which may surround and enclose a hot air chamber B, as well as a combustion chamber C, the latter preferably comprising two chamber portions *c* and *d*, respectively, which range lengthwise of the furnace and communicate at their rear end portions, through a vertical passage *e*. Combustion is supported within the chamber portion *c*, as by fuel admitted through and supplied to an oil burner *f* provided at the front of such chamber portion *c*, the chamber portions *c* and *d* having front walls 4 and 5 and a common rear wall 6, through which latter, in the plane of the chamber portion *d*, is provided an opening to which is applied piping 7 leading to the stack (not shown). The chamber portion *c* is surrounded at top and sides by an arched furnace wall 8, and the chamber portion *d* is similarly surrounded at sides and top by an arched wall 9. These chamber portions may have a common flooring 10, and suitable courses of fire brick 11 may be provided within the combustion chamber *c* at the bottom thereof. The side portions of the arched wall 9 are spaced away from the side portions of the arched wall 8, as clearly indicated in Figure 2.

A suitable space is likewise provided at the sides of the furnace between the main outer furnace wall A and the furnace chamber wall 9, and suitable vertical passages 12 are provided between such walls, at both sides of the furnace, such passages communicating transversely of the furnace through bottom passages 13 provided beneath the furnace flooring 10. At one side of the furnace each of these passages including two of the vertical passages 12 and a bottom transverse passage 13, is adapted to communicate with the outer air, through the main furnace wall A, through a separate port 14, and a damper 15 is applied over each of these ports 14, said damper being vertically adjustable as by chains or wires 16 adapted to be wound about a longitudinal rotating rod 17 supported at that side of the main furnace wall. It is obvious that this rod 17 may be common to all of the dampers so that they all may be simultaneously and equally adjusted either in an opening or closing direction.

Passages 18 are also provided at each side of the combustion chamber *c*, between the respective transverse air passages 13 and the spaces at the sides of the furnace between the arched wall 8 and the arched wall 9. These passages are controlled by longitudinal sliding dampers 19 which may be operated through the agency of longitudinal shafts 20 disposed at the respective sides of the furnace, each such shaft being pinned to the respective dampers 19, or perforated heads 21 thereon, as at 22, as clearly shown in Figure 4. When these dampers 19 are opened communication is established between the extension of the combustion chamber *d* and the hot air chamber B.

Suitable ports or openings 23 are also provided at one side of the arched wall 9, preferably near the crown thereof, and leading from the chamber portion *d* into the chamber B. These ports may be controlled by hinged swinging dampers 24, to which are applied link wires or rods 25 extending outwardly of the main furnace wall A in convenient position for manipulation. When these ports or any one of same establishes such communication, heated air passes directly from the chamber *d* into the heated chamber B.

The piping 7 leading to the stack is provided with a damper or gate valve 26 which may be manipulated to close or open communication between the stack and the chambers *c* and *d*, so that products of combustion may pass to the outer air, or, with the various controlling features suitably adjusted, air may be permitted to descend through the stack and enter the heating chamber to be heated therein, and passed to the combustion chamber.

The fuel burner *f* may be provided with an oil fuel inlet pipe 27 and an air inlet pipe 28, such fluids being mixed in the burner and entering the chamber *c* to support combustion.

The main furnace wall A is indicated as extending upwardly and arched into a dome *a* which surrounds the hot air chamber B at the top and sides. This hot-air chamber extends longitudinally of the furnace and directly over the top of the arched wall 9 of the hot air chamber C, and a bridge wall 9^a at one side thereof, and this chamber is provided at its rearward end with an end wall 6^a constituting an extension of the end wall 6. It will be understood that the furnace as an entirety has a suitable base or foundation 30.

The air received within the heated chamber B, whether it be pure air or mixed air and gases such as products of combustion, is withdrawn from the forward end of such heated chamber in the direction of the

large arrow at the upper left-hand corner of Figure 1. Flow of the heated air in such direction may be produced and maintained in any suitable manner, such as by blower or other fan device. Thus, heated air may be withdrawn from the hot-air chamber and passed to any drying or heat consuming apparatus, or passed into any chamber or interior or circulating system within and through which or by which it is to be utilized or conducted.

From a consideration of the above description, with reference to the drawings, it will be obvious that a high degree of heat may be produced and maintained within both chambers *c* and *d* of the combustion chamber C, and that such heat may be utilized in approximate completeness, and without material loss by radiation, conduction or convection. This is due to the particular and peculiar and particularly and peculiarly provided and arranged passages and means of communication whereby flow and circulation of air and gases may be controlled and maintained. It is found in actual practice that approximately 100 per cent of calories generated in this furnace are passed from the furnace for utilization.

