Dec. 8, 1936. D. J. LUTY 2,063,321

HOT AIR FURNACE

Original Filed July 29, 1932 4 Sheets-Sheet 1

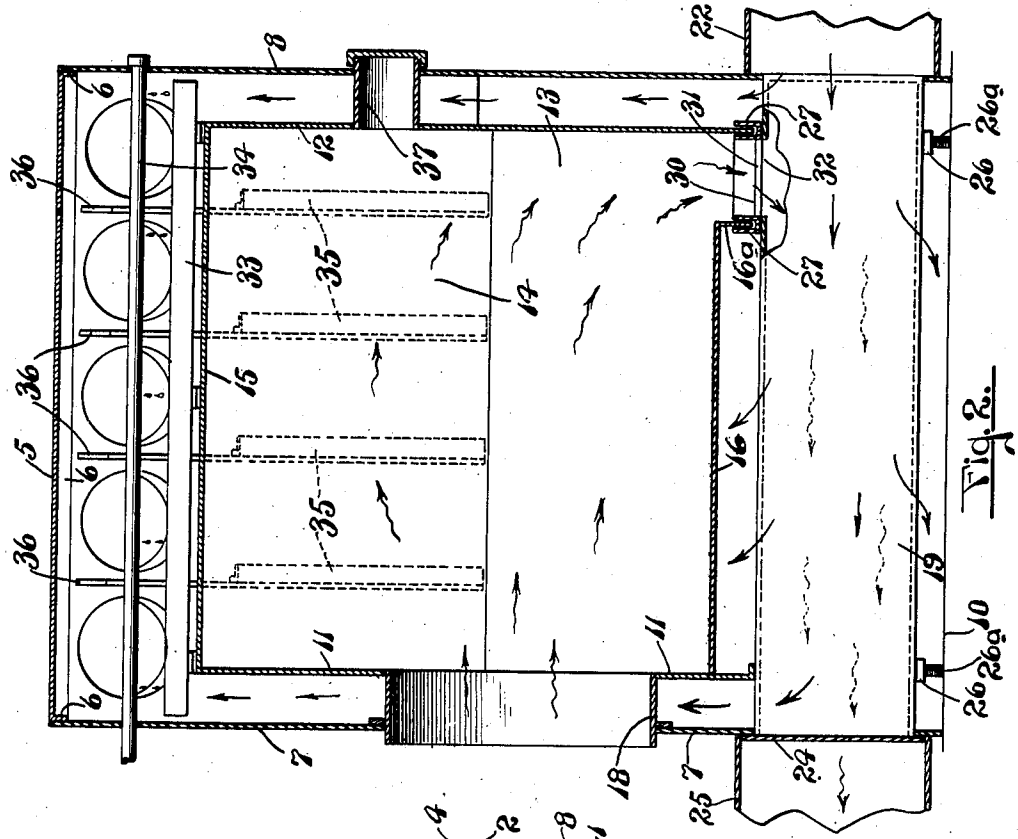

Fig. 2.

