April 5, 1932. W. C. DRAKE ET AL 1,852,154

GAS FIRED FURNACE

Filed Sept. 20, 1928 3 Sheets-Sheet 1

Fig. 1.

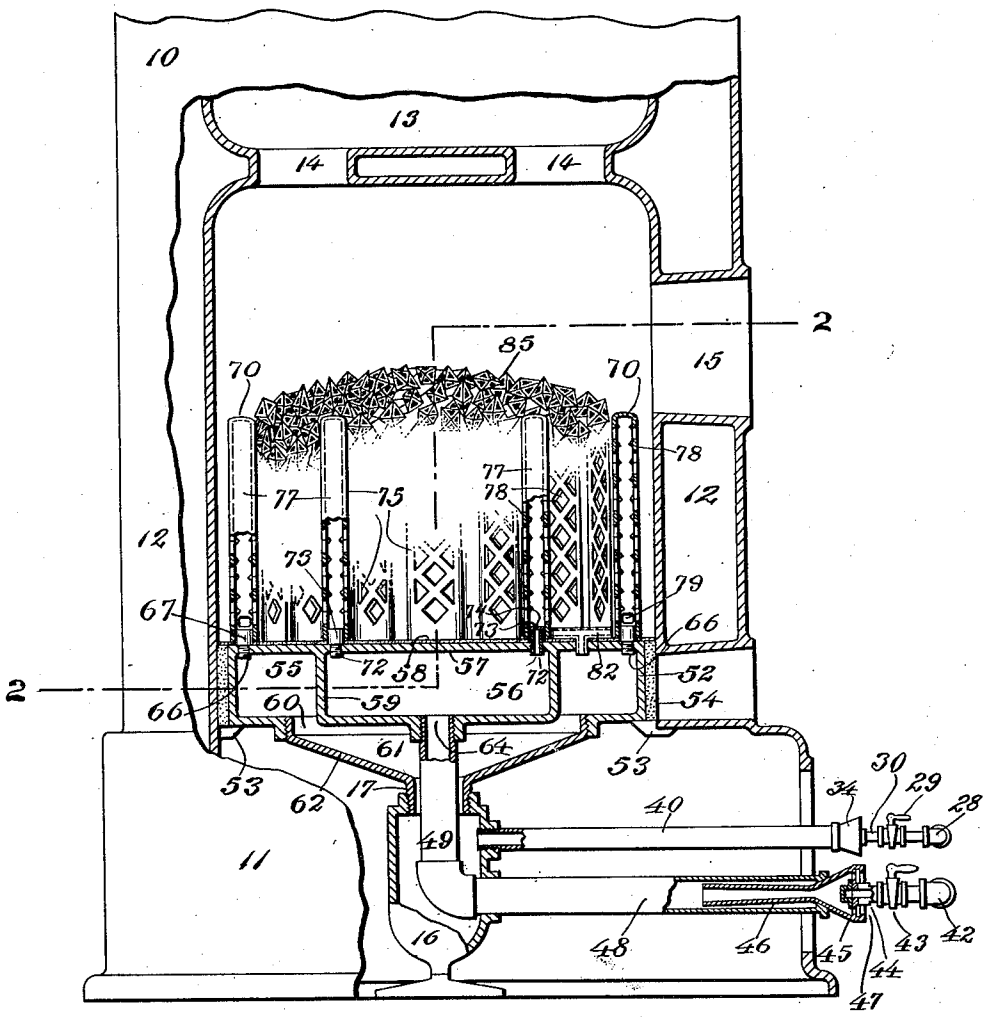

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Fig. 2.

