(No Model.) 2 Sheets—Sheet 1.

# J. GIBBONS.

## HEATING FURNACE.

No. 458,324. Patented Aug. 25, 1891.

Fig. 1.

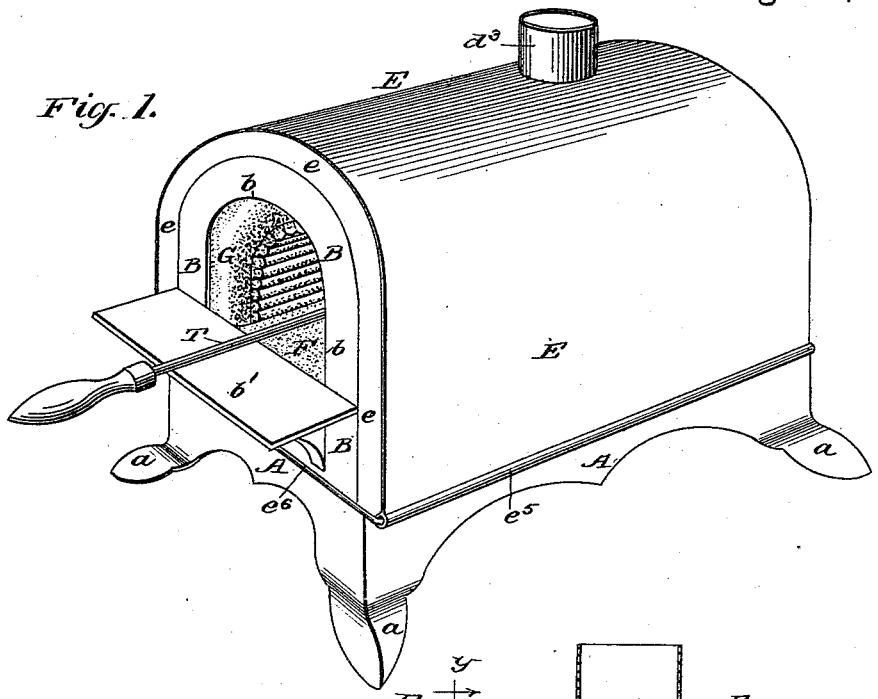
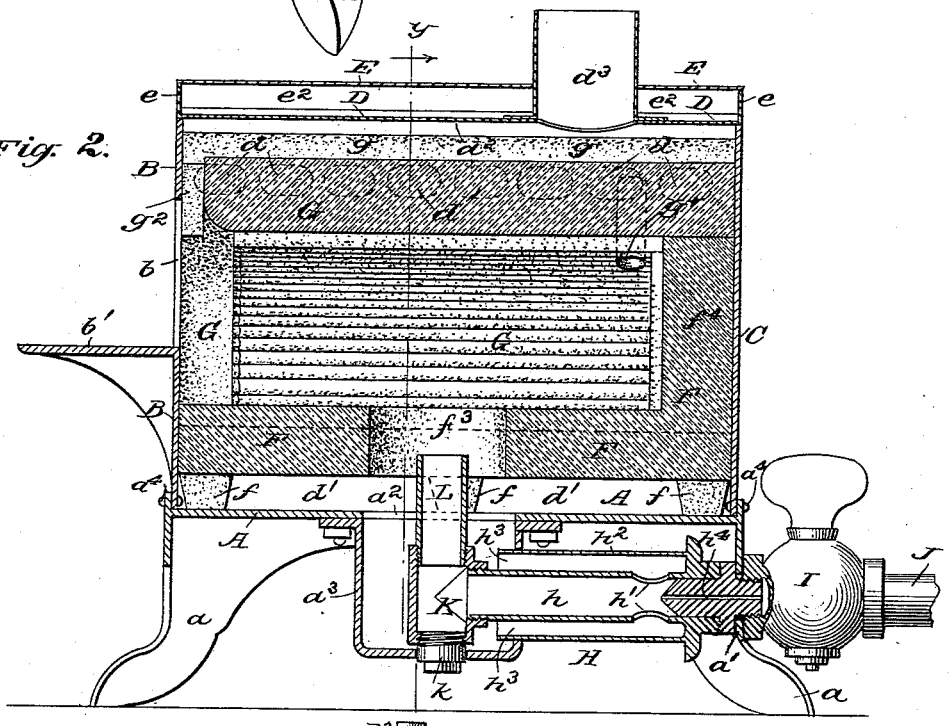



Fig. 2.

