July 11, 1944. A. E. WATTS 2,353,606

HOT AIR FURNACE

Filed April 23, 1941 3 Sheets-Sheet 1

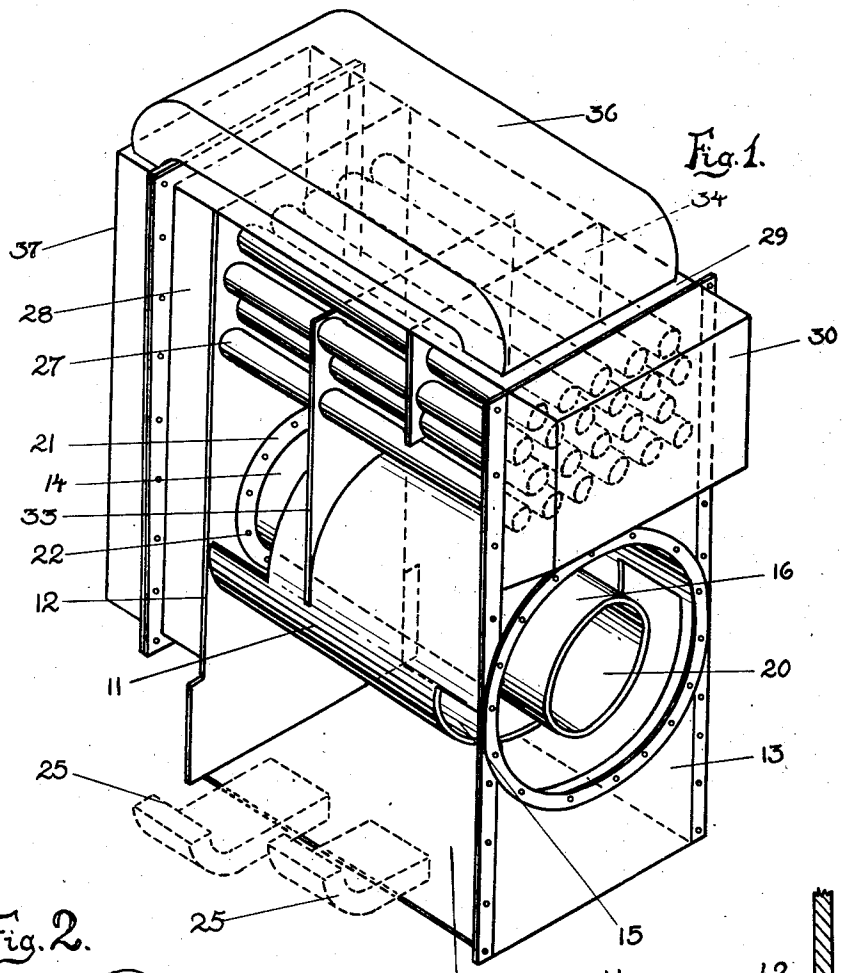


Fig. 1.

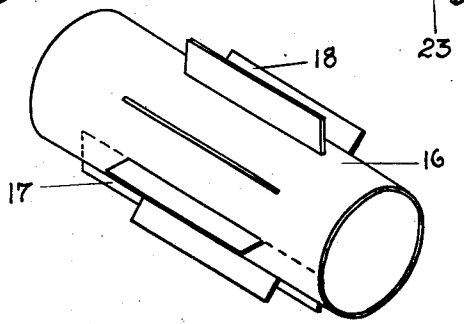


Fig. 2.

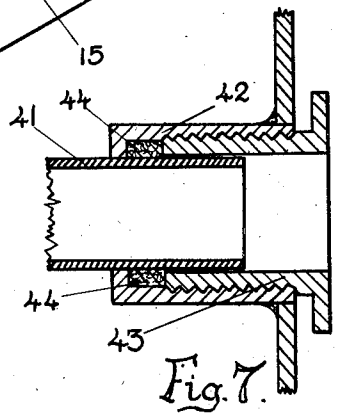


Fig. 7.

Inventor.
A. E. Watts.
By: E. R. Fetherstonhaugh.
Attorney.

