April 2, 1935. D. E. ROSS 1,996,349

WARM AIR FURNACE

Filed July 21, 1933 3 Sheets-Sheet 1

Fig. 1.

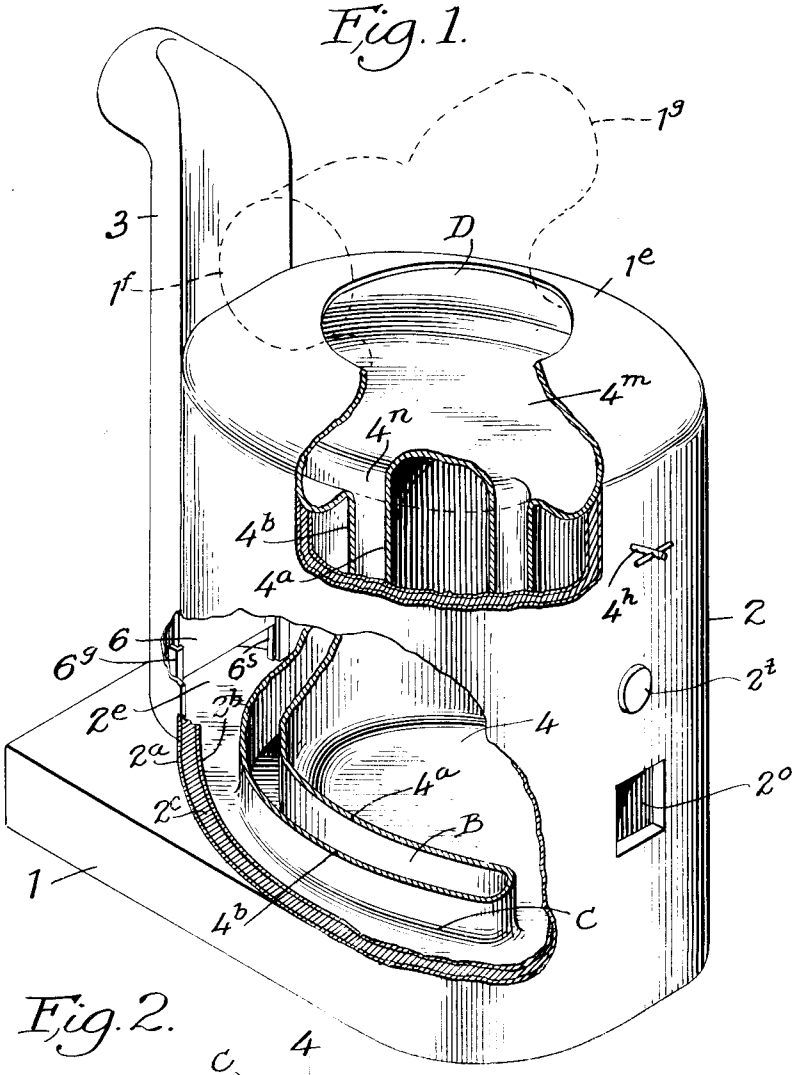
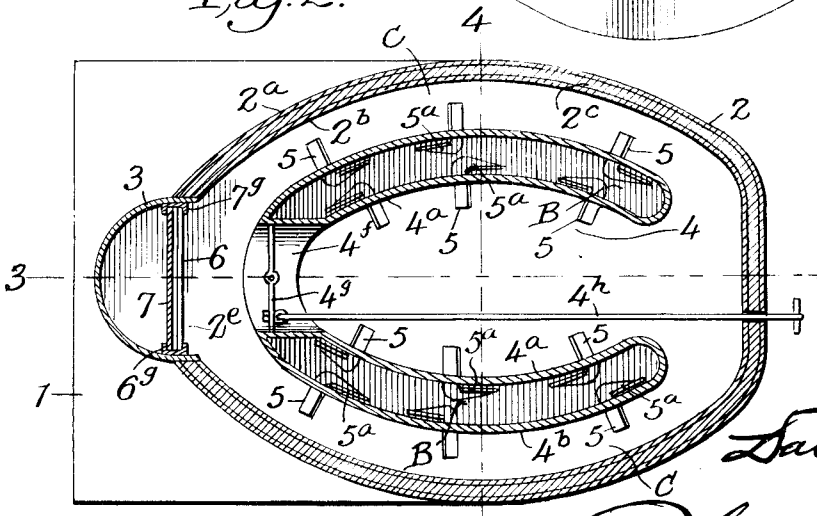


Fig. 2.