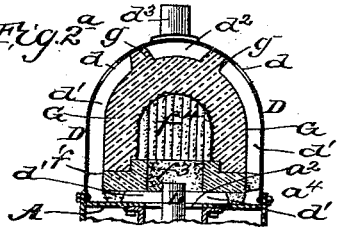



WITNESSES:

J. A. Caswell

C. Sedgwick

Fig. 2




INVENTOR:

J. Gibbons

BY

Munn & Co

ATTORNEYS

(No Model.) 2 Sheets—Sheet 2.

# J. GIBBONS.

## HEATING FURNACE.

No. 458,324. Patented Aug. 25, 1891.

Fig. 3.

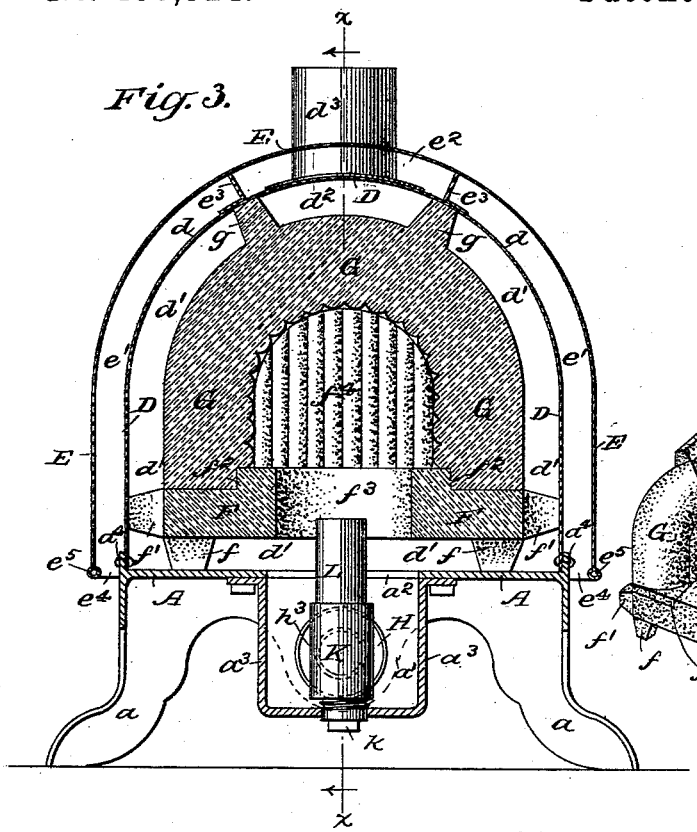


Fig. 4.

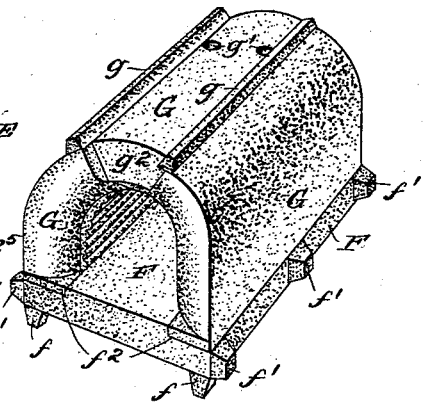


Fig. 6.

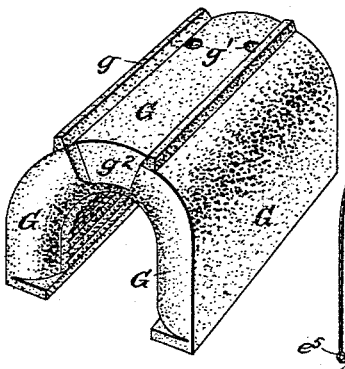


Fig. 7.

