July 24, 1951 G. W. DONLEY 2,562,141

METAL AIR HEATING APPARATUS

Filed Dec. 8, 1945 3 Sheets-Sheet 1

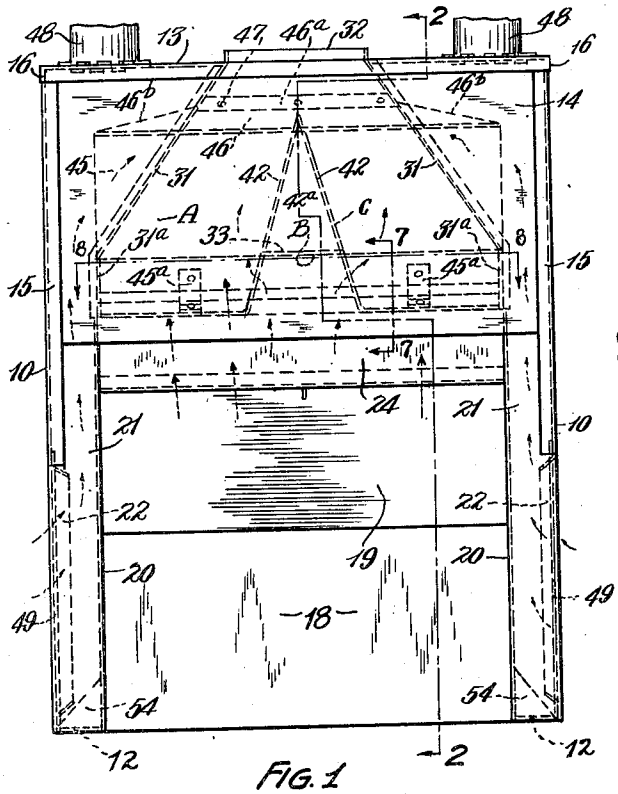


FIG. 1

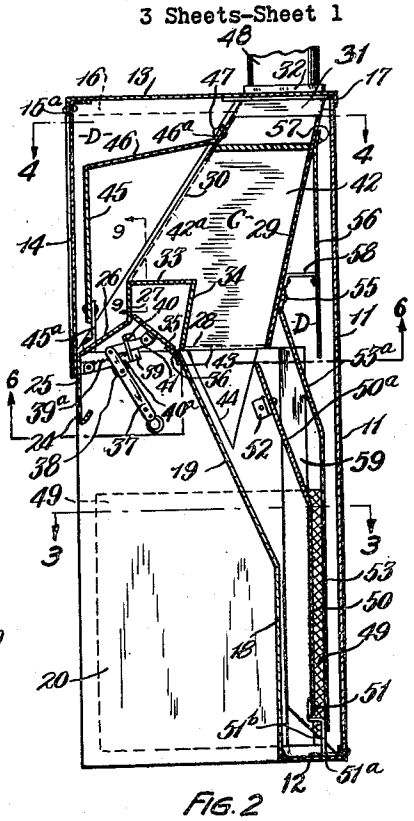


FIG. 2

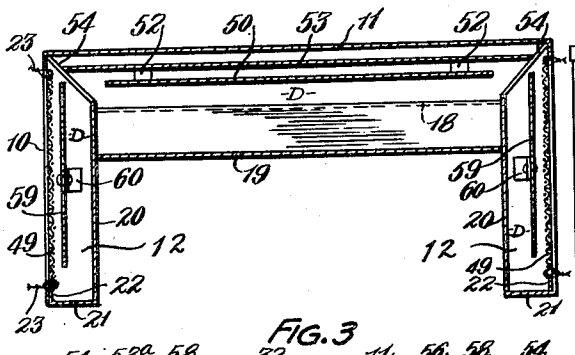


FIG. 3

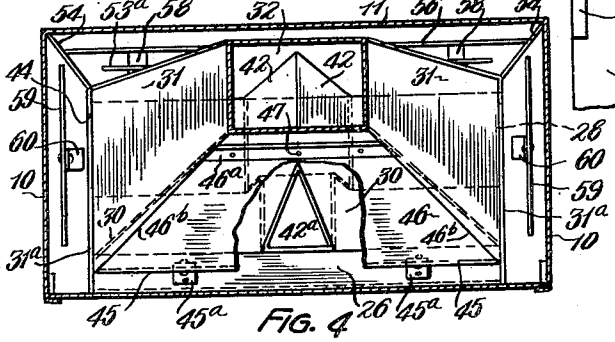


FIG. 4

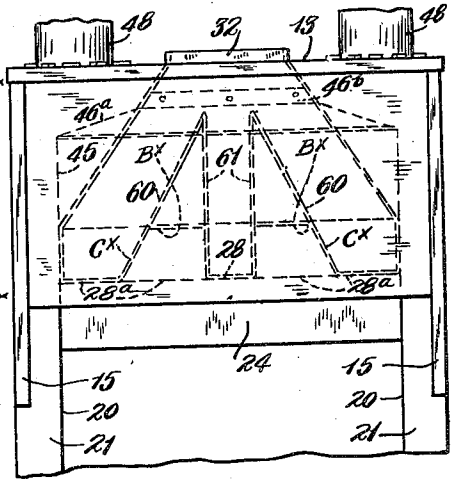