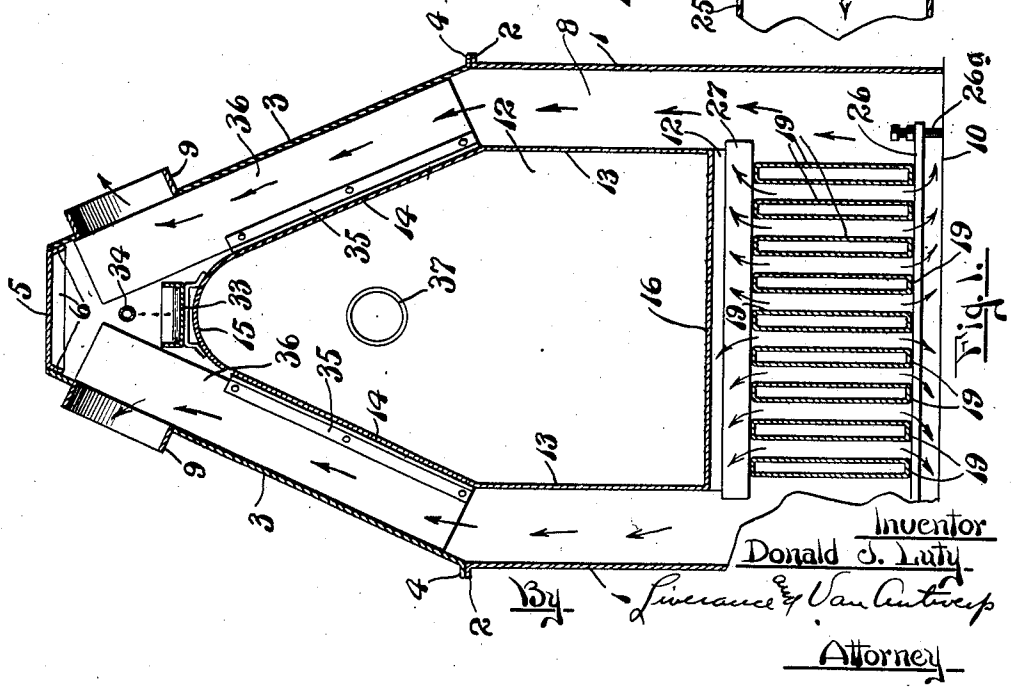

Fig. 1.

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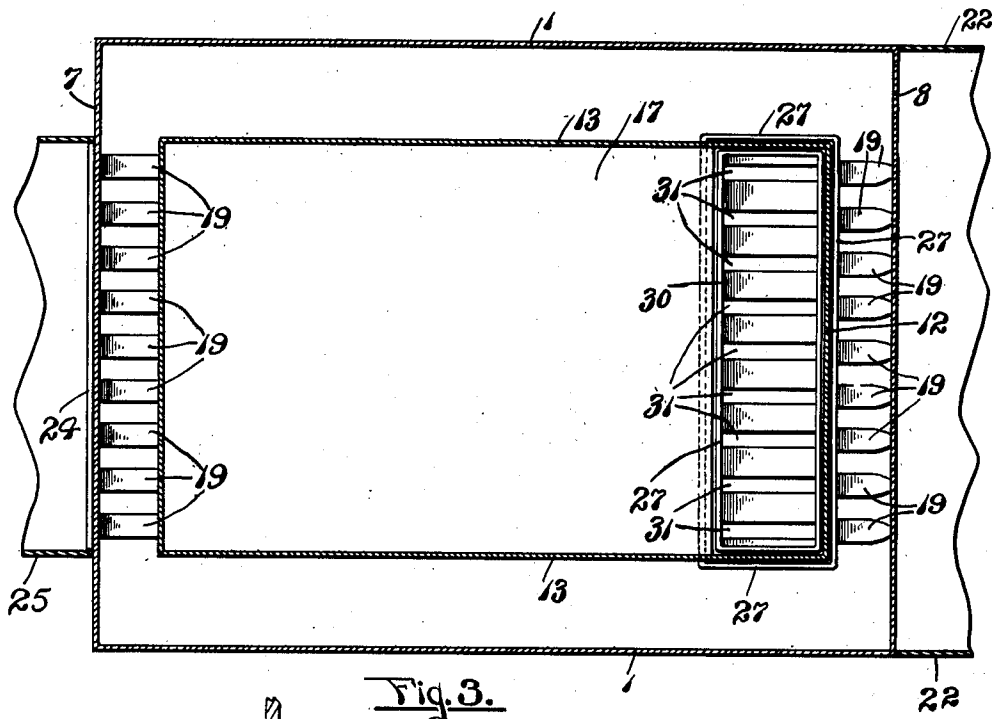

Fig. 3.

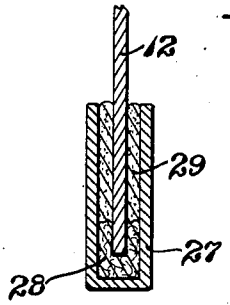

Fig. 4.

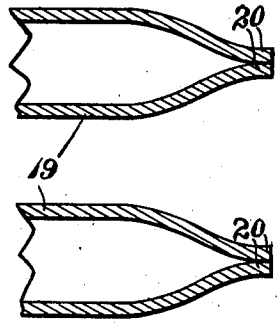

Fig. 5.