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HOT AIR FURNACE

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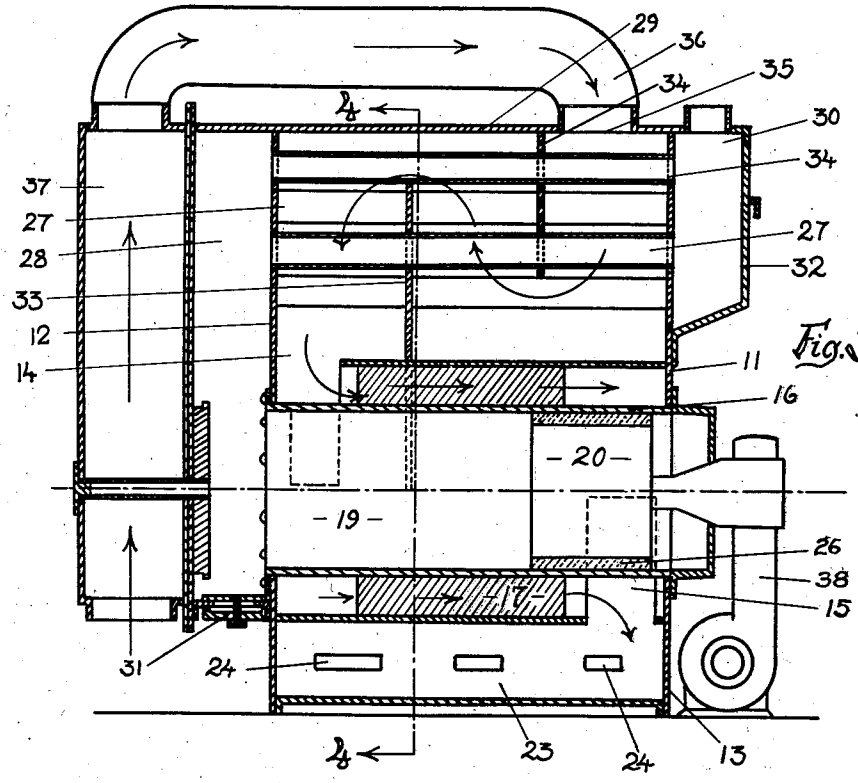


Fig. 3.

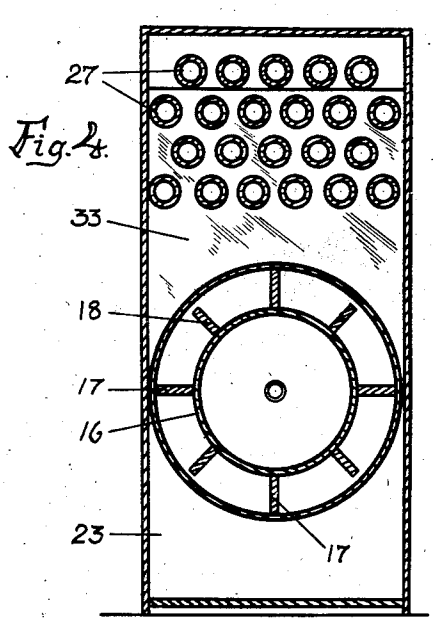


Fig. 4.

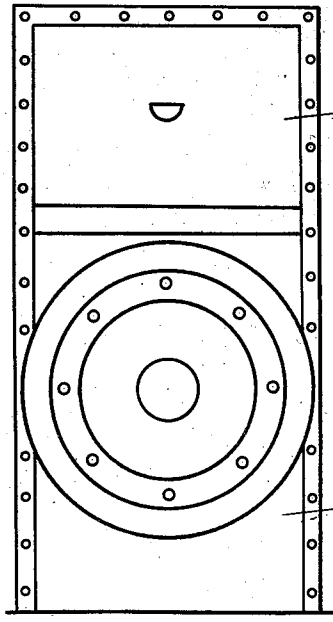


Fig. 5.

INVENTOR.
A. E. Watts.
By: E. H. Fothergill.
ATTORNEY.