Inventor

David E. Ross

By Alexander & Ball

Attorney

April 2, 1935. D. E. ROSS 1,996,349

WARM AIR FURNACE

Filed July 21, 1933 3 Sheets-Sheet 2

Fig. 3.

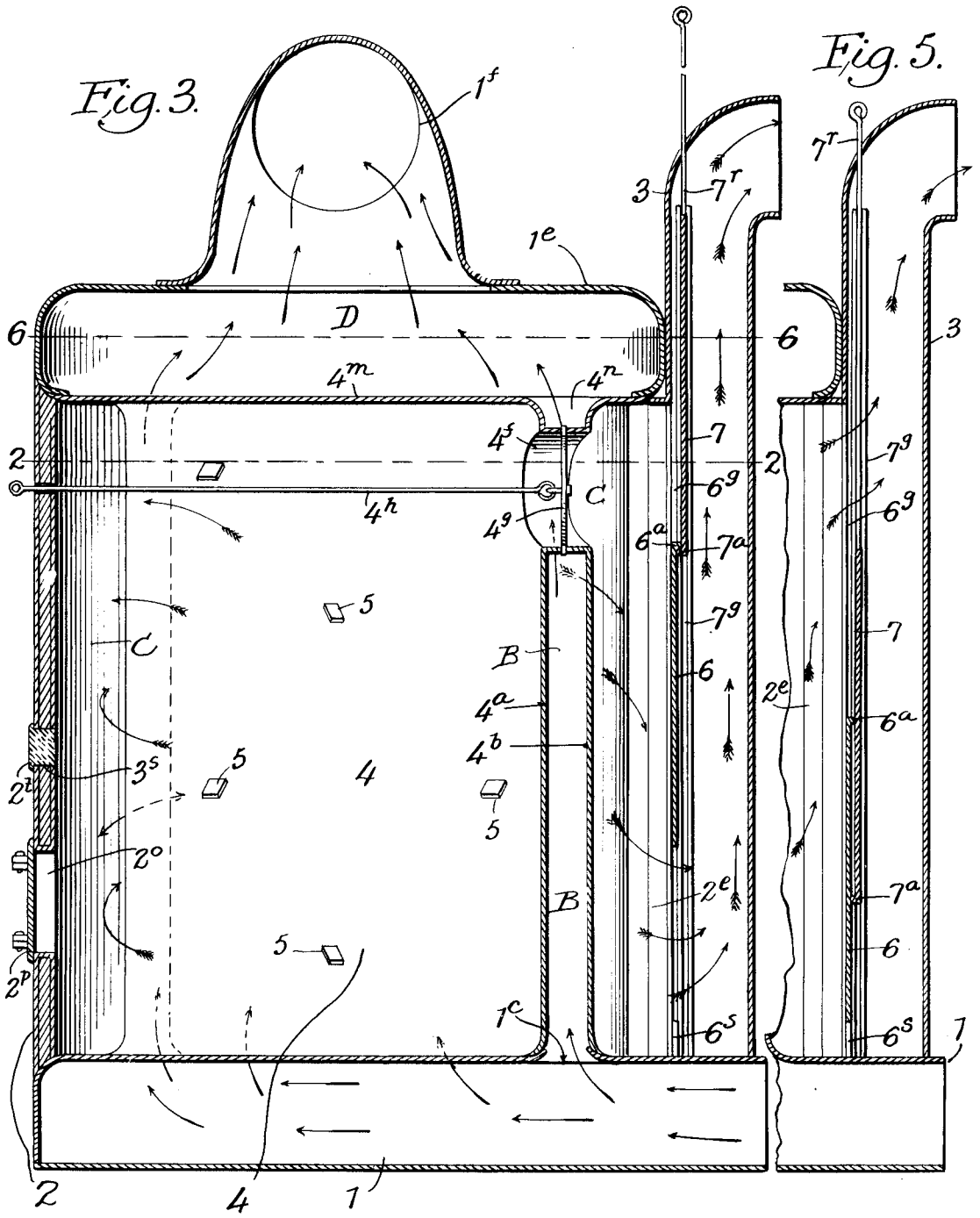


Fig. 5.

Inventor