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HOT AIR FURNACE

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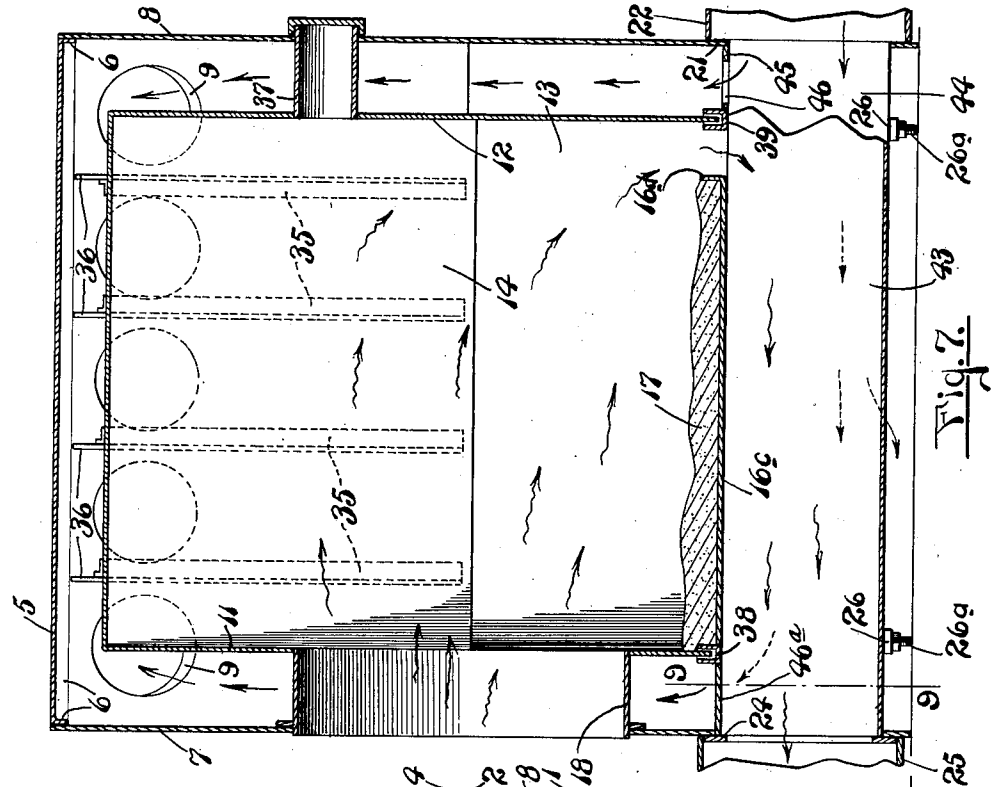

Fig. 7.

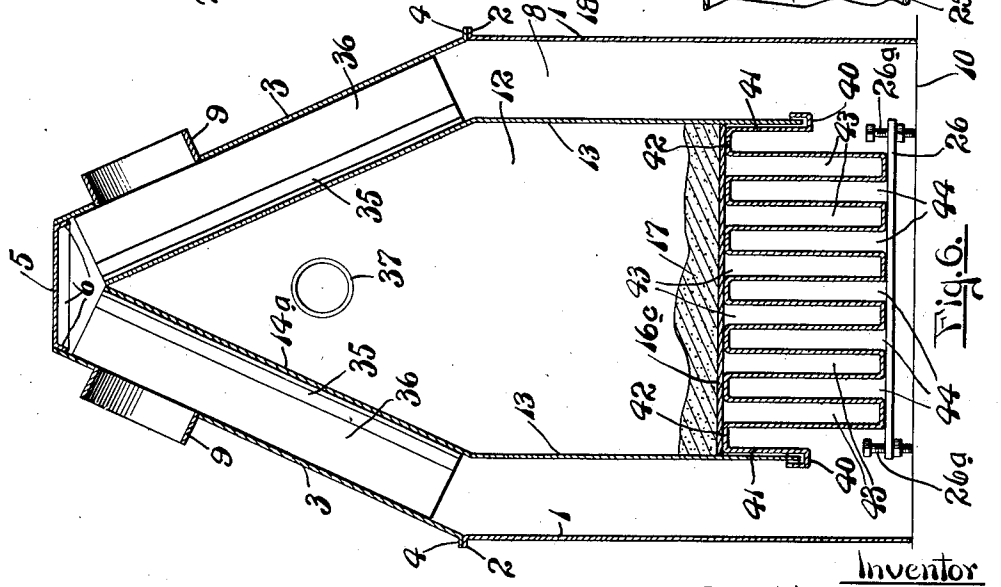

Fig. 6.