July 11, 1944. A. E. WATTS 2,353,606

HOT AIR FURNACE

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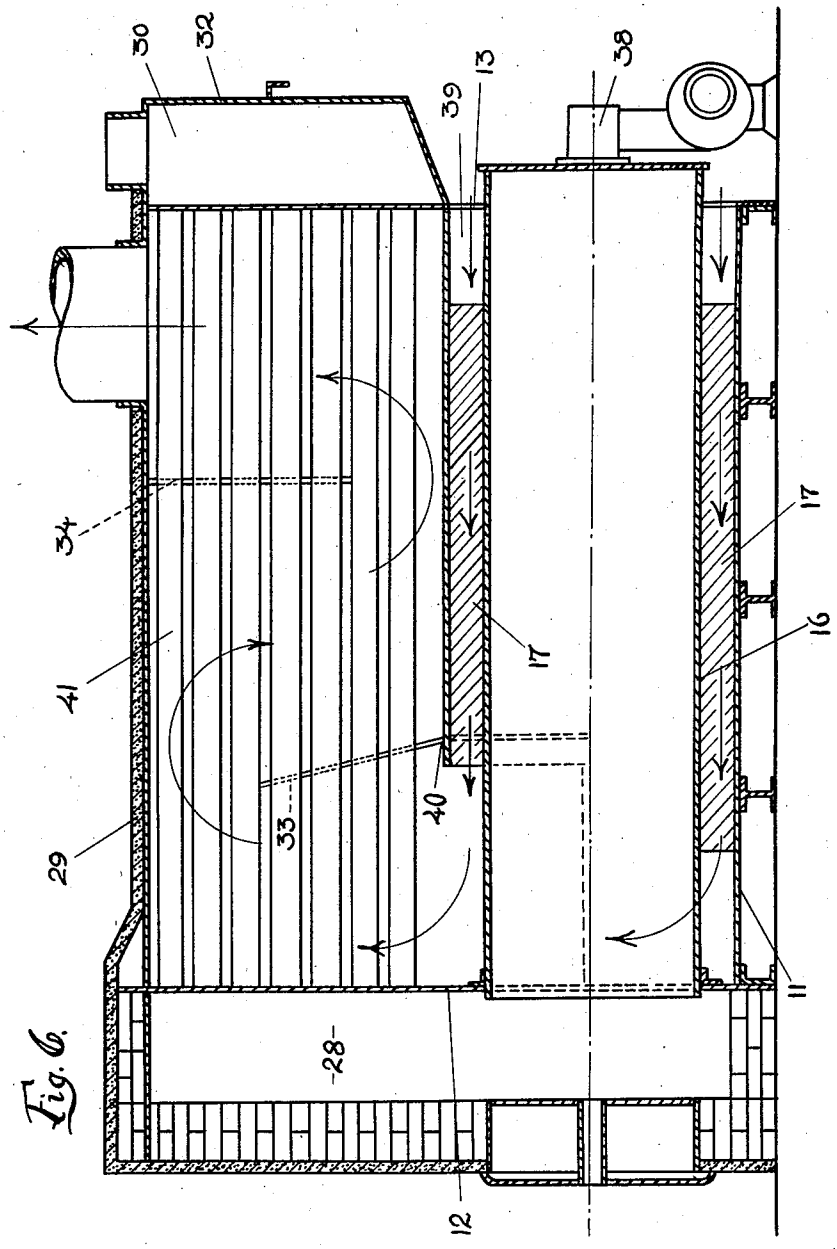


Fig. 6.

INVENTOR.
A. E. Watts.
By: E. N. Fethestonhaugh.
ATTORNEY.

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UNITED STATES PATENT OFFICE

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HOT-AIR FURNACE

Albert Edward Watts, Montreal, Quebec, Canada

Application April 23, 1941, Serial No. 389,937

4 Claims. (Cl. 126—104)

The invention relates to improvements in hot air furnaces as described in the present specification, and illustrated in the accompanying drawings, which form part of the same.

The invention consists essentially of the novel features of construction as pointed out broadly and specifically in the claims for novelty following a description containing an explanation in detail of some of the acceptable forms of the invention.

The objects of the invention are to devise a hot air furnace which will generate the maximum of heat at the minimum of expense; to direct the flow of air in the furnace in vast volumes in such a way that it will receive the maximum of the heat radiation emanating from the fire chamber and consequently avoid the wastage of heat and the accompanying wastage of fuel; to construct a furnace in which every part thereof is easily accessible for cleaning and repairing; to furnish a furnace in which the fire chamber is easily inserted or removed in or from the furnace without the necessity of removing the walls thereof; to facilitate the quick heating of residences, plants and other buildings and avoid wastage; and generally to provide a hot air furnace which can be quickly installed, easily operated, durable in construction and efficient for its purpose.

In the drawings:

Figure 1 is an isometric view of the furnace having the outer walls removed to illustrate the interior of the furnace.

Figure 2 is an enlarged perspective detail of the fire chamber.

Figure 3 is a side sectional view of the furnace.