David E. Ross

By Alexander & Farrell

Attorney

April 2, 1935. D. E. ROSS 1,996,349

WARM AIR FURNACE

Filed July 21, 1933 3 Sheets-Sheet 3

Fig. 4.

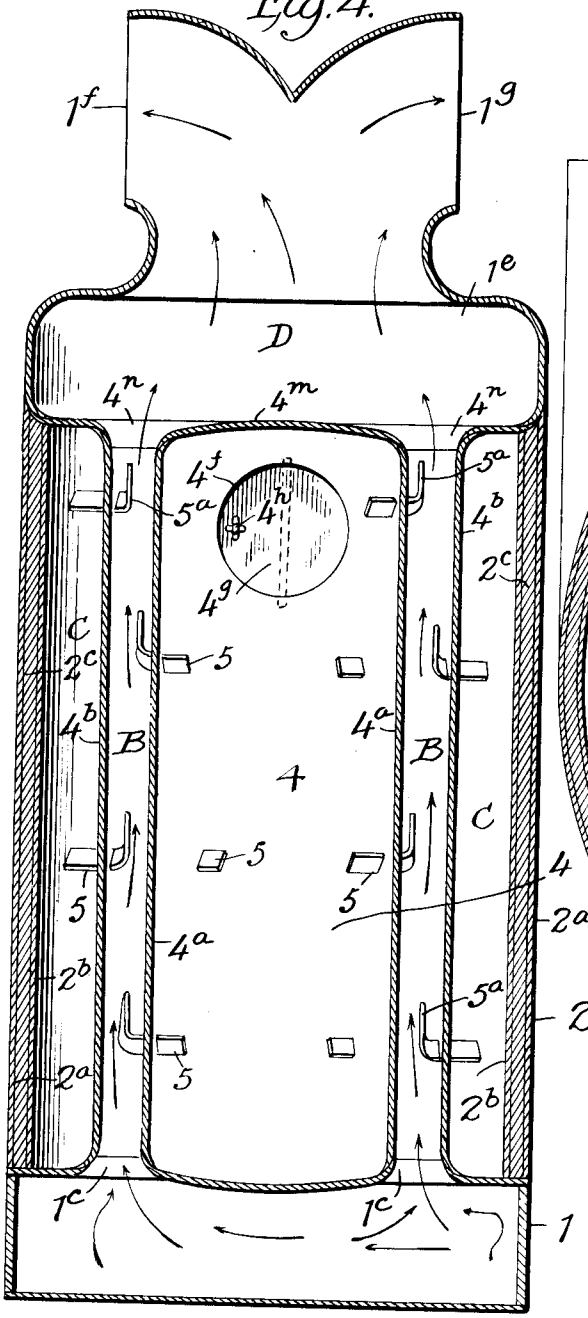
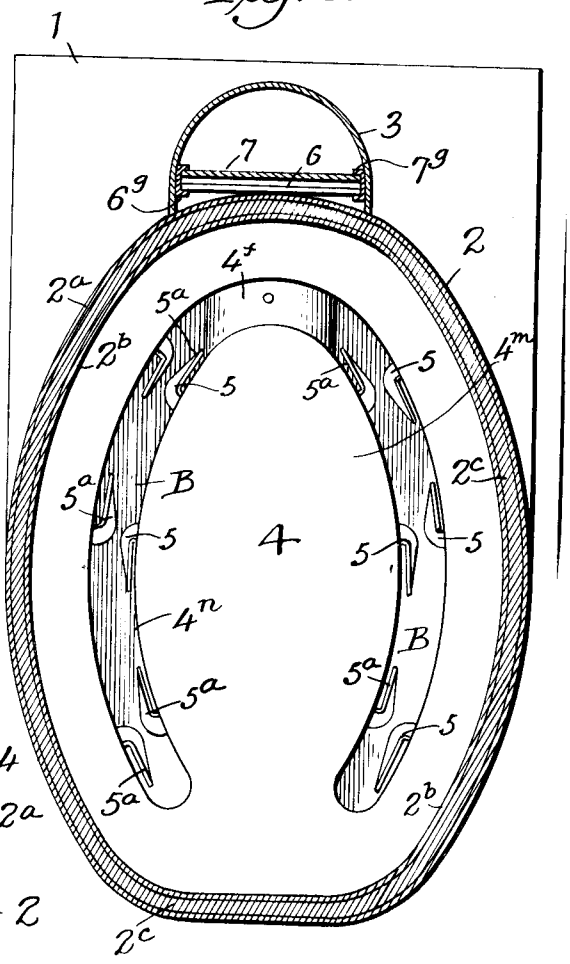