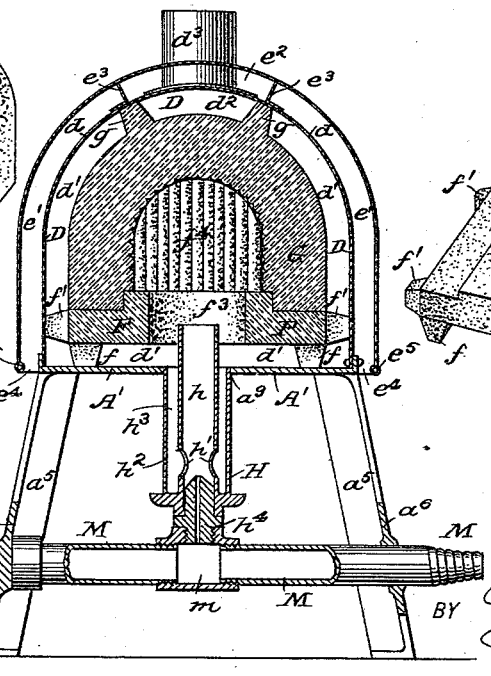
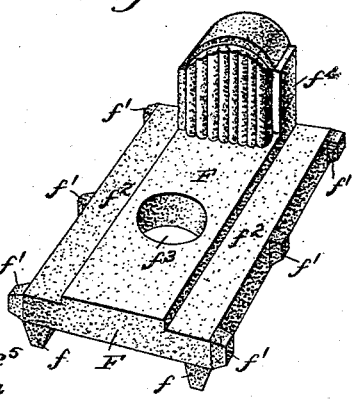


Fig. 5.



WITNESSES:

H. E. Briswell

C. Sedgwick

INVENTOR:

J. Gibbons

BY

Munn & Co.

ATTORNEYS

# UNITED STATES PATENT OFFICE.

JAMES GIBBONS, OF JERSEY CITY, NEW JERSEY.

## HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 458,324, dated August 25, 1891.

Application filed May 27, 1890. Serial No. 353,376. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES GIBBONS, of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Heating-Furnace, of which the following is a full, clear, and exact description.

My invention has for its object to provide a simple and efficient heating-furnace of that class commonly used by tinmen or sheet-metal workers for heating soldering-irons, but adapted for all analogous uses. The furnace embodies novel structural features, which, in connection with an improved form of Bunsen burner, give most satisfactory operative results with great economy of fluid fuel as compared with other furnaces of this general character.

The invention consists in certain novel features of construction and combinations of parts of the heating-furnace, all as hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view of my improved heating-furnace with an ordinary soldering-iron therein. Fig. 2 is a central longitudinal vertical sectional view of the furnace, taken on the line $x\ x$ in Fig. 3. Fig. $2^a$ is a transverse sectional detail view of a modified form of the furnace with the outermost casing removed. Fig. 3 is a vertical transverse sectional view taken on the line $y\ y$ in Fig. 2. Fig. 4 is a perspective view of the fire-brick or refractory lining of the furnace. Fig. 5 is a perspective view of the lower and rear parts of the refractory lining. Fig. 6 is a perspective view of the upper arched top and side portion of the lining; and Fig. 7 is a transverse vertical sectional view of the furnace, showing a modified arrangement of the fluid-fuel burner.

The heating-furnace has a base or bottom plate A, preferably made of cast-iron and provided with suitable supporting-legs $a$, one at each of its four corners.

In the preferred construction (shown in Figs. 1 to 6, inclusive, of the drawings) the fluid-fuel burner, hereinafter fully explained, lies mainly in horizontal position under the furnace-base and rests in a hole made in a pendent lug or lip $a'$, provided at the back end of the base to support one end of the burner and the gas-supply pipe, as shown best in Figs. 2 and 3 of the drawings. The base is also provided with an opening $a^2$, through which the mixing and flame tube of the burner passes. A cast-metal open-topped casing or cup $a^3$, fastened to the bottom of the base around its opening $a^2$, sustains the forward end of the burner and its flame-tube, as will presently be described. The furnace-base A is also preferably provided with an upwardly-projecting marginal flange $a^4$, to which are bolted or riveted the front and back end plates B C and the inner arched top plate D, which, with the base, form the interior chamber of the furnace, which is provided with a peculiarly-shaped refractory or fire-brick lining constituting the fire-pot, and to be hereinafter described. The end plates B C are preferably made of cast metal, and the plate D is preferably made of sheet metal. The back end plate C is closed or solid; but the front end plate B has a central opening $b$, through which to pass a soldering-iron T or other tool or device to be heated in the fire-pot or chamber of the furnace. The plate B also has a projecting ledge or shelf $b'$, preferably cast with it and forming a support for the iron or tool, as shown in Fig. 1 of the drawings.