Figure 4 is a vertical sectional view as taken on the lines 4—4 in Figure 3.

Figure 5 is a front elevation of the furnace.

Figure 6 is a side sectional view of a modified form of the furnace particularly adaptable for commercial use.

Figure 7 is an enlarged detail of an acceptable manner of securing the smoke tubes.

Like numerals of reference indicate corresponding parts in the various figures.

Referring to the drawings:

The hot air furnace consists of a furnace casing as indicated by the numeral 10 and as shown in the accompanying drawings, which is somewhat rectangular in shape, but of course varied shapes and sizes may be made in accordance with the best practice in furnace construction.

The stationary casing 11 is secured within the furnace casing 10 to the end walls 12 and 13 thereof and is provided with an open air inlet 14 and an open air outlet 15 at its ends and this stationary casing may be welded to the furnace casing and is so arranged that the air inlet is in its upper portion at one end, while the air outlet is at its lower portion at the other end.

The fire chamber 16 is in the form of a cylindrical casing having open ends and adapted to be introduced within the cylindrical casing 11, and supported therein by means of a plurality of guide ribs 17, which longitudinally project outwardly from the fire chamber and engage with the inner circumference of the stationary casing 11.

The fire chamber 16 is also provided with a plurality of radiation vanes 18 and has the open ends 19 and 20 which extend through the main apertures of the end walls 12 and 13 of the furnace casing. The end wall 12 is provided with a cylindrical bearing member 21, which is located around the main aperture and adapted to form an additional support for one of the ends of the fire chamber 16; this bearing member is simply fastened to the end wall by means of the bolts 22 or it may be firmly secured thereto by welding or other suitable means.

The stationary casing and the movable fire chamber may be made of any suitable material but are preferably made of sheet steel, and the fire chamber is lined with fire bricks 26. In domestic furnaces this lining of fire bricks may only extend to that portion which comes in direct contact with the flame, while in commercial furnaces it may be advisable to line the inner circumference of the fire chamber throughout.

The space created beneath the stationary casing 11 between the end walls and the bottom wall of the furnace casing forms a plenum chamber 23, and this chamber is provided with a plurality of air ducts 24 which are suitably connected to air conveyors 25 leading to the various parts of the house, factory, barracks, or other type of building in which the heating system is installed.

The smoke tubes 27 are located above stationary casing 11 and extend longitudinally within the furnace and are supported in the apertures that are formed in the end walls 12 and 13, and secured in any convenient manner. A vertical flue chamber 28 is located in the rear of the furnace and has a communicating passage with the removable casing which is the fire chamber, and is closed in at the top by the top wall 29 of the furnace and forms a communication passage with the smoke tubes. The other ends of the

smoke tubes communicate with the flue chamber **30** which is located in the front portion of the furnace and is connected to the chimney flue.

The flue chambers **28** and **30** are provided with furnace doors, or other type of closure, **31** and **32** for permitting the cleaning of the flue chambers when required.

The upper portion of the furnace casing in which the smoke tubes are located may well be termed an auxiliary air heating chamber, while the space located between the stationary casing and the fire chamber may well be termed the main heating chamber, and in the auxiliary air heating chamber are located baffle walls **33** and **34**.

These baffle walls **33** and **34** are provided with apertures through which the smoke tubes extend and the baffle wall **33** extends across the furnace casing and straddles the stationary casing and is secured to the stationary casing and the furnace walls by welding, or other suitable fastening means. The baffle wall **33** extends upwardly from the stationary casing for a specified distance leaving a pre-determined opening from its top edge to the top wall **29** of the furnace. The baffle wall **34** also extends across the furnace casing and is welded, or otherwise secured, to the top wall and/or to the other walls of the furnace casing, and extends downwardly from the top wall for a predetermined distance, leaving a predetermined opening between its lower edge and the stationary casing.

These baffle walls are of course suitably spaced apart and it is, of course, understood in certain installations other baffle walls may be included. As shown in the accompanying drawings, the baffle wall **34** is located in the forward portion of the furnace and adjacent to the air inlet **35**, which is located in the top wall **29** and forms the mouth of the air conveyor **36**, and this air conveyor extends horizontally to the rear of the furnace, and is either connected or forms a part of the rear and vertical air conveyor **37**. The baffle wall **33**, as illustrated, is preferably located in the rear portion of the furnace.