FIG. 5

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METAL AIR HEATING APPARATUS

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Fig. 6

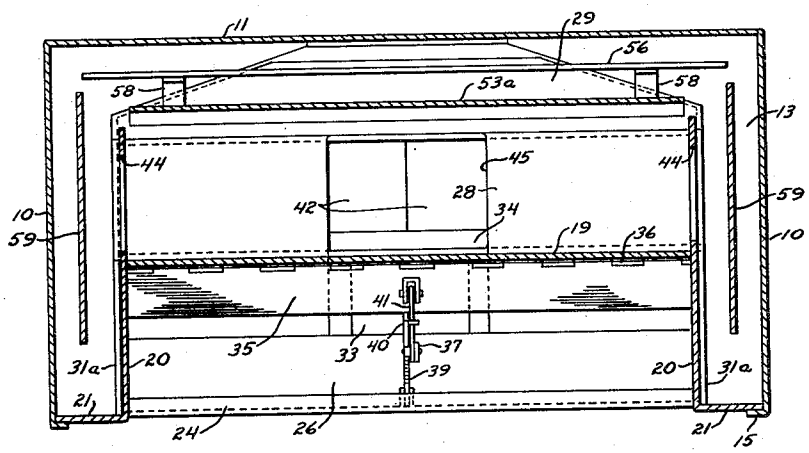
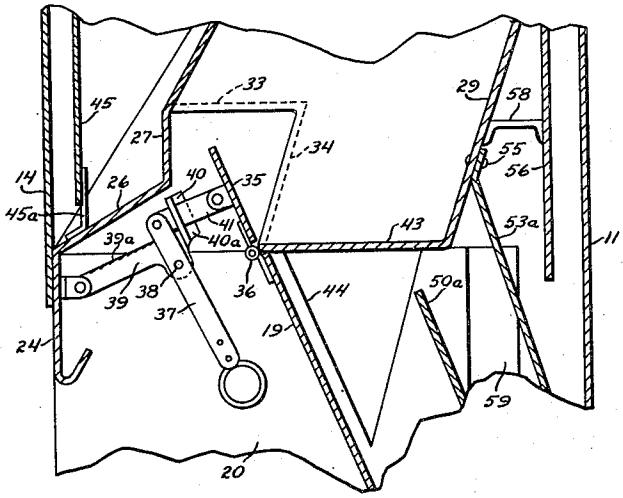


Fig. 7



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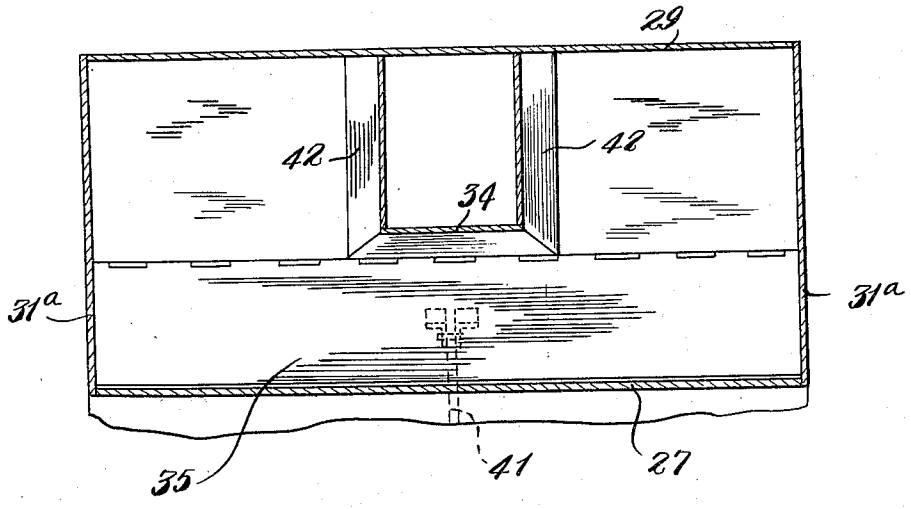