Fig. 6.



Inventor

David E. Ross

By Alexander & Sawall

Attorneys

Patented Apr. 2, 1935

1,996,349

UNITED STATES PATENT OFFICE

1,996,349

WARM AIR FURNACE

David E. Ross, La Fayette, Ind., assignor to Rostone, Incorporated, La Fayette, Ind., a corporation of Indiana

Application July 21, 1933, Serial No. 681,647

10 Claims. (Cl. 126—99)

This invention relates to warm or hot air furnaces for use in heating systems. The furnace embodies novel features especially adapting it for use in connection with heating systems employing continuous forced air circulation and continuous heat output. While the furnace is especially designed for continuous operation, (as contra-distinguished from intermittent operation as now used in connection with the majority of furnaces), it can also be used in intermittent heating systems if desired, but in such cases a larger size of furnace would be required for a given space to be heated than if it was used continuously with forced air draft. Where the furnace is intended to be operated continuously it can be completely fabricated and assembled at the shop, and be of such small overall dimensions that it can be readily passed through an ordinary house door and installed on the job as a complete unit.

My novel furnace can be used with any ordinary type of fuel such as gas, oil or coal. Where oil or gas is used suitable automatic burners would be provided in the furnace; and where coal or coke is to be used suitable grates, or automatic stokers, should be provided and fitted in the fire box of the furnace.

The accompanying drawings illustrate a furnace embodying the invention, and I will describe the same with reference to said drawings to enable others skilled in the art to readily adapt and use the same. I have not however illustrated the auxiliary equipment, such as blowers, burners and automatic controls, which would be used in connection with such furnace when installed as part of a continuously operating forced-air-circulating heating system. In the claims are set forth the essentials of the invention and novel features of construction and novel combinations of parts for which protection is desired.

In said drawings:—

Fig. 1 is a perspective view of the complete furnace, omitting the burner or grate, parts being broken away to show interior features.

Fig. 2 is a transverse sectional view on the line 2—2 Fig. 3.

Fig. 3 is a vertical longitudinal section on the line 3—3, Fig. 2, showing the flue plates in raised position.

Fig. 4 is a transverse vertical section on the line 4—4, Fig. 2.

Fig. 5 is a vertical section similar to Fig. 3 showing the flue plates in partly lowered position.

Fig. 6 is a transverse sectional view on the line 6—6, Fig. 3.

The furnace comprises a hollow base 1, which may be of cast or fabricated metal, and is approximately rectangular and is rounded at the forward end of the furnace, and open at its rear end for the admission of air taken either directly from the room or from the outside by a suitable duct (not shown). Mounted on this base is an approximately oval-shaped casing 2 which is preferably composed of inner and outer sheet metal walls 2*a* and 2*b* having the space between them filled with a non-heat-conducting packing 2*c* of any suitable material. The lower edge of the casing 2 may be welded or otherwise tightly connected to the top of the base, so as to prevent leakage of gases of combustion or air through the joint.