In the modified form of construction shown in Figures 5 and 6, the general arrangement, construction and combination of parts and features are the same as in the figures previously discussed, and certain additional features are shown as follows:

Hot air chamber B is shown as communicating with a casing 31, extending to the casing 32 of a power or fan blower of any preferred or suitable type (not shown), it being understood that the casing is to conventionally represent a unit for withdrawing the heated air or other fluid from the combustion chamber B, such casing 32 being shown as having a main discharge pipe or casing 33, and likewise a branch or return discharge casing 34, whereby a portion of the heated fluid may be returned to the several ports 14 which in turn communicate with the chambers 12. It thus results that pre-heated or super-heated air or other fluid may be directed back to the combustion chamber, provided the dampers 19 are open so that communication may be established through the passages 18. This will operate to produce a greater efficiency and conservation of furnace action and heat units. Likewise such heated air or other fluid thus returned to the furnace may pass into the combustion chamber C, descending from hot air chamber B through the ports 23 when the dampers 24 are suitably adjusted.

Furthermore, I provide a battery 29 of boiler tubes suitably disposed within the combustion chamber B, and it will be understood that such boiler tubes or any other heat consumers may be located at this zone of the furnace or at any other desired or suitable zone for the purpose of taking up or consuming or utilizing the calories of the heat units generated in the furnace. A water feed or feed reservoir 29^a for and communicating with the boiler tubes 29 or the like, is indicated as disposed upon the top of the dome *a*, and it will be understood that the water or other substance heated in these tubes 29 may be conducted through a line pipe 29^b to any suitable point for use or distribution.

The air pipe 28 may be extended through the hot air chamber B, such air pipe receiving air from an air pump 28^a located at the rear of the furnace, and in this way pre-heated air may be forced into the combustion chamber *c*, mixed with fuel oil suitably pumped in or injected through the oil feed pipe 27.

In operating the furnace, it therefore results that great saving of fuel is produced over and beyond ordinary furnace practice, and the room or interior, in which the furnace is installed, may be kept at a cool temperature, which is impossible in the use of furnaces in which the usual losses of heat units occur.

In the particular operation of the furnace, constructed and organized as above described and shown in the drawings, air may be drawn into and through the communicating chambers 12 and 13 upon opening the dampers controlling the ports 14. This air will pass at the side of and underneath the combustion chamber, and will receive heat therefrom by conduction. The air thus heated will rise into the hot air chamber B. The heated air and products of combustion within the chamber *d* may be withdrawn therefrom through the ports 18 after manipulation of the dampers 19 to open such ports, such heated air or products of combustion entering the passages 13 and the passages 12 which communicate with the hot air chamber B. It will be understood that the passages 12 at the one side of the furnace having the ports 14, are prevented from direct communication with the hot air chamber B, by the bridge wall or partition 9^a, as shown in Figure 2.

Likewise, air may be drawn through the stack into the chamber C, after suitable adjustment of the damper 26, and heated within such chamber and commingled with the products of combustion therein, and the air and products of combustion may be withdrawn from the chamber *d* through the ports 23 after adjustment of the dampers 24, and thrown thus into the hot air chamber B. It thus results that air may be taken into the furnace either through the ports 14 or the stack, or both, and such air,

together with the products of combustion, may pass from the combustion chamber *d* through the ports 18 into the passages 12, and thence to the hot air chamber, or may pass from the combustion chamber into the hot air chamber through the ports 23. These various passages and ports provide for a thorough heating of air supplied to the furnace, such air passing about and over the combustion chamber walls or parts thereof, such air in motion being passed over the highly heated walls throughout approximately the entire length of the furnace, both inside and outside the arched wall 9 and over the arched wall 8, and the heated air, with the products of combustion (if the dampers 19 and 24 be opened), are passed finally over the arched wall 9 throughout the length of the furnace and it results that a maximum of the calories resultant upon combustion in the chamber *c* are withdrawn from the furnace, or applied to boiler tubes or the like 29 within the furnace, the outer wall A of the furnace being maintained approximately cold, and a maximum heating efficiency being provided.

It is obvious that many changes and variations with respect to details and features of construction and combination may be made in practicing the invention, in departure from the particular structures hereinabove described and shown in the drawings, and in adapting the invention to varying conditions of use and service, all without departing from the real spirit of the invention.

Having thus disclosed my invention, I claim and desire to secure by Letters Patent:

1. A furnace having a combustion chamber and a hot air chamber, and a main furnace wall within which such heating and hot air chambers are contained, there being a path provided for air circulation exteriorly of the combustion chamber and leading to the hot air chamber.