It will consequently be seen that the air is fed through the conveyors **36** and **37**, and this feeding may be natural or be forced in by a blower, as the case may be, and this air circulates into the auxiliary air heating chamber and is deflected by means of the baffle walls so that every portion of heating surface located in this chamber will be brought into contact with the flowing air, as naturally when the furnace is in use the smoke tubes will radiate additional heat as well as the natural heat located in this chamber, which is created by the heating means there beneath.

The rear baffle wall will direct the flowing air downwardly so that the air will flow in the main heating chamber created by the stationary casing and the fire chamber and from thence into the plenum chamber and out through the air ducts.

It is, of course, understood that the directional flow of the air may be reversed in certain cases; that is to say it may enter into the main chamber first and up into the auxiliary chamber where the smoke tubes are located, all depending on the kind of installation desired.

The means for effecting the heat may, of course, be varied, but, as illustrated an oil burner **38** is shown located in the front of the furnace and connected with the fire chamber. In Figure 6 of the illustrations a furnace structure is shown having its general principles similar to the type as illustrated in the other figures, but it is more particularly used for commercial purposes and the air inlet is located in the front of the furnace and is fed, or drawn, between the stationary casing and the movable casing, (the latter of course being the fire chamber) and upwardly into the auxiliary or heating chamber and around the baffle walls and out through the air duct **39**.

The stationary casing is of a slightly different construction than the stationary casing as hereinbefore described in that the upper portion thereof terminates short of the rear wall of the furnace, and the underside of the stationary casing extends from end wall to end wall of the furnace and does not terminate short of the front wall as illustrated in Figure 3.

The rear baffle wall **33** may, if it is desirable, be arranged at an angle as indicated by the numeral **40** for gradually decreasing or increasing the diameter of the lower rear portion of the auxiliary heating chamber for a better distribution and circulation of the air.

The smoke tubes **41** simply project through the apertures provided in the rear and front walls of the furnace, and these tubes may simply be fastened at one end so that when it is desired to renew either one or more of the tubes, it is only necessary to unfasten them at one end and pull them out. It is, of course, understood that these smoke tubes may be rigidly secured at each end; in other words it is quite important that there will be no mixture of the smoke with the air, and when the smoke tubes are not fixedly secured a special means will have to be utilized to prevent any possibility of the smoke or soot escaping into the air chambers.

An example for securing one end of the tubes is illustrated in Figure 7, in which internally threaded collars **42** project through the apertures of an end wall of the furnace and engage with the ends of the smoke tubes, and these collars may be welded to the end wall or secured in any convenient manner, and the externally threaded bushings **43** are adapted to engage with the collars **42**, and asbestos packings **44** are located within the collars and are pressed tightly in engagement with the tube ends by means of the bushings, which may be tightly screwed into the collars **42**, for that purpose.

It will therefore be seen that these smoke tubes are easily accessible for cleaning, and also allowance is provided for expansion and contraction of the tubes, and the access thereto is, of course, accomplished through the flue chamber **30**.

It has been mentioned that the upper air chamber of the furnace forms an auxiliary heating chamber but, of course this is to infer that the auxiliary heating is effected by any heat radiation that may emanate from the smoke tubes.

In both the domestic and commercial furnaces the system of heating the air is similar, and in providing means for directing and deflecting the air the proper circulation of the air is assured, and consequently the heating of the air is rapidly increased, as well as the volume, because a greater portion of the furnace is utilized for heating the air thereby minimizing wastage of fuel and increasing its heating capacity.

The various parts of the furnace are easily accessible, and the movable casing, that is to say the fire chamber, is easily removed from the furnace without the necessity of breaking down the furnace walls, and accordingly if the fire chamber is defected a new chamber may very quickly replace it and avoid considerable time and expense

that would naturally occur with ordinary furnace construction where fire boxes have to be renewed.

What I claim is:

1. In hot air furnaces, a furnace casing, a stationary casing secured to and intermediate the height of the end walls of said furnace casing and extending laterally into contacting relation with the sides of the furnace casing, said stationary casing having a cut-away portion in its top portion adjacent to one end and a cut-away portion in its lower portion adjacent to the other end to form air inlet and air outlet passages, said stationary casing separating the interior of the furnace casing into upper and lower air heating chambers, a removable fire chamber having guide ribs adapted to engage with the inner surface of said stationary casing, a plurality of longitudinal radiation vanes emanating outwardly from said fire chamber, a plurality of smoke tubes situated above said stationary casing and extending through the end walls of said furnace casing, a smoke flue forming a smoke passage between said fire chamber and said smoke tubes, an air inlet duct connected to said upper heating chamber, means for circulating and directing the flow of air around said smoke tubes in the upper heating chamber and between said stationary casing and removable fire chamber and into said lower heating chamber, and air ducts connected to said heating chamber.