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HOT AIR FURNACE

Original Filed July 29, 1932 4 Sheets-Sheet 4

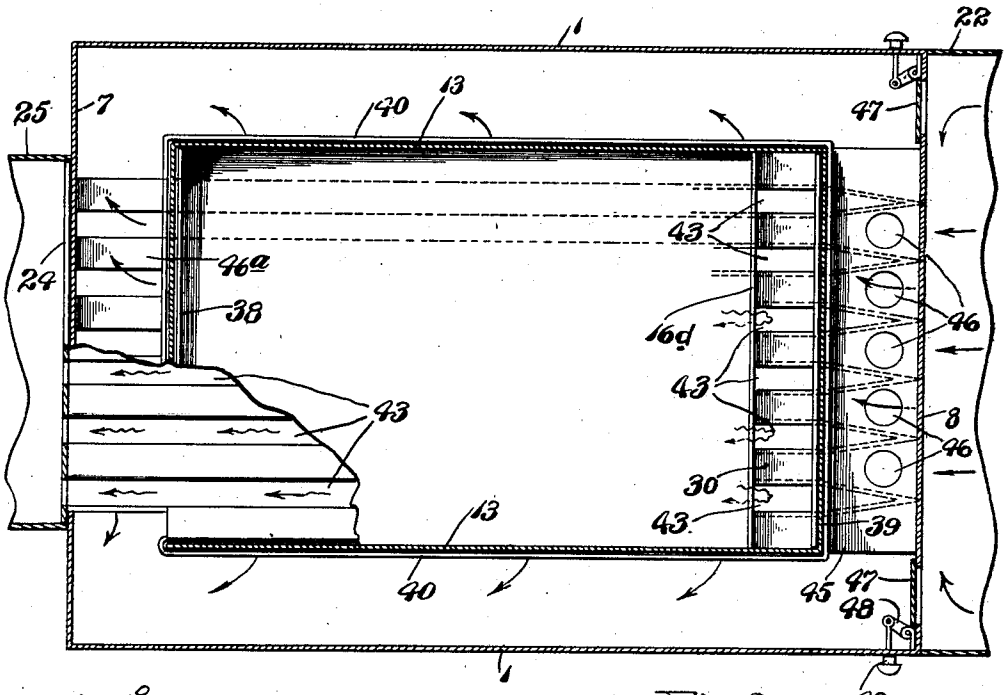

Fig. 8.

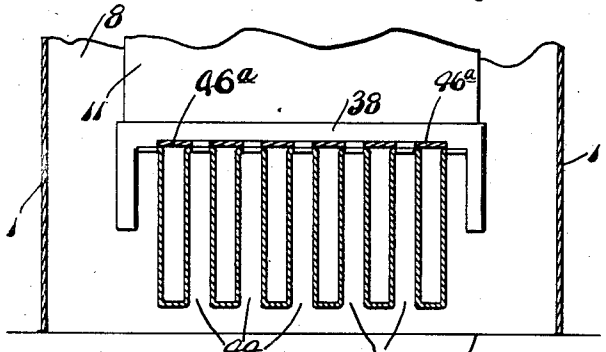

Fig. 9.

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UNITED STATES PATENT OFFICE

2,063,321

HOT AIR FURNACE

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Application July 29, 1932, Serial No. 625,642
Renewed November 18, 1935

8 Claims. (Cl. 126—116)

This invention relates to hot air furnaces and is concerned with a novel construction of furnace which is particularly adapted to have oil or gas, preferably, burned therein as a fuel, though in no sense limited to such fuel for operation, and wherein the products of combustion are carried in flues underneath and lengthwise of the combustion chamber of the furnace in direct and intimate association with air around the flues which is thus heated, in addition to the heat given off from the walls and top of the combustion chamber to the air within the enclosing casing which surrounds the combustion chamber, flues and the like.