2. A furnace having a combustion chamber and a hot air chamber and a main furnace wall within which such heating and hot air chambers are contained, there being a path provided for air circulation exteriorly of the combustion chamber and leading to the hot air chamber; means of communication being provided between the combustion chamber and such path for air circulation.

3. A furnace having a combustion chamber and a hot air chamber and a main furnace wall within which such heating and hot air chambers are contained, there being a path provided for air circulation exteriorly of the combustion chamber and leading to the hot air chamber; means of direct communication being provided between the combustion chamber and the hot air chamber.

4. A furnace having a combustion chamber and a hot air chamber and a main furnace wall within which such heating and hot air chambers are contained, there being a path provided for air circulation exteriorly of the combustion chamber and leading to the hot air chamber; means of communication being provided between the combustion chamber and such path for air circulation; an outside air passage member being provided communicating with the combustion chamber.

5. A furnace having a combustion chamber and a hot air chamber and a main furnace wall within which such heating and combustion chambers are contained, there being a path provided for air circulation exteriorly of the hot air chamber and leading to the hot air chamber; means of direct communication being provided between the combustion chamber and the hot-air chamber; an outside air passage member being provided communicating with the combustion chamber.

6. A furnace, comprising a combustion chamber member having inner and outer interconnecting chambers, and a hot air chamber; there being an air circulation path extending at the sides and bottom of said combustion chamber member.

7. A furnace, comprising a combustion chamber having an inner chamber within which combustion takes place and an outer chamber communicating therewith, and a hot air chamber; there being an air circulation path extending at the sides and bottom of said combustion chamber and communicating with said hot air chamber; said circulation path comprising a plurality of separate passages each provided with a damper.

8. A furnace, comprising a combustion chamber having an inner chamber within which combustion takes place and an outer chamber communicating therewith, and a hot air chamber; there being an air circulation path extending at the sides and bottom of said combustion chamber and communicating with said hot air chamber; means of communication being provided between said outer chamber of the combustion chamber and said air circulation path.

9. A furnace, comprising a combustion chamber having an inner chamber within which combustion takes place and an outer chamber communicating therewith, and a hot air chamber; there being an air circulation path extending at the sides and bottom of said combustion chamber and communicating with said hot air chamber; means of communication being provided between said outer chamber and said hot air chamber.

10. A furnace, provided with a combustion chamber comprising an inner chamber and an outer chamber, said chambers having walls one of which arches over the other of which, there being a main furnace wall enclosing the aforementioned walls and likewise enclosing a hot air chamber, said inner and outer combustion chambers communicating with each other, an outside air passage member in communication with said outer chamber, means of communication being provided between said outer chamber and said hot air chamber, air passages adapted to communicate with the outer air and arranged within said main furnace wall and between the same and the wall of said outer chamber, and means of communication between said air passages and said outer combustion chamber, said air passages communicating each at one end with said hot air chamber.

11. A furnace, provided with a hot air chamber and a combustion chamber, and means for returning to the furnace heated fluid withdrawn from the hot air chamber.

12. A furnace, provided with a heated chamber and a heating chamber, and means for returning to the furnace heated fluid withdrawn from the heated chamber; there being a fluid circulation passage within the furnace and communicating with the heating chamber and through which said returned heated fluid may be passed to the heating chamber.

13. A furnace, provided with a hot air chamber and a heating chamber, and means for returning to the furnace heated fluid withdrawn from the hot air chamber; there being a fluid circulation passage within the furnace and communicating with the heating chamber and through which said returned heated fluid may be passed to the heating chamber; means being provided for regulating communication between said passage and said combustion chamber.

14. A furnace, provided with a hot air chamber and a combustion chamber, and means for returning to the furnace heated fluid withdrawn from the hot air chamber; means being provided controlling communication between the combustion chamber and the hot air chamber.

15. A furnace, comprising a combustion chamber and a hot air chamber; there being a plurality of boiler tubes disposed within the hot air chamber; means of communication being provided between the hot air chamber and the combustion chamber.

16. A furnace, comprising a combustion chamber and a hot air chamber; there being a plurality of boiler tubes disposed within the hot air chamber; means of communication being provided between the combustion chamber and the hot air chamber; means being provided for returning a heated fluid from the hot air chamber to the furnace.

17. A furnace having a heating chamber and a heated chamber, and a main furnace wall within which such heating chamber is contained, there being a path provided for air circulation exteriorly of the heating chamber and leading to the heated chamber; in combination with means for withdrawing heated fluid from the heated chamber.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN SCHUMACHER.

Witnesses:
RAYMOND JAS. BLAKESLEE,
EDNA TURNER.