The casing 2 has a vertical outlet slot 2*e* in its rear end to permit the escape of the products of combustion into a flue 3 mounted on the base and preferably formed of sheet metal and connected with the casing 2 as shown. The front end of the casing 2 may be provided with one or more openings 20 for access to the ash pit or fire box, and such opening or openings may be closed by suitable doors, indicated at 2*p* in Fig. 3. The casing may also be provided with a sight opening 3*s*, closed by a transparent refractory plate 2*t*.

Mounted upon base 1 within and spaced from the inner wall of the casing 2 is an approximately oval horseshoe-shaped combustion chamber or fire box 4 having inner and outer walls 4*a* and 4*b*. This fire box is so placed in the casing that its closed end is adjacent the outlet 2*e* and its open end is adjacent the door 2*o* in the front wall of the casing. The walls 4*a* and 4*b* are preferably made of thin metal and the space between walls 4*a*, 4*b*, forms a duct B that communicates with the chamber in base 1 through an opening or openings 1*c* in the top of the base, which opening may approximately correspond to the horseshoe-shape of the double walled fire box 4. The curved space between the exterior wall 4*b* of the fire box and the interior wall 2*b* of the casing 2 forms ducts C for the products of combustion issuing from the open front end of the fire box, said ducts C communicating through outlet 2*e* with the flue 3.

A small outlet 4*f* is provided in the rear upper end of fire box 4, adjacent the upper end of the outlet 2*e* in the casing, through which products of combustion can be passed directly from the fire box to the outlet 2*e* and flue 3. The outlet 4*f* is normally closed by a damper or valve 4*g* which may be operated by a rod 4*h* that extends to the outside of the casing as indicated in Figs. 1, 2, 3. In case coal or wood is used as fuel the

outlet 4*f* could be opened when kindling the fire.

The upper ends of fire box 4 and ducts B and C are closed by a metal top plate or plates 4*m*, or other suitable means, so that products of combustion cannot escape from the fire box, except at the open front thereof into duct C; nor can air enter the fire box from duct B. Plate 4*m* is provided with an opening or openings 4*n* which permits the heated air to rise from duct B into a distributing chamber D within a sheet metal dome 1*e* mounted on top of the casing.

At advantageous positions both on the interior and exterior walls 4*a*, 4*b* of the fire box 4 are arranged what I term "impingers" 5. These impingers are preferably formed of pieces of heat conducting metal of substantial thickness and preferably extend through the fire box walls 4*a* and 4*b* and project into the duct B and also into the duct C. The ends 5*a* of the impingers within duct B are so shaped that the high velocity air stream passing up through duct B contacts with the impingers and will be broken or divided into a turbulent stream which increases the effective contact of the air with the heated walls 4*a*, 4*b*. To increase the wiping effect the impingers are so shaped that the air in the middle of the duct B contacting with the curved blades of the impingers is diverted thereby against the hot walls 4*a* and 4*b*, and in addition the impingers act as heat conductors and transmit heat from the hot gases in the fire box and duct C through the walls 4*a*, 4*b* of the fire box into the air stream in duct B. The impingers are preferably made in one piece and pierce the walls and are preferably welded in place and thus act more efficiently to transfer heat by conduction from the fire box 4 and duct C directly to the air in duct B.