This results in a very great economy in that a much greater efficiency in the absorption of heat units by the air is attained, and with a lesser proportion of the heat units being wasted and escaping in the smoke pipe and stack which carries the products of combustion away from the furnace.

In addition the furnace construction may be directly designed to be used with an oil burning unit, the furnace and the oil burner being sold and installed together whereby the most efficient balance of the furnace capacity with the oil burner may be attained, this resulting in a still further economy of fuel consumption.

The invention is directed to many novel constructions, combinations and arrangements of parts for the practical and effective attainment of the objects stated, as well as many others not at this time specifically enumerated, but which will be apparent as an understanding of the invention is had from the following description, taken in connection with the accompanying drawings, in which,

Fig. 1 is a transverse vertical section through the furnace of my invention.

Fig. 2 is a longitudinal vertical section therethrough.

Fig. 3 is a horizontal section taken substantially midway between the upper and lower sides of the furnace and also showing the air supply conduit and the smoke pipe conduit in section.

Fig. 4 is a fragmentary enlarged detail of the construction used for sealing certain joints between parts used in the construction.

Fig. 5 is a fragmentary enlarged horizontal section through the rear end portion of two of the flues through which the products of combustion circulate.

Figs. 6 and 7 are views similar to Figs. 1 and 2, respectively, of a different form of construction embodying the invention.

Fig. 8 is a horizontal section similar to that shown in Fig. 3 of said different form of furnace construction, and

Fig. 9 is a fragmentary vertical section substantially on the plane of line 9—9 of Fig. 7.

Like reference characters refer to like parts in the different figures of the drawings.

In the preferred form of structure, that shown in Figs. 1 to 5 inclusive, the outer furnace casing is of the usual material used for furnace casings, that is, sheet metal, and includes vertical sides 1 which at their upper edges have outturned flanges 2, joined with which are upwardly converging sides 3, as shown in Fig. 1, having flanges 4 at their lower edges bearing against and adapted to be secured to the flanges 2 of the sides 1. The upper edges of the inclined upper portions 3 of the casing have a top 5 extending between them which has downwardly extending flanges 6 at its sides and ends, the flanges 6 at the sides being secured to the parts 3 in any suitable manner. The furnace casing is completed by a front 7 and a back 8 secured to the side members 1 and 3 and the top 5 in any preferred or conventional manner. The upwardly inclined upper portions 3 of the casing near their upper edges carry a plurality of outwardly extending sleeves 9 forming outlets for the heated air which is heated within the furnace casing and with which furnace pipes may be connected to lead to the several rooms of a house or other building heated by the furnace. The furnace casing at its lower edges may rest upon a floor 10, such as the concrete floor in a basement, so that the casing provides an enclosure within which the air heating unit of the furnace is enclosed which is spaced from the sides and ends of the outer casing, and it is in these spaces that the air is heated and circulates upwardly to the outlets at 9.

Within the furnace casing described a combustion chamber for burning fuel is enclosed. It includes a front 11, a back 12, vertical side sections 13 and upwardly and inwardly inclined side sections 14 connected at their upper edges by an integral curved dome 15 (see Fig. 1). There is a bottom 16 to the combustion chamber located between the lower edges of the sides 13 which extends toward but stops a distance from the back 12, its rear portion being turned downwardly to make a vertical flange 16a (Fig. 2). The front 11 has an opening therein in which a short cylindrical inlet 18 is secured, the same extending through the front 7 of the furnace casing. It is at this opening, through the cylinder 18, that the oil or gaseous fuel burner may be located,

or if other fuel is used, it is through this opening that the fuel is entered into the combustion chamber for burning.

The sides 13 of the combustion chamber terminate a short distance above the lower edges of the front 11 and back 12; and the lower edges of said front and back are located a distance above the floor 10 and are supported by horizontal flues 19 of metal which extend the full length of the furnace casing at the lower portion thereof and are spaced apart from each other as shown in Fig. 1. The rear ends of the flues 19 (Fig. 5) are pressed together as indicated at 20 and welded together to make gas tight connections. The lower part of the back 8 of the furnace casing is cut away to provide an opening of the height of the flues 19 and of a length sufficient that the ends of all of the flues may pass therethrough. Preferably the air is forced into the furnace as by a blower or other equivalent pressure means.