Outside of the arched top plate D is sustained a larger plate or casing E, preferably made of sheet metal and having the same general arched form as the inner plate or casing D, and providing between the two plates a space about one-half inch wide and closed at the ends by strips or flanges $e\ e$, which may be bent or crimped inward at opposite ends of the outer plate E. Two longitudinally-ranging strips or partitions $e^3\ e^3$, placed between the plates D E, divide the space between them into three passages or chambers $e'\ e'\ e^2$, those $e'\ e'$ being at opposite sides of the furnace and the one $e^2$ being at its top. The passages $e'\ e'$ open to the atmosphere at $e^4$ $e^4$ at the lower edges of the plate E to admit air to be superheated and passed to the burner to maintain combustion thereat, as hereinafter more fully explained.

The outer casing or jacket E is preferably provided at it lower side margins with stiff-

ening-beads $e^5$ $e^5$, which also receive within them the rearwardly-bent opposite ends of a retaining wire or rod $e^6$, the central part of which ranges across the front of the furnace beneath its ledge $b'$, as shown in Figs. 1 and 3 of the drawings.

The interior refractory lining of the furnace by and within which the fire-pot or chamber is formed, is preferably made in two parts, a lower part F, which forms the bottom and back end wall of the fire-pot, and an upper arched part G, which forms the sides and top of the fire-pot. The main or body portions of these linings when placed together are sufficiently smaller than the chamber formed within or between the base-plate A and the arched plate D to provide between the linings and said parts A D a space, say, about one-half inch in width, and which is divided into three distinct passages $d'$ $d'$ $d^2$, by means of two ribs or partitions $g$ $g$, which, as shown, are formed upon the arched top of the refractory lining G and come immediately under the longitudinal partitions or strips $e^3$ $e^3$, which divide the space between the casing-plates D E into the three passages $e'$ $e'$ $e^2$, above mentioned.

The part F of the lining (shown in Fig. 5 of the drawings) is provided at each side with a few pendent lugs or feet $f$, and at opposite side edges it has two or more lateral lugs $f'$. These lugs $f$ $f'$ sustain the bottom lining above the base-plate A and also center it laterally within the inner casing-plate D, and as the upper part G of the lining is fitted into top side rabbets $f^2$ $f^2$ of the lower lining-piece F the latter will also center and steady the part G within the arched casing-plate D of the furnace. The ribs or flanges $g$ $g$ on the lining part G, while dividing the space between the refractory lining and the plate D into the three passages $d'$ $d'$ $d^2$, also hold the lining part G down onto the part F. (See Figs. 2, 3, and 7 of the drawings.) The passage $d^2$, which is the hot-product outlet, extends along under the outer passage $e^2$ and discharges into a short flue-pipe $d^3$, which passes through the space $e^2$. The pipe $d^3$ and the passage $d^2$ have no communication with the space $e^2$, which is simply a dead-air chamber, which, in so far as the efficient operation of the furnace is concerned, may be omitted altogether; but it is preferred, as it serves as a non-conductor of heat from the furnace-top and also allows the outer casing or jacket E to be curved completely around the top of the furnace to give it a more symmetrical appearance than it would have if cut away between the two partitions $e^3$ $e^3$, above mentioned. The passage $d'$, in which atmospheric air is superheated to maintain combustion at the burner, extends entirely around the linings F G below the ribs or flanges $g$ $g$ and between the inner casing-plate D and the base-plate. These ribs or flanges $g$ $g$ may be substituted by any other suitable partition plates or strips similarly located in the casing; but I prefer to form them on the refractory lining G of the fire-pot, as shown and above described.