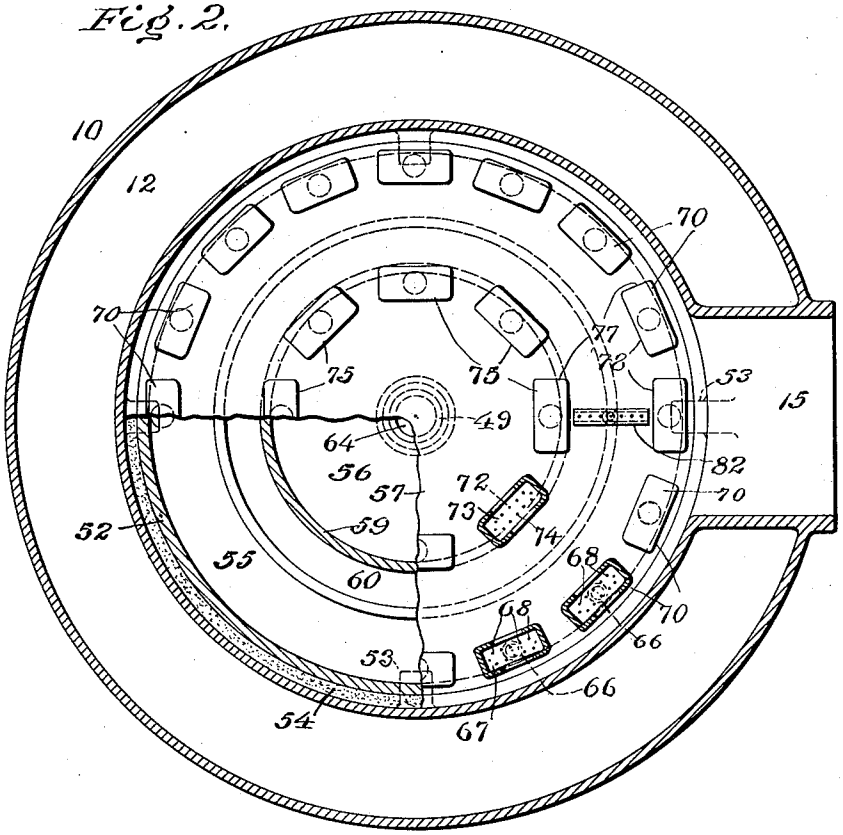

Fig. 3.

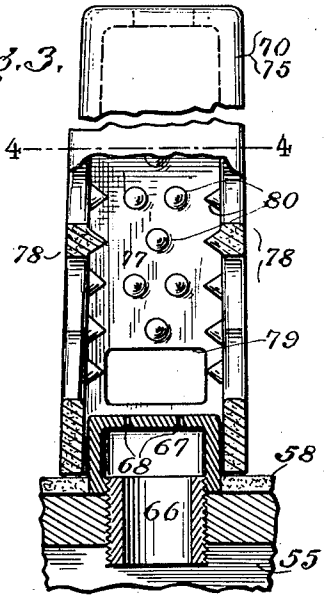

Fig. 4.