The front ends of the flues 19 extend through an opening in the front plate 7 of the casing and are connected to a vertical plate 24, which has openings therethrough in direct communication with the front ends of the said flues 19. This plate is located at the front of the front plate 7 of the furnace casing and forms part of the breeching to the smoke pipe 25 which is designed to carry away the products of combustion to a chimney or other stack to which the pipe 25 leads. The flues 19 are supported on cross bars 26 located underneath the same and which are adjustable by means of adjusting screws 26a through their ends. Each of the flues 19, at its upper side and for a short portion of its length between the back 12 of the combustion chamber and the rear edge of the bottom 16 of said combustion chamber, is cut away so that the products of combustion may pass downwardly into the flues 19, move the length thereof toward the front and be delivered to the smoke pipe 25.

At the place where the products of combustion pass from the combustion chamber downwardly into the flues 19, it is necessary to provide a secure seal and one which will not be disturbed by contraction and expansion nor result in warping of the parts of the combustion chamber through uneven expansions and contractions. To this end a rectangular frame 27 having U-shaped sides and ends is located upon and across the upper sides of the flues 19, the downwardly extending flange 16a entering the forward channel of this frame and the lower edge portion of the back 12 of the combustion chamber entering the U-shaped rear channel of said frame, and the sides 13 at their rear end portions entering the shorter end channels of the frame. The U-shaped members of the frame are adapted to receive packing and cement. That is, as shown in Fig. 4, in the lower part of said U-shaped members of the frame asbestos packing is placed and above it a cement 29, and the parts which enter these U-shaped members of the frame are forced downwardly through the cement while it is in a plastic state and into the packing whereby, after the cement has set, a very secure gas tight seal is provided.

A rectangular plate 30 is located and secured within the frame covering the spaces between the flues 19 and having openings 31 which register with the openings 32 made in the upper sides of the flues 19 for the passage of the products of combustion into the flues.

The construction also lends itself to the ready installation of a shallow elongated water holding receptacle 33 to be mounted on and above the upper part of dome 15 of the combustion chamber. A water pipe 34, connected with a water main, extends lengthwise through the furnace casing above the receptacle 33, is closed at its free end, and has small openings in its underside from which water may drip into the pan, which water is vaporized to humidify the air.

It is also a feature of the present invention that the upper portion of the space between the furnace casing and the combustion chamber may be vertically divided. To this end angle supports 35 are secured at the outer sides of the walls 14 of the combustion chamber to which partitions 36 may be detachably connected. All of the angles 35 do not necessarily need to have the partitions 36 connected thereto at one time but a plurality of the angles may be connected with said walls 14 and partitions 36 connected thereto, as many or as few as may be desired, and the same may be rearranged and changed after the furnace installation if it proves desirable. In practice angles 35 are connected to the walls 14 at one point only, preferably at a point substantially midway between the ends of the angles 35 as otherwise the heat to which the walls 14 are subjected, being subjected to higher temperature than that to which the angles 35 are subjected, there is liable to be undesired stresses set up productive of warping. The partitions divide the space enclosed between the furnace casing and direct the heated air to the outlets 9 between said partitions as is evident.

The short cylinder 37, connected to the back 12 and extending through the back 8 of the casing and over which a covering cap is shown in Fig. 2, is for purposes of inspection, particularly of the burning flame when oil or gaseous fuel is used.

With this construction air forced through the conduit 22 may pass in part between the rear walls 8 and 12, but the major portion is forced forwardly between the flues 19. The products of combustion leaving the combustion chamber and traversing the length of the flues 19 serve to heat this air very rapidly. This heated air passes forwardly and also upwardly between the flues and thence laterally as indicated by arrows in Fig. 1, and a portion of it is forced downwardly and thence laterally passing upwardly between the sides of the enclosing casing and the combustion chamber, while all such air as is carried forward to the front of the furnace then passes upwardly between the front walls 7 and 11 as indicated by the arrows. The air leaves the furnace casing through the outlets 9 and the warm air pipes connected thereto leading to the different rooms.