The part F of the lining is provided with a vertical hole $f^3$, through which the flame of the burner enters the fire-pot, and at its back end said lining F has a vertical end wall $f^4$, which closes the rear end of the arched lining part G and protects the back plate C from the excessive heat of the burner. This part G is provided at its arched top and near its rear end with a couple of holes $g'$ $g'$ within or between the ribs or flanges $g$ $g$, and at its front end between said flanges the arched top is cut away or recessed at $g^2$. These holes or openings $g'$ $g^2$ provide for escape of hot products from the rear and front ends of the fire-pot into the chamber or outlet $d^2$, and thence out through the pipe or flue $d^3$ of the furnace. The front opening or passage $g^2$ next the front end plate B is more particularly useful as a hot-product outlet from the fire-pot when or after a soldering iron or tool is placed in the pot, as then the burner-flame expands and has a tendency to draw back out of the front opening of the fire-pot; but this is practically prevented by the outlet the passage $g^2$ gives to the flame directly into the hot-product outlet $d^2$ and thence to the flue. The passage $g^2$ also admits atmospheric air next the front plate B to keep it cool and allow said air to sweep rearward along the passage $d^2$ to the flue $d^3$ to keep the top of the inner casing B from being overheated and burned out quickly. These operative features of my invention are shown best in Fig. 2 of the drawings.

The inner casing-plate D of the furnace is provided near each of the division or partition strips $e^3$ $e^3$ with a series of holes or openings $d$, or it may be but a single slot-opening near each partition-strip, to allow passage of air from the space or chamber $e'$ between the casing-plates E D to the passage or chamber $d'$ between the plate D and the refractory fire-pot lining G F of the furnace, so as to be superheated by said lining or fire-pot prior to its passage through the opening $f^3$ in the bottom of the fire-pot to the point of ignition of the burner to maintain combustion in the furnace and also to the tube or stem of the burner. These air passages or inlets $d$ are shown in full lines in Figs. 3 and 7 and in dotted lines in Fig. 2 of the drawings.

I will next describe the preferred arrangement of fluid-fuel burner, which is shown in Figs. 2 and 3 of the drawings. This burner H is an improved type of Bunsen burner made with a central mixing tube or stem $h$, which has air-inlet apertures $h'$ near its back or inner end and is surrounded at its inner part by a cup-casing $h^2$, which forms a chamber $h^3$ between the stem and casing, through which air must pass to enter the stem through its apertures $h'$ and intimately mix within the stem with a proper quantity or volume of gas admitted through a nipple $h^4$. This nipple, which is preferably fitted at its forward end within the

stem or tube $h$ by a slip-joint, is at its rear reduced and its externally-screw-threaded end passed through an aperture in the pendent lug $a'$ of the furnace-base A, and the casing of the valve I of the gas-supply pipe J is screwed onto the nipple outside of the lug, which binds the nipple firmly to the base and valve, while allowing the body-portions $h$ $h^2$ of the burner to be slipped onto or off of the nipple, as occasion may require in fitting up or repairing the furnace. The cup-casing $h^2$ fits loosely in a hole made in the side of the lower casing or cup $a^3$, which is fixed to the base A, and communicates through the base-opening $a^2$ with the hot-air passage or chamber $d'$ of the furnace-body. Hence the passage $d'$ is in communication with the chamber $a^3$ of the burner to supply the burner with air which has already been superheated in the passage or chamber $d'$.

The forward end of the stem or mixing-tube $h$ of the burner is preferably screw-threaded to engage threads of a T-coupling K, to the upper end of which is held a short nipple or pipe L, which enters the fire-pot opening $f^3$, and from the end of which pipe L the burner flames directly upward into the fire-pot. I have closed the lower end of the T-coupling K with a screw-plug $k$, which projects downward through the bottom of the cup-casing $a^3$, and not only steadies the parts K L in vertical position, but when removed by unscrewing it from below the casing $a^3$ allows the burner H to be slipped or slid forward from its gas-supply $h^4$, as will be understood from Fig. 2 of the drawings. It will be noticed that the T-coupling K and the flame-pipe L, when the burner is in operation, have communication with the air-superheating chamber or passage $d'$ of the furnace only through the mixing-tube or stem $h$ of the burner.