The furnace draft is regulable by means of suitable valves or dampers located in the outlet 2*e* at the rear of casing 2. Preferably I employ two slidable plates 6 and 7 movable in vertical guide channels 6*g* and 7*g*, upper plate 7 having an inwardly extending flange 7*a* at its lower end (Figs. 3 and 5) and plate 6 having an outwardly extending flange 6*a* at its upper edge. A stop 6*s* provided at the lower end of guide 6*g* prevents plate 6 from completely closing the outlet for the gases at the bottom of the opening 2*e*. The plates 6 and 7 are shown in raised position in Figure 3, and in lowered position in Fig. 5. The plates 6 and 7 may be raised or lowered by any suitable means. As shown a rod 7*r* is connected to plate 7 and extends upwardly through flue 3, and projects through the flue above the casing. When the top plate 7 is sufficiently raised its flange 7*a* engages the flange 6*a* on plate 6 as shown in Fig. 3 and then both plates can be further raised to provide a larger opening for the passage of the products of combustion from duct C into flue 3. The top plate 7 can be lowered (see Fig. 5) so that the upper half of the outlet 2*e* will be open to give quick exit to the flue gases. By means of the sliding dampers 6 and 7 the intensity of the draft can be so regulated that a minimum of excess air will be drawn through the furnace thereby reducing the heat loss caused by admission of excess air into the flue. Plates 6 and 7 can also be used to regulate the height of and position of the opening through which the hot gases enter the flue.

The air entering the rear end of the hollow base 1 is forced upwardly through openings 1*c* into the horseshoe-shaped duct B, between the walls 4*a* and 4*b* of the fire box, the flow of air being indicated by tailless arrows in Figs. 3–5. The metal walls 4*a* and 4*b* are preferably thicker than the walls 2*a*, 2*b* of the casing 2, as most of the heat transmission will be through the walls 4*a*, 4*b*.

The air rises in duct B between the plates 4*a*, 4*b* and passes through openings 4*n* into chamber D, and thence passes out through the distributing elbows 1*f*, 1*g* into hot air conduits, not shown.

The burner employed (not shown) is placed in the center of the fire box 4, and when the furnace is in operation damper 4*g* is closed and the products of combustion (indicated by tailed arrows in Figs. 3–5 pass toward the front of thef urnace to and around the front open end of the horseshoeshaped fire box; into the duct C and thence back toward the rear of the fire box, and escape into the flue 3. The products of combustion in passing around the ends of the horseshoe-shaped fire box 4, have the full height, looking at section B—B (Fig. 1) of shells 4*a* and 4*b* in which to turn and reverse their direction. When solid fuels are used the damper 4*g* can be opened when the fire is kindled or a fresh charge of fuel is placed upon the fire, to permit quick exit to the flue 3 for the products of combustion, cutting down the long passage that the gases would necessarily have to follow in going forward and reversing around the ends of the horseshoe-shaped fire box 4. When the fire is properly burning damper 4*g* should be closed.

The insulation 2*c* in the furnace casing reduces radiation to a minimum: and the temperature of the outside sheet 2*a* under operating conditions will be only slightly higher than room temperature. Such outside sheet can be finished with a durable finish of any color desired. Preferably all corners in the air duct and top and bottom air chambers are rounded in order to reduce to a minimum the frictional resistance to flow of air and thus lessen the power necessary to overcome this resistance.

I claim:—

1. A furnace, an outer casing; upper and lower plate members in said casing; spaced apart walls extending between said plate members to form a single air duct of substantial U-shape in horizontal section throughout the height of said walls, the inner of said walls cooperating with said plate members to form a fire box open at its front, the outer of said walls being in spaced relation to the outer casing and cooperating with said plates to form passages to convey the products of combustion from the open front of said fire box; flue means communicating through the outer casing oposite the rear of the fire box; duct means to supply air to be heated between said walls; and further duct means to convey the heated air to a point of use.

2. In combination with a furnace as set forth in claim 1, means for deflecting the air in moving in said air duct against the said walls.

3. In combination with a furnace as set forth in claim 1, an adjustable damper in the flue for regulating the escape of the products of combustion, said damper comprising upper and lower damper plates separately sliding in the vertically elongated opening in the casing for the flue, and releasable means connecting the dampers when in raised position to provide an adjustable direct outlet at the lower end of said elongated opening, and when in lowered position to provide an adjustable direct outlet at the upper end of said enolgated opening.