2. In hot air furnaces, a furnace casing, a stationary casing secured to and intermediate the height of the end walls of said furnace casing and extending laterally into contacting relation with the sides of the furnace casing, said stationary casing having a cut-away portion in its top portion adjacent to one end and a cut-away portion in its lower portion adjacent to the other end to form air inlet and air outlet passages, said stationary casing separating the interior of the furnace casing into upper and lower air heating chambers, a removable fire chamber having guide ribs adapted to engage with the inner surface of said stationary casing, a plurality of longitudinal radiation vanes emanating outwardly from said fire chamber, a plurality of smoke tubes situated above said stationary casing and extending through the end walls of said furnace casing, a baffle wall vertically located in the upper heating chamber and having apertures through which said smoke tubes extend, said baffle wall straddling said stationary casing and secured thereto and to the side walls of said furnace casing and projecting upwardly and terminating short at a predetermined distance from the top of said furnace casing, a secondary baffle wall secured to the top of said furnace casing and extending downwardly in a vertical direction and terminating at a predetermined distance from the top of said stationary casing and having apertures through which said smoke tubes extend, a smoke flue forming a smoke passage between said fire chamber and said smoke tubes, an air inlet duct connected to said upper heating chamber, means for circulating and directing the flow of air around said smoke tubes in the upper heating chamber and between said stationary casing and removable fire chamber and into said lower heating chamber, and air ducts connected to said heating chamber.

3. In hot air furnaces, a furnace casing, a stationary casing secured to and intermediate the height of the end walls of said furnace casing and extending laterally into contacting relation with the sides of the furnace casing, said stationary casing having a cut-away portion in its top portion adjacent to one end and a cut-away portion in its lower portion adjacent to the other end to form air inlet and air outlet passages, said stationary casing separating the interior of the furnace casing into upper and lower air heating chambers, a removable fire chamber having guide ribs adapted to engage with the inner surface of said stationary casing, a plurality of longitudinal radiation vanes emanating outwardly from said fire chamber, a plurality of smoke tubes situated above said stationary casing and extending through the end walls of said furnace casing, a baffle wall vertically located in the upper heating chamber and having apertures through which said smoke tubes extend, said baffle wall straddling said stationary casing and secured thereto and to the side walls of said furnace casing and projecting upwardly and terminating short at a predetermined distance from the top of said furnace casing, a secondary baffle wall secured to the top of said furnace casing and extending downwardly in a vertical direction and terminating at a predetermined distance from the top of said stationary casing and having apertures through which said smoke tubes extend, a smoke flue forming a smoke passage between the fire chamber and the smoke tubes, a vertical air inlet duct secured to the rear of said furnace casing and horizontal air inlet duct connected to said vertical air inlet duct and to the upper heating chamber of the furnace.

4. In hot air furnaces, a furnace casing, a stationary casing secured to and intermediate the height of the end walls of said furnace casing and extending laterally into contacting relation with the sides of the furnace casing, said stationary casing having a cut-away portion in its top portion adjacent to one end and an opening in its forward portion adjacent to the other end to form air inlet and air outlet passages, said stationary casing separating the interior of the furnace casing into upper and lower air heating chambers, a removable fire chamber having guide ribs adapted to engage with the inner surface of said stationary casing, a plurality of longitudinal radiation vanes emanating outwardly from said fire chamber, a plurality of smoke tubes situated above said stationary casing and extending through the end walls of said furnace casing, a baffle wall vertically located in the upper heating chamber and having apertures through which said smoke tubes extend, said baffle wall straddling said stationary casing and secured thereto and to the side walls of said furnace casing and projecting upwardly and terminating short at a predetermined distance from the top of said furnace casing, a secondary baffle wall secured to the top of said furnace casing and extending downwardly in a vertical direction and terminating at a predetermined distance from the top of said stationary casing and having apertures through which said smoke tubes extend, a smoke flue forming a smoke passage between the fire chamber and the smoke tubes, and air inlet and outlet openings in said stationary casing communicating respectively with said heating chamber.

ALBERT E. WATTS.