Before explaining the modified arrangement of the burner shown in Fig. 7 I will briefly describe the complete operation of the heating-furnace shown in Figs. 1, 2, and 3 of the drawings, and as follows: After the gas or fluid fuel is admitted to the burner by opening the valve I and the gas is lighted at the top of the tube or pipe L and flames into the fire-pot through its bottom opening $f^3$ the passage of hot products through the openings $g'$ $g^2$ $d^2$ to the outlet-flue $d^3$ will induce an indraft of atmospheric air through the lower openings $e^4$ at the sides of the outer casing or jacket E into the side passages $e'$, between the casings D E, and thence through the openings $d$ of the casing-plate D into the passage $d'$, between said plate and the fire-pot, and thence the air, when highly heated by the fire-pot and plate D, will pass into the fire-pot through its opening $f^3$ to maintain combustion at the burner. It will be understood that the heat which the plate D takes up from the fire-pot will suffice to primarily heat the air as it passes through the spaces $e'$ $e'$ before it enters the space $d'$, wherein the air will be very highly superheated by direct contact with the fire-pot walls before entering the fire-pot opening next the point of ignition of the burner. It will also be noticed that a portion of the air highly superheated in the passage $d'$ will enter the burner-passage $h^3$ between its cup-casing $h^2$ and mixing tube or stem $h$, and will enter this tube through its openings $h'$, and travel along the tube as it intermingles with the gas or fluid fuel admitted at the burner-nipple $h^4$, and the very hot gas and air mixture will burn at the end of the pipe L directly into the furnace fire-pot and with an intensely-hot flame fed by the main body of superheated air entering the fire-pot opening directly from the passage or chamber $d'$. Hence the flame will be very efficient, as well as economical, in heating the soldering-iron or tool passed into the fire-pot.

I wish it to be distinctly understood that the outer casing or jacket E is not essential, as it may be omitted, as illustrated in Fig. $2^a$ of the drawings, and the atmospheric air would then pass directly through the openings $d$ of the casing D into the passage or chamber $d'$ next the fire-pot, and thence to the interior of the burner and fire-pot; but I prefer to use the outer casing or jacket E, as it not only provides the outer initial air-heating passages $e'$ $e'$, but it prevents annoying or excessive radiation of heat from the furnace to the operator.

The only difference between the heating-furnace shown in Figs. 1, 2, and 3 and the furnace shown in Fig. 7 of the drawings is that the last-named apparatus has legs $a^5$, which are higher than the legs $a$ of the other furnace to allow the burner H to be fitted below the furnace in a vertical position and to be fed with fluid fuel or gas by a pipe ranging laterally and adapted for side connection of a gas-service pipe. This pipe M is sustained in a hole in a cross-bar $a^6$, connecting two side legs $a^5$, and at its other end is closed by a cap or plug, into which a screw $a^7$ is passed through an opposite cross-bar $a^8$. The pipe M has a T-fitting $m$, into which is screwed the gas-supply nipple $h^4$, upon which is fitted by a slip-joint the burner-body, which comprises the mixing and flame tube $h$, apertured at $h'$, and the outer cup-casing $h^2$, providing an air-superheating chamber or passage $h^3$ between the parts $h$ $h^2$. The burner-casing $h^2$ is also fitted loosely into a hole $a^9$ in the bottom of the base-plate A′ of the furnace. Hence the burner-body may be lifted from the gas-supply nipple $h^4$ and the entire gas-supply nipple-pipe fittings M $m$ may be very readily removed from the leg-frame of the furnace and be as easily adjusted thereto.

The operation of this burner is substantially the same as that of the other one above described, the main volume of air superheated in the furnace chamber or passage $d'$ entering the fire-pot through its opening $f^3$, while a portion of said air passes down into the burner-passage $h^3$ and thence to the interior of the tube $h$, to intermingle therein with the

gas or fluid fuel from the nipple $h^4$ to make a very highly inflammable mixture of air and gas, which burns with a very hot flame directly into the fire-pot from the end of the mixing-tube $h$.

The furnace having the horizontally-arranged burner and supplied by a service-pipe connected at the rear of the apparatus sets lower down and requires less bench-room than the furnace having the vertical burner fed by a service-pipe entering from the side of the base or leg-frame. Hence the first-described construction (shown in Figs. 1, 2, and 3 of the drawings) is preferred in practice.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a heating-furnace of the character described, the combination, with a casing having a lower opening, of a fire-pot in the casing having a lower opening, a fluid-fuel burner at said lower openings flaming into the fire-pot, said fire-pot made smaller than the casing to provide an air-superheating chamber between them, which communicates with the fire-pot at or near the burner or flame-opening, the fire-pot also having an open front and an upper hot-product outlet or passage, and the casing having atmospheric-air inlets to the air-superheating chamber, substantially as described.