4. A furnace, an outer casing; upper and lower plate members in said casing; spaced apart walls extending between said plate members to form a

single air duct of substantialy U-shape in horizontal section throughout the height of said walls, the inner of said walls cooperating with said plate members to form a fire box open at its front, the outer of said walls being in spaced relation to the outer casing and cooperating with said plates to form passages to convey the products of combustion from the open front of said fire box; flue means communicating through the outer casing opposite the rear of the fire box; said air duct having an opening opposite the flue forming a direct outlet from the fire box; a damper in said opening; duct means to supply air to be heated between said walls; and further duct means to convey the heated air to a point of use.

5. In combination with a furnace as set forth in claim 4, an adjustable damper in the flue for regulating the escape of the products of combustion, said damper comprising upper and lower damper plates separately sliding in the vertically elongated opening in the casing for the flue, and releasable means connecting the dampers when in raised position to provide an adjustable direct outlet at the lower end of said elongated opening, and when in lowered position to provide an adjustable direct outlet at the upper end of said elongated opening.

6. A furnace, an outer casing, upper and lower plate members in said casing; spaced apart walls extending between said plate members to form a single air duct of substantially U-shape in horizontal section throughout the height of said walls, the inner of said walls cooperating with said plate members to form a fire box open at its front, the outer of said walls being in spaced relation to the outer casing and cooperating with said plates to form passages to convey the products of combustion from the open front of said fire box, flue means communicating through the outer casing opposite the rear of the fire box, an air chamber below the fire box to supply air to be heated between said walls, and an air dome above the fire box to collect the heated air for distribution to a point of use.

7. In combination with a furnace as set forth in claim 6, an adjustable damper in the flue for regulating the escape of the products of combustion, said damper comprising upper and lower damper plates separately sliding in the vertically elongated opening in the casing for the flue, and releasable means connecting the dampers when in raised position to provide an adjustable direct outlet at the lower end of said elongated opening, and when in lowered position to provide an adjustable direct outlet at the upper end of said elongated opening.

8. In a furnace, a casing having a vertically elongated outlet opening, a double walled fire box of substantial U-shape in the casing, the outer of said walls being in spaced relation to the casing and forming a passage for the products of combustion, and the space between the double walls of the fire box forming an air heating duct, an adjustable damper for regulating the escape of the products of combustion, said damper comprising upper and lower damper plates separately sliding in the outlet opening; and releasable means connecting the damper plates when in raised position to provide an adjustable direct outlet at the lower end of said outlet opening, and when in lowered position to provide an adjustable direct outlet at the upper end of said outlet opening.

9. In a furnace, a casing having a vertically elongated outlet opening; upper and lower plate members in said casing; spaced apart walls extending between said plate members to form an air duct of substantial U-shape in horizontal section, the inner of said walls cooperating with said plate members to form a fire box open at its front, the outer of said walls being in spaced relation to the casing and cooperating with said plates to form passages to convey the products of combustion from the open front of said fire box, an adjustable damper for regulating the escape of the products of combustion, said damper comprising upper and lower damper plates separately sliding in the outlet opening, and releasable means connecting the damper plates when in raised position to provide an adjustable direct outlet at the lower end of said outlet opening, and when in lowered position to provide an adjustable direct outlet at the upper end of said outlet opening.

10. In a furnace, a casing, upper and lower plate members in said casing, spaced apart walls extending between said plate members to form a single air duct of substantial U-shape in horizontal section throughout the height of said walls, the inner of said walls cooperating with said plate members to form a fire box open at its front, the outer of said walls being in spaced relation to the casing and cooperating with said plates to form passages to convey the products of combustion from the open front of said fire box, flue means communicating through the outer casing opposite the rear of the fire box, an adjustable damper in the flue for regulating the escape of the products of combustion, said damper comprising upper and lower damper plates separately sliding in a vertically elongated opening in the casing for the flue, and releasable means connecting the dampers when in raised position to provide an adjustable direct outlet at the lower end of said elongated opening, and when in lowered position to provide an adjustable direct outlet at the upper end of said elongated opening.

DAVID E. ROSS.