With this construction the air is subjected not only to the heated combustion chamber but is initially heated at and below the combustion chamber by the heat given off from the flues 19 with which the air is first brought into immediate and intimate contact. With such a construction the high temperature gases, which are the products of combustion, instead of leaving directly from the combustion chamber to a smoke pipe, are required to pass through the flues 19 and there is a much greater opportunity to extract a greater portion of the heat from said gases and give it to the air than if the gases did not pass through said flues. This results in a very considerable economy in fuel comsumption, as is evident.

There is permitted the desired and required expansion and contraction of materials. The

temperatures of adjacent parts in most cases are substantially the same so that expansion of one part in association with others is substantially uniform with the part with which it contacts. For instance the expansion of the sides of the frame **27** is substantially uniform throughout its length. The expansion of the ends may not be thus uniform but the distance is so short that the amount of expansion is comparatively negligible whereby the seal described is not broken or disturbed. This construction, which is a preferred construction, has proved fully practical and serviceable and without defects in operation and secures in full measure the desirable result of great economy in fuel consumption.

In Figs. 6 to 9 inclusive, a somewhat modified form of construction is shown. The front and back plates **11** and **12** of the combustion chamber are sealed in U-shaped cross bars **38** and **39** at their lower edges, using the same type of asbestos and cement seal as shown and described with reference to Fig. 4. The bottom plate **16c** has an upturned flange **16d** at its rear edge and the refractory material **17** lies above the plate **16c** which is also utilized as a cover for the flues which carry the gases of combustion to the smoke pipe, and is not spaced above such flues as the plate **16** is above the flues **19** in Fig. 1. The flues for carrying the gas and the intermediate spaces for the air to circulate through are bent up from a single continuous plate of metal in which the side edges are formed with U-shaped receiving seats **40** for the lower edges of the side plates **13** of the combustion chamber, are then continued upwardly in sections **41** one along the inner side of each part **13**, are then bent at right angles at **42** to lie directly underneath the plate **16c** and are formed with a successive series of U-shaped bends making flues **43** and alternate air conducting flues **44**. The upper ends of the flues **43** are closed by the plate **16c**, the lower ends of said flues being the integral lower ends of the U-shaped bends made in the plate, while the air flues **44** are open at their lower ends and at their upper ends are bounded by the upper bent portions which are made in the plate, as shown in Fig. 6.

As shown in Fig. 8, a plate **45** lies over this flue construction between the rear sealing member **39** and the back **8** of the furnace casing. In said plate, holes **46** are made, which provide connections between the air flues **44** and the space enclosed by the furnace casing between the walls **8** and **12**. A plate **46a** is located between the front sealing member **38** and the front of the furnace over the flues and it has openings which are in communication with like openings made in the upper ends of the air flues **44**, as shown in Fig. 9, for a part of the warm air, forced through the flues, to pass upwardly between the front wall **7** of the casing and the front wall **11** of the combustion chamber; and of course other warm air circulates downwardly and laterally from the lower open sides of the air flues **44**.

In addition to the air which is forced into the furnace casing as described, the rear side **8** of the furnace casing at each side of the flues, may have openings therein which are adapted to be closed by dampers **47** (Fig. 8) pivotally mounted and each having an arm **48** connected thereto from which an operating rod **49** extends outwardly through a side **1** of the casing, whereby the dampers may be opened or closed. In open position air will pass from the cold air inlet flue **22** directly into the furnace casing at each side between the sides **1** and **13** of the structure.

The construction just described is a form of construction operating upon substantially the same principle as that first described. The principle of operation, that of forcing the heated products of combustion downwardly and longitudinally through flues located underneath the combustion chamber, is preserved with a consequent economy of operation and fuel consumption.

A hot air furnace of the constructions described, as previously stated, is very economical with respect to fuel consumption, is simple to construct, is inexpensive and is particularly efficient in all respects. The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. A hot air furnace comprising an outer enclosing casing, cross means in the lower portion of the casing, adjustable means supporting said cross means for adjusting and leveling the same, a plurality of flues spaced from each other transversely and lying longitudinally of the casing between the front and back thereof, each of said flues having an opening therein at its upper side, an enclosed combustion chamber within the casing spaced from the walls thereof and resting upon said flues having an outlet at its lower portion to pass products of combustion therefrom into the flues, means for excluding the products of combustion from between the flues located at said combustion chamber outlet, means for carrying air to and between the flues at the rear ends thereof, and means for carrying the products of combustion from said flues at the forward ends thereof.