2. In a heating-furnace of the character described, the combination, with a casing having a lower opening, of a fire-pot in the casing having a lower opening, a fluid-fuel burner flaming into the fire-pot at said openings, said fire-pot made smaller than the casing to provide an air-superheating chamber between them and also having an open front and upper front and rear hot-product outlets, and the casing having atmospheric-air inlets to the air-superheating chamber, substantially as described.

3. In a heating-furnace of the character described, the fire-pot made with a lower flame-inlet opening and an open front and with a rear hot-product outlet or passage opening to a hot-product flue, and also with an upper independent outlet or passage opening to said flue, substantially as described, whereby hot products may have a rear exit from the fire-pot, and surplus hot products seeking front exit will pass through the upper front outlet, as set forth.

4. In a heating-furnace of the character described, the fire-pot made without lower hot-product outlets and having a lower flame-inlet opening and an open front and provided with both rear and front upper hot-product outlets or passages, substantially as described, whereby flame or hot products can have exit only from the upper part of the fire-pot mainly through its rear outlets, and surplus hot products seeking front exit will pass through the upper front outlet, as set forth.

5. In a heating-furnace of the character described, the combination, with a casing, of a fire-pot therein and made smaller to provide an air-superheating chamber between them, said fire-pot made without lower hot-product outlets and having a lower flame-inlet opening and an open front and provided with an upper opening to a hot-product outlet at the casing, said casing having atmospheric-air inlets at the air-superheating chamber, and a fluid-fuel burner flaming into the fire-pot at its lower opening, substantially as described.

6. In a heating-furnace of the character described, the combination, with a casing, of a fire-pot therein and made smaller to provide an air-superheating chamber between them, said fire-pot made without lower hot-product outlets and having a lower flame-inlet opening and an open front and provided with independent front and rear upper openings to a hot-product outlet at the casing, said casing having atmospheric-air inlets at the air-superheating chamber, and a fluid-fuel burner flaming into the fire-pot at its lower opening, substantially as described.

7. In a heating-furnace of the character described, the combination, with a casing, of a fire-pot therein and made smaller to provide a space between them, and partitions between the fire-pot and casing, forming an upper hot-product outlet and providing an air-superheating chamber at each side of the fire-pot, said fire-pot having an open front, a flame-inlet and an opening to said hot-product outlet, and the casing having atmospheric-air inlets to the air-superheating chambers, substantially as described.

8. In a heating-furnace of the character described, the combination, with a casing, of a fire-pot therein and made smaller to provide a space between them, and partitions between the fire-pot and casing, forming an upper hot-product outlet and providing an air-superheating chamber at each side of the fire-pot, said fire-pot having an open front, a flame-inlet and front and rear openings communicating with the hot-product outlet at the casing, and the casing having atmospheric-air inlets to the air-superheating chambers, substantially as described.

9. In a heating-furnace of the character described, the combination, with inner and outer casings providing a space between them, of a fire-pot in the inner casing and made smaller to provide a space between them and formed with an open front, a flame-inlet and a hot-product outlet, partitions between the fire-pot and inner casing providing an upper hot-product outlet and side air-superheating chambers outside the fire-pot, and partitions between the two casings forming initial air-superheating chambers opening at their outer parts to the atmosphere, the inner casing having air-inlets at the outer parts of the inner air-superheating chambers, substantially as described.

10. In a heating-furnace of the character described, the combination, with a casing, of a fire-pot therein and made smaller to provide

an air-superheating chamber between them, said fire-pot having an open front and a flame-inlet, the casing provided with atmospheric-air inlets to the air-superheating chamber, and a Bunsen burner flaming into the fire-pot and having an outer cup-casing providing an air-superheating chamber around its mixing-tube and communicating only with the air-superheating chamber of the furnace-casing, substantially as described.

11. In a heating-furnace of the character described, the combination, with a casing, of a fire-pot therein and made smaller to provide a space between them, partitions between the fire-pot and casing forming an upper hot-product outlet and providing an air-superheating chamber at each side of the fire-pot, said fire-pot having an open front, a flame-inlet and front and rear openings to said hot-product outlet, the casing having atmospheric-air inlets to the air-superheating chambers, and a Bunsen burner flaming into the fire-pot and having an outer cup-casing providing an air-superheating chamber around its mixing-tube and communicating only with the air-superheating chamber of the furnace-casing, substantially as described.