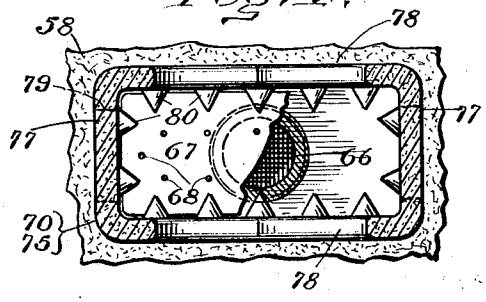

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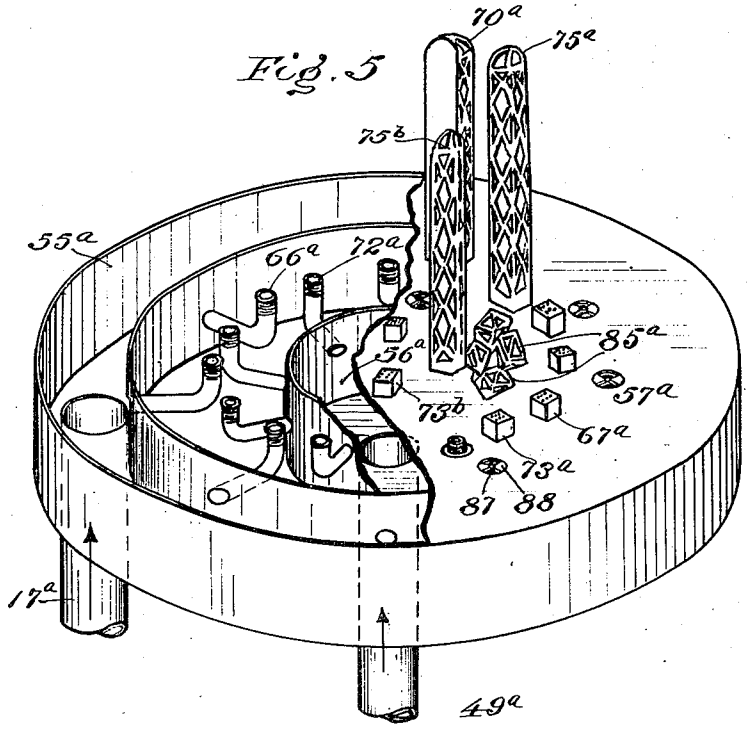
Fig. 5



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UNITED STATES PATENT OFFICE

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GAS FIRED FURNACE

Application filed September 20, 1928. Serial No. 307,169.

This invention is a novel gas fired furnace, such for example as may be used for house heating purposes, for heating or vaporizing water, or similar uses. For residence heating the invention may be used with steam, hot water, vapor or air systems.

In part the present invention may be considered as an improvement on the apparatus disclosed in the application of J. F. Meader, filed December 6, 1927, Serial Number 238,146 for gas combustion; but certain features hereof may be embodied in other types and forms of furnace and employed without reference to the apparatus of Meader.

The general object of the present invention is to afford a gas combustion method and apparatus or furnace possessing high efficiency, convenience of operation and control, simplicity of structure and rugged durability. A particular object is to adapt existing coal furnaces to gas firing, with ease of installation. Another object is economy, both of labor and fuel, with possibility of thermostatic control and safety of operation. A further object is to afford a system of gas heating which will be operative with ordinary municipal service gas pressures, without requiring high pressure of gas. A further object is to improve the heating efficiency of gas combustion by practically applying the generated heat thereof initially to a mass of radiant or incandescent bodies, the heat being then communicated both by convection and radiation to the boiler or other device to be heated.

Other and further objects and advantages of the invention will be explained in the hereinafter following description of an illustrative embodiment thereof or will be understood to those conversant with the subject. To the attainment of the said objects and advantages the present invention consists in the novel gas fired furnace, and the novel features of operation, combination, arrangement and structure herein illustrated or described.

In the accompanying drawings Fig. 1 is a general elevation partly in central section and partly diagrammatic of a gas fired furnace embodying the present invention.

Fig. 2, on a larger scale, is a general plan view taken partly in horizontal section on the line 2—2 of Fig. 1, but with the optional loose radiant elements omitted, and some of the radiant column elements in section.

Fig. 3, on a still larger scale, is an elevation and partial vertical section of one of the column radiants and parts to which it is fitted.

Fig. 4 is a horizontal section taken on the line 4—4 of Fig. 3, and with parts broken away.

Fig. 5 is a perspective view of a modification of the apparatus shown in Figs. 1 and 2.

A furnace 10 is shown in the drawings, its firebox resting upon a base section 11. With the furnace is shown embodied a boiler represented by the usual iron boiler portion or water leg 12 around the periphery of the firebox and a water leg 13 above the center, these exposed to the incandescent heat of the radiant fire bed to be described. The portion or leg 12 may be described as a heat absorbing metallic wall laterally enclosing the combustion chamber and constructed hollow to contain the fluid to be heated. Passing upwardly between the water legs are shown flues 14 for the outgoing gases, which may be caused to travel back and forth in usual manner. At the front of the furnace is shown the usual firing opening 15 giving access to the combustion chamber within the firebox. The furnace parts thus described may be of standard construction since it is an advantage of the present invention that it may be adapted to existing furnaces of various types.