FIG. 8

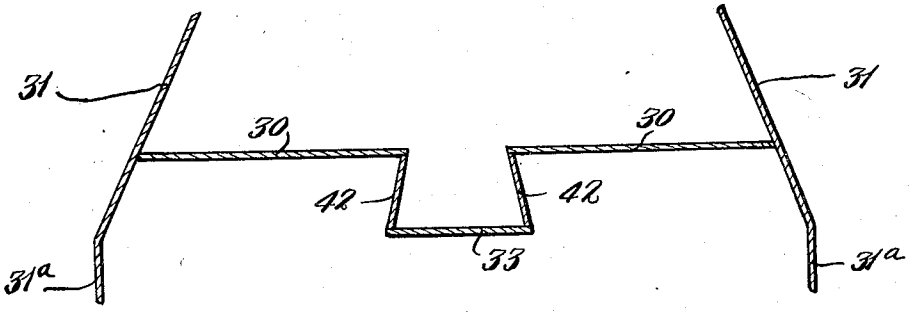


FIG. 9

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UNITED STATES PATENT OFFICE

2,562,141

METAL AIR-HEATING APPARATUS

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Application December 8, 1945, Serial No. 633,609

7 Claims. (Cl. 126—121)

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This invention relates to air-heating apparatus of the fireplace unit type illustrated, described and claimed in my Patent No. 2,151,016 issued March 21, 1939, the units of the type referred to in said patent being adapted to be set into a building construction and to provide for the circulation of air in heat-transferring relation to the said units, whereby heat may be transferred by convection as well as by radiation to the rooms in which the units are installed.

The general object of my invention herein is to secure a greater heating efficiency than is obtainable by the construction embodied in my aforesaid patent, with resultant economy in fuel consumption.

I accomplish the foregoing objects, as well as additional objects, which will be set forth hereinafter, in and through the construction and arrangement of parts shown in the drawing hereof wherein Fig. 1 represents a front elevational view of a fireplace embodying my invention; Fig. 2 is a sectional view corresponding approximately to the line 2—2 of Fig. 1; Fig. 3 is a sectional view corresponding to the line 3—3 of Fig. 2; Fig. 4 is a sectional view taken on the line 4—4 of Fig. 2, parts of the upper front baffle and the front wall of the smoke dome being broken away; Fig. 5 is a front elevational view of the upper portion of a fire place unit showing a modification of the smoke dome and heated-air distributing means; Fig. 6 is a horizontal section taken on line 6—6 of Fig. 2; Fig. 7 is a fragmentary vertical section on line 7—7 of Fig. 1; and Figs. 8 and 9 are fragmentary sections taken on lines 8—8 and 9—9 of Fig. 2 of the drawings.

Referring now to the drawing and particularly to Figs. 1–4 of the same, 10 denotes the sides, 11 the back, 12 a bottom wall, for the air chamber, (to be described hereinafter) and 13 the top of the housing for my fireplace unit, the bottoms of the sides and back and the wall 12 of said housing being suported on the hearth. 14 denotes the upper front member of the housing, the sides of the same being overlapped by flanges 15 on the front of the sides 10, which flanges are secured to the side edges of the front member, as by bolts (not shown). The top is provided with downwardly extending flanges 15a, 16 and 17 which overlap and are secured to the upper ends of the corresponding front, side and back members of the housing.

Within the outer housing is located a fireplace, the same comprising a back wall having a lower vertical section 18 connected at its bottom (as by welding) to the bottom wall 12, said fireplace also having an upper forwardly inclined section 19. The fireplace also has sides 20 which are spaced from and parallel with the sides of the housing. The rear wall of the fireplace is spaced from the rear wall of the housing and the sides 20 are also spaced from the side walls of the housing. Connected to and preferably formed with the outer edges of the sides 20 of the fireplace are vertical side panels 21 the outer ends of the lower portions of which are rearwardly flanged, as shown at 22, and the flanges are received within the forward edges of the housing sides 10 and secured thereto, as by wire clips 23, while their upper portions are overlapped by and secured to the lower portions of the flanges 15a.

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24 denotes a hood which is secured at its sides to the upper ends of the panels 21 and the upper end of which hood is overlapped by the lower end of the front member 14 of the housing. The upper end of this hood has connected thereto and preferably formed integral therewith an upwardly and inwardly inclined wall 26 forming the lower end of the front wall of the smoke dome A and from the upper end of which there extends a narrow vertical wall 27.