12. In a heating-furnace of the character described, the combination, with inner and outer casings providing a space between them, of a fire-pot in the inner casing and made smaller to provide a space between them and formed with an open front, a flame-inlet and a hot-product outlet, partitions between the fire-pot and inner casing providing an upper hot-product outlet and side air-superheating chambers outside the fire-pot, partitions between the two casings forming initial air-superheating chambers opening at their outer parts to the atmosphere, the inner casing having air-inlets at the outer parts of the inner air-superheating chambers, and a Bunsen burner flaming into the fire-pot and having an outer cup-casing providing an air-superheating chamber around its mixing-tube and communicating only with the main air-superheating chamber of the furnace-casing, substantially as described.

13. In a heating-furnace of the character described, the combination, with a casing, of a fire-clay fire-pot therein and made smaller and provided with lengthwise ribs or flanges $g\ g$, and an upper outlet $g'$, opening to a hot-product outlet formed between the casing and the fire-pot and its flanges, substantially as described.

14. In a heating-furnace of the character described, the combination, with a casing, of a fire-clay fire-pot therein and made smaller and provided with lengthwise ribs or flanges $g\ g$, an upper rear outlet $g'$ and a front outlet $g^2$, both opening to a hot-product outlet formed between the casing and the fire-pot and its flanges, substantially as described.

15. In a heating-furnace of the character described, the combination, with a base-plate and a casing D thereon, of a fire-pot in the casing and made smaller and composed of two refractory parts F G, the part F having bottom and side lugs $f\ f'$, upper side rabbets $f^2$ $f^2$, a flame-aperture $f^3$, and a rear wall $f^4$, and the part G having top lengthwise ribs or flanges $g\ g$ and hot-product outlets $g'\ g^2$, said casing D having atmospheric-air inlets $d$ and providing between it and the fire-pot two side air-superheating chambers $d'$ and an upper hot-product outlet $d^2$, substantially as described.

16. In a heating-furnace of the character described, the combination, with a base-plate and a casing D thereon, of a fire-pot in the casing and made smaller and composed of two refractory parts F G, the part F having bottom and side lugs $f\ f'$, upper side rabbets $f^2$ $f^2$, a flame-aperture $f^3$, and a rear wall $f^4$, and the part G having top lengthwise ribs or flanges $g\ g$ and hot-product outlets $g'\ g^2$, said casing D having atmospheric-air inlets $d$ and providing between it and the fire-pot two side air-superheating chambers $d'$ and an upper hot-product outlet $d^2$, and an outer casing E and partitions $e^3\ e^3$ between the casings D E and providing open-bottomed initial air-superheating chambers $e'\ e'$, communicating by the inlets $d$ with the inner air-superheating chambers $d'$, substantially as described.

17. In a heating-furnace of the character described, the combination, with an outer casing and a smaller fire-pot therein, providing an air-superheating chamber between them, of a cup-casing $a^3$, opening to said air-superheating chamber, and a burner comprising an inner mixing-tube $h$, apertured at $h'$, and a cup-casing $h^2$, surrounding the tube and opening to the casing $a^3$, said mixing-tube being extended to flame into the fire-pot, substantially as described.

18. In a heating-furnace of the character described, the combination, with the base-plate, a casing thereon, and a fire-pot in the casing and having a bottom flame-inlet and made smaller to provide an air-superheating chamber $d'$ between it and the casing and above the base-plate, said base-plate provided with a bottom opening $a^2$ and a cup-casing $a^3$ thereat opening to the chamber $d'$, of a burner comprising an inner mixing-tube $h$, apertured at $h'$ and surrounded by a cup-casing $h^2$, fitted to the lower casing $a^3$, a coupling K, held to the outer end of the burner-tube $h$, a pipe L, connected to the coupling and facing the flame-opening of the fire-pot, and a plug $k$, passed through the bottom of the lower casing $a^3$ into the coupling K, substantially as described, for the purposes set forth.

JAMES GIBBONS.

Witnesses:
HENRY L. GOODWIN,
EDGAR TATE.