Describing first the gas connections, these may be constructed as in the Meader application or otherwise. They are shown as including a gas pot 16, similar to that in the Meader application, resting on the bottom or floor within the base section from which extends an upwardly extending nipple 17 to the radiant fire apparatus to be described. The height of the nipple 17 and of the second pipe contained therein may be predetermined or adjusted to bring the radiant apparatus at the proper height in relation to the overhead portion of the boiler, the fire door, etc.

Gas may be supplied from a main 28 controlled by a cock 29 from which extends a delivery pipe 30 delivering through an orifice disk as in the Meader application into

the tapered portion 34 of a Venturi tube so as to create an induced action carrying the gas and indrawn air through and out by the flaring portion of the Venturi tube into a surrounding pipe 40 which leads directly to the gas pot 16, so that the gas-air mixture is conducted through the pot to the uptake 17.

With the present invention there are preferably two sets of gas connections delivering a base or main supply and a second or supplemental supply. The connections 28 to 40 described, and the gas pot 16, may conduct the base or main supply of gas to the furnace while the connections next to be described may conduct the supplemental supply, or the arrangement may be reversed, either set of connections constituting the base and the other the supplemental supply.

The second set of gas connections comprises a second main or supply pipe 42 which may be larger than the main 28 for the purpose of carrying a supplemental supply. The main 42 is controlled by a cock 43 having an orifice delivery pipe 44 delivering into the tapered portion 45 of a Venturi tube 46. At the entrance to the Venturi tube is shown an air damper 47 controlling the admission of air by induced draft into the stream of gas, and the base supply connection may have a similar air controlling damper. The Venturi tube 46 is shown delivering into a pipe 48 which extends through the wall of the gas pot 16 and thence upwardly in the form of an uptake 49 surrounded by the nipple 17.

The elements thus far described present an uptake or nipple 17 delivering a small or base supply of gas-air mixture, intended to be maintained in permanent operation, and a second uptake 49 conducting a second or supplemental gas-air supply intended to be placed intermittently in operation, the combined supplies thereby giving the necessary flexibility of operation desirable for automatic furnace control, for example by thermostat.

Above the gas supply connections and the two uptakes 17 and 49 is shown the gas distributing means and the radiant elements and parts carrying them. In our preferred form there is embodied a chambered box 52 in the nature of a manifold and it may be of circular form to conform to the furnace and may rest on lugs 53 preexisting in the furnace, with packing material 54 closing the space between the box and furnace wall. The box or manifold is a part of the gas distributing means and is shown formed with a peripheral chamber 55 and a central chamber 56. Both the chambers are closed above by a top plate 57 above which may be set an asbestos gasket 58 to protect the metal against the high radiant heat of the elements directly above. The two chambers 55 and 56 are separated by a partition wall 59.

Gas-air mixture is supplied to the outer or main or primary chamber 55 through aperture 60 in the bottom wall thereof, the same connected by a chamber 61 with the gas pot 16, this connecting chamber being bounded by a wall 62 which may flare upwardly from the nipple 17. By this arrangement the base or primary air supply is fed directly and continuously to the outer chamber or manifold 55 when the cock 29 is turned on. Similarly the central chamber or manifold 56 has a lower entrance 64 and this is shown connecting directly with the uptake 49, so that secondary or supplemental gas-air supply is fed directly to the interior or secondary manifold 56 when the cock 43 is turned on.

Each manifold 55 or 56, when in operation, is intended to deliver gas-air mixture to be burned as a Bunsen flame for the heating of the incandescent elements superposed above the respective manifolds. Thus in the top wall 57, and directly over the manifold or distributing chamber 55 is a circular series of openings engaged by nipples 66 which extend through the top plate 57 and through the gasket 58. Each nipple has secured at its upper side a cap or tip 67 provided with apertures 68 and having a form, for example square, to fit and give support to the connected radiants. These radiants are herein shown as tall and substantially upright elements or columns 70, there being a circular series of them near the periphery of the box 52 and extending upwardly in slightly spaced relation to the water leg 12 of the furnace.