28 denotes a smoke shelf which forms the bottom of the smoke dome, the said dome having a rear wall 29 which extends upwardly and rearwardly from the rear end of the smoke shelf, a front wall 26, 30, the central portion of the lower end of the latter being secured, as by welding, to the top of the wall 27 and which extends upwardly and rearwardly therefrom and from the wall 26. The smoke dome also has side walls 31 the lower ends 31a of which extend vertically from the opposite ends of the smoke shelf and then converge toward the upper end of the housing, where the top of the dome is provided with a flue connection 32.

In its lower front portion the smoke dome is provided with a pocket B forming a portion of the external boundary of an air-circulating and heating delivery tube in the smoke dome, which pocket comprises the central portion of the vertical wall 27, a horizontal wall 33 extending rearwardly from the said portion of the wall 27, and a substantially vertical wall 34 which connects the rear end of the wall 33 with the front end of the smoke shelf. The walls 27, 33 and 34 close the front bottom portion of the boundary of the air tube and constitute a pocket for the damper 35, the lower end of which is shown as pivotally connected at 36 with the top of the fireplace wall 19, and the front end of which engages the

upper end of the wall 26, when closed, the damper and the wall 26 extending the full length of the smoke dome. This damper, when closed, will shut off all communication between the fireplace and the smoke dome. When open, by the means to be described, it will rest against the rear wall 34 in the pocket, thereby allowing the products of combustion to pass freely into the smoke dome, including any smoke lying under the lower surface of the pocket B.

The means shown herein for opening and closing the damper comprise an operating handle 37 pivotally connected at 38 to an arm 39 which in turn is pivotally secured to the hood 24 and which has a vertical angle iron arm 40 connected thereto provided in the flange 40a with a slot for a pawl 41 which is pivotally connected at one end to the upper end of the operating lever 37 and its other end to the damper. It will be obvious that, by pulling forwardly upon the lever 37, the damper will be swung to open position, whereby it may rest against the wall 34. The arm 39 is provided with ratchet teeth 39a for cooperation with the pawl.

Positioned within the smoke dome, but out of communication therewith, is an inverted V-shaped air circulating and heating tube C, the same comprising inclined side walls 42 extending between and connected at the rear and front edges to the rear and front walls 29 and 30 of the smoke dome, with its apex spaced from the top of the smoke dome and below the top 13 of the housing. The bottom of the wall 34 of the damper pocket is connected to the smoke shelf immediately in front of an opening 43 in the latter, the shape and area of the opening being preferably determined by the shape and size of the space included between the bottoms of the side walls 42 of the tube C.

The walls constituting the sides 20 of the fireplace are substantially rectangular and project rearwardly beyond the wall 18 of the latter and extend to the top of the wall 19, with their upper ends engaging and forming a sealing contact with the ends of the smoke shelf. The upper ends of the walls 20 are provided with V-shaped openings 44 for admitting air from opposite sides of the air chamber D into the tube C. The air thus admitted has been heated by contact with and radiation from the fireplace as well as by contact with and radiation from baffles heated by radiation from the fireplace in the manner to be described hereinafter.

The air delivered to the tube C is in turn delivered therefrom through the front wall 30 of the smoke dome beneath a baffle having a vertical wall 45, shown as supported at its lower end by angle clips 45a secured thereto and to the wall 26 and spaced from the latter. The upper end of the vertical wall 45 has connected thereto, and preferably integral therewith, an upwardly and rearwardly inclined upper wall 46 the rear end 46a of which is secured to the front wall of the smoke dome above the outlet 42a for air from the tube C. Except at its front edge, the wall 46 is not coextensive with the wall 45, the sides of the former wall being cut away, as shown at 46b (Figs. 1 and 4) so that the rear edge 46a is of substantially the same width as the portion of the smoke dome to which it is attached, as by rivets 47, air flowing up through the tube C and out in under the upper wall 46 of the wall 45 will flow out from the sides of such upper wall into the outer housing primarily adjacent the rear thereof due to the inclination of the wall 46.