2. A hot air furnace comprising, an outer enclosing casing of sheet metal, a combustion chamber having walls substantially parallel with the walls of said casing located within the casing and spaced therefrom, a plurality of spaced flues located horizontally and lengthwise of and at the lower part of the casing below said combustion chamber, said combustion chamber having a bottom extending rearwardly from its front end toward but terminating short of the rear wall of the combustion chamber thereby providing an outlet from the combustion chamber, said flues in the upper sides thereof having openings in communication with said outlet, a plate located across said flues at said outlet having openings in communication with the openings in the flues, a conduit at the lower rear portion of the casing carrying air to and into the spaces between said flues, and a pipe at the lower front portion of the casing into which the front ends of said flues extend to deliver products of combustion passing through the flues to said pipe.

3. In a hot air furnace, a sheet metal outer casing having spaced apart front and back and spaced apart vertical side walls, the upper portions of which are inclined inwardly toward each other, and a top completing the casing located between the upper edges of the side walls and the front and back, said casing having outlets at its upper end in each side, a combustion chamber having vertical front and back, vertical side walls and a dome having sides inclined upwardly and inwardly toward each other and integrally connected by a curved section, a bottom for said combustion chamber located a short distance above the lower edges of said front and back and extending rearwardly, a plurality of horizontal flues,

spaced apart from each other, lying the full length of said casing, underneath the combustion chamber and upon which the front and back of said combustion chamber rest, thereby spacing the flues from the bottom of the combustion chamber, said flues at their upper sides having openings in communication with the combustion chamber, means for preventing passage of products of combustion between the flues and permitting said passage into said flues, and means for carrying air into the casing at and between the rear ends of the flues, as specified.

4. A hot air furnace comprising, an outer enclosing casing, an inner enclosed combustion chamber having an outlet opening at its lower portion, spaced flues located longitudinally of the casing below the combustion chamber and provided with openings in alinement with said combustion chamber outlet, means for closing the space between the several openings and the periphery of the outlet, means for rigidly attaching the spaced flues around the outlet opening and supporting means extending from the inner enclosed combustion chamber adapted to slidably engage the several flues whereby expansion of the combustion chamber may readily occur.

5. A hot air furnace of the class described comprising, an outer casing, an enclosed combustion chamber having a short inlet slidably extending through the outer casing whereby fuel may be fed thereinto, said combustion chamber having an outlet at its lower portion, connecting means around said outlet, flues extending underneath the bottom portion of the combustion chamber, said flues having openings adjacent the combustion chamber, means for rigidly attaching the flues to the connecting means so that the openings therein connect with the outlet opening in the lower portion of the combustion chamber, said flues being slidably mounted at all other points with respect to the combustion chamber whereby they may readily expand.

6. A hot air furnace comprising a plurality of substantially horizontally disposed flues arranged in spaced relation, a combustion chamber arranged above said flues, means for conducting products of combustion solely from one end of said combustion chamber downwardly to said flues, and means for introducing air to be heated to the spaces between said flues, said last mentioned means being located adjacent the said first means whereby the incoming air will contact said flues at their hottest point.

7. A hot air furnace comprising a plurality of substantially horizontally disposed flues, arranged in spaced relation, a combustion chamber arranged above said flues and in direct heat conductive engagement therewith, a casing enclosing said flues and combustion chamber and spaced from said combustion chamber, means for conducting the gaseous products of combustion downwardly to said flues, means for conducting air to the spaces between said flues, and means for conducting said air upwardly from said spaces to the space between said combustion chamber and casing.

8. A hot air furnace comprising a plurality of substantially horizontally disposed flues arranged in spaced relation, a combustion chamber arranged above said flues in heat conductive engagement therewith, a casing surrounding and spaced from said flues and combustion chamber, means for conducting products of combustion solely from one end of said combustion chamber downwardly to said flues, means for introducing air to be heated to the spaces between said flues and means for conducting said air from the spaces between said flues to the space between said casing and said combustion chamber.

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