As seen in Fig. 2 the several radiant columns 70 are spaced fairly close to each other and form a ring facing directly and in close proximity to the wall or furnace element to be heated. A satisfactory spacing between the columns and the furnace wall is about one inch more or less, being such as to deliver a high radiant heat to the wall and yet not so close as to impair the combustion or prevent circulation between the columns and the wall and the transfer of heat by convection. The described radiant columns 70 constitute the primary or base heating means of the furnace. The primary gas-air supply is fed continuously to the ring of radiant columns 70 which are thereby maintained in a constant state of incandescence so as to deliver heat with great effectiveness both by radiation and convection to the furnace walls to be heated, the waste gases passing up through the flues 14 and effecting further heating as in any furnace.

The secondary heating means may be supplied from the central chamber or manifold 56 through nipples 72 extending through the plate 57 and connected to caps 73 having apertures 74 delivering the mixture for the maintenance of a Bunsen flame within a series or circle of radiant columns 75 spaced slightly from each other and spaced substantially from the outer series of columns 70. In times

of high service both sets of columns will be supplied with mixture and maintained in high incandescence.

The columns illustrated are representative of incandescent or radiant elements having substantial vertical dimension and able to stand up above the distributing box substantially vertically or parallel to the furnace walls. While other incandescent structures will carry out the same principle our preferred embodiment is as shown, in which each column 70 or 75 consists of an integral or rigid elongated refractory element composed, for example of the same ceramic material as heretofore used for gas heated radiants. Each column is shown as four sided with two sides 77 substantially closed and two sides 78 of open work or latticed design. In cross section the columns are preferably oblong as seen in Figs. 2 and 4, with the broad sides open or latticed and the narrow sides closed, one of the open sides facing toward the furnace wall. Each closed side of each column may have an aperture 79 near its lower end so as to facilitate the interflow of mixture and the initial igniting of the burners within all of the columns. The general flow within each column will be upwardly and this flow is shown as interrupted by numerous small projections or teats 80 standing inwardly from the several walls, and not only producing agitation, mixing and improved combustion, but increasing the incandescent surface, thereby increasing the rapidity and efficiency of combustion due to the phenomenon of surface combustion.

It will be understood that in starting operation the main or primary supply will be turned on and ignition will be started through the furnace door 15 which thereafter will preferably be closed. The flames will spread until the burners within all of the outer series of columns are in operation. When increased demands require the supplemental or secondary burners to be placed in operation it is necessary to turn on the secondary supply and the ignition will be transmitted across from one series of columns to the other; or a special pilot tube 82 may be employed drawing combustion mixture from the chamber 55 and maintaining a transverse train of small gas flames extending from one series of columns to the other as indicated in Figs. 1 and 2.

Under certain conditions the apparatus thus far described will be sufficient for ordinary purposes. This invention however permits the described series of radiant columns to be supplemented by substantially filling the spaces between them with loose radiants 85 of any desired character, for example like those shown in the Meader application, these to be placed in carefully built up relation in the space within the inner series of radiant columns or in the space between the two series of radiant columns or in both such spaces and may be built up substantially to the top level of the columns, more or less, but preferably not higher than as shown in Fig. 1 wherein the columns and loose radiants terminate substantially near the lower level of the fire door 15.

In the embodiment thus far described it will be seen that there is comprised a system of radiants so assembled or held as to constitute in effect a peripheral wall which faces the fire box wall with means supplying gas and air for the incandescent heating of the radiants so that the incandescent wall, of substantial extent both peripherally and longitudinally, constantly delivers radiant heat with maximum effectiveness to the fire box wall. The radiant wall elements are preferably spaced clear away from the fire box wall, leaving room for circulation between.

The outer ring or peripheral series of radiants may be supplemented by the inner ring as described, although this is optional as the outer ring alone may in some cases be sufficient; and when only the outer series of radiants is employed, directly facing the furnace wall, preferably these radiants are in substantial contact with each other to constitute a substantially closed wall, and they may be continued much higher than shown in Fig. 1, namely substantially to the top of the combustion chamber and even around inwardly in parallelism with the top of the chamber. This arrangement of radiants constitutes substantially a hollow cylinder facing outwardly, and it may be inwardly backed to exclude combustion from the interior; and alternate columns may be supplied from a base manifold and supplemental manifold respectively, permitting regulation as already described.

Provision may be made for the admission of supplemental atmospheric air by suitable passages extending through the plate 57 into the combustion zone, preferably regulable by a damper. Another modification is to invert the manner of supporting the radiant columns; namely instead of arranging them standing up from a supporting plate 57, suspending them inverted below an elevated refractory plate, but substantially in the same positions as indicated in Fig. 1.

The modification shown in Fig. 5 comprises a base supply pipe 17^a delivering into a manifold chamber 55^a between concentric walls, while the supplemental supply 49^a is delivered into a central chamber 56^a, the two chambers being covered by a common plate 57^a suitably apertured to receive nipples 66^a and 72^a. These nipples are shown extending horizontally from the respective chambers into the space separating them, this permitting the respective nipples to be connected with perforated caps 67^a and 73^a respectively

supporting radiant columns 70^a and 75^a respectively. An additional set of nipples supports perforated caps 73^b on which are fitted radiant columns 75^b. The columns 70^a and 75^a form a single series or ring and alternate ones are supplied respectively from the base and supplemental supplies so that all of them are in operation only when both supplies are in effect, and at such times the inner series or ring of columns 75^b is also in operation.

In this Fig. 5 form a system of loose radiants 85^a may be built up between or surrounding the column radiants 70^a and 75^a. In any embodiment supplemental air may be introduced to the combustion point above the plate 57 or 57^a, preferably regulable by dampers so as to control the total amount of air taking part in the connection. Thus as indicated in Fig. 5 there may be a series of apertures 87 controlled by dampers 88 which may be set initially to the desired extent of opening or may be adjusted at will by any mechanical connecting means. Analogously additional air may be supplied to the combustion in the embodiment of Figs. 1 and 2 either by special air passages from below penetrating the chambers 55 and 56, and damper controlled in any manner from beneath, or by omitting the packing 54 between the blocks 52 and the furnace wall and permitting air to ascend through the space also under damper control, which control may be effected by maintaining the base chamber 11 closed except for a damper controlled air admission thereto.

In any form of the invention it will be understood that the effect of the present invention is to increase relatively the proportion of heat which is utilized in the form of radiant heat as compared with that utilized as heat of convection. The purpose and operation of the radiants, and their arrangement as herein described and claimed, is to convert the maximum possible amount of heat energy into radiant heat and to transmit it by radiation as effectively as possible to the fire box wall or furnace surface to be added, in whatever type of furnace the invention is employed. The usual operation of the invention is preferably to maintain the main or base supply and radiants in full operation, giving a heating effect somewhat less than the minimum expected to be required, and to supplement this intermittently or variably by means of the supplemental or secondary fuel supply and radiants. These may be thermostatically controlled either to put them into or out of operation for intermittent periods of variable length or to maintain them in continuous operation, while varying the supply and heating effect.

There have thus been described one or more gas-fired furnace constructions embodying the principles and attaining the objects of the present invention. Since many matters of operation, combination, arrangement and structure may be variously modified without departing from the principles involved it is not intended to limit the invention to such matters except so far as set forth in the appended claims.

What is claimed is:

1. A gas fired furnace having a heat absorbing metallic wall laterally enclosing a combustion chamber and constructed hollow to contain a fluid to be heated, a support for a system of radiants within the combustion chamber, a system of radiants carried by said support comprising an outer circular series of upstanding hollow radiants constituting a wall closely facing the chamber wall to radiate heat thereto, and an inner series of such upstanding radiants, and separate means supplying combustion gas and air for the incandescent heating of each series of radiants, with separate regulation thereof.

2. A gas fired heating furnace having a heat absorbing metallic wall laterally enclosing a combustion chamber and constructed hollow to contain a fluid to be heated, a support in the lower part of the chamber for a system of radiants, a series of hollow column radiants carried by said support and forming a peripheral series spaced from and facing said wall to radiate heat thereto, and an enclosed collection of loose radiants in the space within the series of column radiants, and means supplying combustion gas and air for the incandescent heating of the radiants, including passages leading to the hollow column radiants.

3. A gas fired heating furnace having a firebox wall laterally enclosing a combustion chamber, a support for a system of radiants within the lower point of the combustion chamber, a system of radiants carried by said support comprising an outer series of upstanding hollow column radiants constituting a wall closely facing the chamber wall to radiate heat thereto, and an inner series of such upstanding column radiants, said support formed with series of openings leading into the interiors of such hollow radiants, and means supplying combustion gas and air to said openings in the support for the incandescent heating of the respective series of radiants.

4. A gas fired heating furnace having a firebox wall laterally enclosing a combustion chamber, a support for a system of radiants within the combustion chamber, a system of radiants carried by said support comprising an outer series of upstanding hollow column radiants constituting a wall closely facing the firebox wall, and an inner series of such upstanding column radiants, and means supplying combustion gas and air to the hollow interiors of such columns for the incandescent heating of the respective series of radiants, the several column radiants

being constructed with open sides, and supported rigidly in position, and having a bed of loose radiants occupying the space between the column radiant series substantially to the full height thereof.

5. A gas fired furnace having a heat absorbing metallic wall laterally enclosing a combustion chamber and constructed hollow to contain a fluid to be heated, a hollow supporting manifold formed with a series of outer burner openings and a series of inner burner openings, directed upwardly, said supporting manifold carrying series of outer and inner hollow refractory members coupled respectively to the burner openings of said support, whereby gas flowing through each burner opening passes directly into and through each refractory member, and said supporting manifold having separate passages for supplying combustion gas and air to the inner and to the outer burner openings respectively.

6. A gas fired furnace having a heat absorbing metallic wall laterally enclosing a combustion chamber and constructed hollow to contain a fluid to be heated, a supporting manifold within the bottom of the chamber formed with outer and inner openings all directed upwardly, said manifold carrying outer and inner hollow refractory members coupled to said openings and means supplying combustion gas and air to the manifold so that gas flowing through said openings passes directly into said refractory members for combustion therein, whereby an incandescent bed is maintained sustaining a high temperature zone in the bottom of the furnace radiating directly to all parts of the hollow chamber wall.

7. In combination with the hollow walls of a heating furnace enclosing a combustion chamber, a gas manifold within the bottom of the chamber, means supporting the manifold in a manner substantially to close the chamber bottom, the manifold having an outer and an inner series of burner openings directed upwardly, and separate gas-air passages leading to the respective series, a bed of radiant members supported on the manifold and means for relatively regulating the supply of gas-air mixture to the outer and inner series of openings.

8. A gas fired furnace having a heat absorbing metallic wall laterally enclosing a combustion chamber, and constructed hollow to contain a fluid to be heated, a hollow supporting manifold formed with a first series of burner openings and adjacent thereto one or more additional burner openings directed upwardly, said supporting manifold carrying a first series of hollow refractory members and adjacent to them one or more additional hollow refractory members all coupled respectively to the burner openings of said support, whereby gas flowing through each burner opening passes directly into and through each refractory member, and said supporting manifold having separate passages for supplying combustion gas and air to the first series and to the adjacent series of burner openings respectively, and means for cutting off the supply to said additional burner openings to reduce the total heating effect.

9. A gas fired heating furnace having a heat absorbing metallic wall laterally enclosing a combustion chamber and constructed hollow to contain a fluid to be heated, a support in the lower part of the combustion chamber for supporting a system of radiants, a system of radiants carried above said support and out of contact with the chamber wall, comprising a peripheral series of elongated hollow radiant columns rigidly mounted and presenting a wall facing the metallic chamber wall, and spaced a substantial distance inwards thereof, to radiate heat thereto, combined with a built up bed of loose radiants enclosed and confined within the peripheral series of radiant columns, and means supplying combustion gas and air for the incandescent heating of said system of radiants.

In testimony whereof, this specification has been duly signed by:

WARREN C. DRAKE.
ERNEST B. PRIEBE.