The top wall 13 of the housing is provided with one or more outlet connections 48, communicating with the portion of the air chamber D surrounding the fireplace and the smoke dome, for delivering air heated directly and indirectly by the fireplace to any desired point or points. For the purpose of utilizing efficiently the heat of the fireplace for transmitting heat to the air admitted through the screened side openings 49 to the portion of the chamber D which surrounds the fireplace, and the bottom of which chamber is defined by the wall 12, I have provided the following construction and arrangement of baffles:

50 denotes the vertical lower portion and 50a the forwardly inclined upper portion of a baffle located at the rear of the fireplace, the side edges of the said baffle being shown as located between the front and rear of the screened openings 49. The lower end of the baffle 50, 50a is secured to the upper vertical portions 51 of Z-shaped clips each having a substantially horizontal flange at its bottom whereby it is secured to and supported from the bottom wall 12 of the air chamber. The baffle 50, 50a, is of slightly less width than the width of the fireplace whereby its upper inclined portion is secured to the upper extensions of the side walls 20 of the fireplace below the opening 43, as by angle clips 52, with its upper end in substantial registration with the rear of the openings 44.

53 denotes the vertical lower portion and 53a the forwardly inclined upper portion of a second baffle located rearwardly of the baffle 50, 50a. The baffle 53, 53a is considerably wider than the baffle 50, extending at its lower ends to and in contact with diagonal gussets 54 connecting the rear corners of the housing with the rear corners of the fireplace. The lower end of the vertical portion 53 of the baffle is secured to and supported by the lower vertical portions 51b of the Z-shaped clips which also support the baffles 50, 50a. The upper end of the wall 53a is secured to and against the rear wall 29 of the smoke dome, as by rivets 55.

56 denotes a vertically extending baffle which is interposed between the rear of the smoke dome and the rear wall 11 of the housing and which is supported at its upper end from the smoke dome, as by rivets 57, and at its lower portion by means of braces 58 interposed between and secured to the baffle and to the rear wall of the smoke dome.

59 denotes vertical baffles interposed between the sides 20 of the fireplace and the screened openings 49. These baffles are shown as supported at their lower ends by angle clips 60 secured thereto and to the bottom 12 of the housing, and they extend upwardly above the ends of the smoke shelf.

It will be noted that the walls 27 and damper 35 form therebetween a throat through which products of combustion from the fireplace are delivered into the smoke dome directly from the fireplace section 19 and 26 from opposite sides of the lower edge of the pocket B provided in the front of the tube C for the reception of the damper when the latter is in its open position.

In Fig. 5 there is shown a modification of my invention which differs from the form shown in Figs. 1–4 inclusive in that two tubes $C^{\times}$ are provided in the smoke box for the passage therethrough of heated air from below the smoke shelf.

Each of these tubes has an upwardly inclined side wall 60 and a vertical side wall 61, the bottom of the space between the said walls being closed by the central portion 28a of the smoke shelf 28, pockets Bx being formed in the lower portions of the tubes in the same manner as the pocket B is formed in the front lower portion of the tube C in Figs. 1 to 4. The remaining parts of Fig. 5 are substantially identical with the corresponding parts of Figs. 1 to 4, and are identified by the same numerals by which they are identified in the preceding views.

With the parts arranged and constructed as shown and described, it will be evident that when the walls of the fireplace are heated, as by means of gas logs or other source of heat, the air to be heated will be drawn into the fireplace heater through the screened openings 49, and air passing in contact with the side and end walls of the fireplace and in contact with the smoke dome will be heated by contact therewith and by radiation therefrom; it will also be heated by contact with and radiation from the baffles 50, 50a 53, 53a, 56 and 59.

Air which has been partially heated by contact with the side and back walls of the fireplace and by contact with and radiation from the baffle 50, 50a as well as a part of the air which is heated by contact with the side walls of the fireplace and by contact with and radiation from the baffles 59 will be delivered into the tube C through opening 43 and will leave through outlet 42a and thence beneath the baffle 45, 46, from the ends of which it mingles with the air which has been heated by contact with and radiation from the baffles 53, 53a, 56, and part of the air which has been heated by contact with and radiation from the side walls of the fireplace and the baffles 59.

It will be noted that the air which passes between the baffle 53 and 53a and the rear wall 11 of the housing is divided as it ascends, part of it passing between the upper inclined portion 53a of the said baffle and the baffle 56, it being discharged from the ends of the space between the last mentioned baffle and the rear wall of the smoke dome into the space surrounding the latter, the other portion of the ascending air passing between the baffle 56 and the rear wall 11 and being heated in its passage by contact with and radiation from the baffle 56 which in turn has been heated by conduction from the rear wall of the dome, as well as by contact with the air which passes between the same and the said rear wall of the dome.

The air passing between the baffles 50, 50a and 53, 53a is heated by contact with and radiation from the former baffle, as well as by contact with the upper portion of the baffle 53, 53a, which is connected to and heated by conduction from the rear wall of the smoke dome. The air passing between the baffle walls 50, 50a and 53, 53a passes in part through the opening 43 into the air tubes C or Cx and in part in contact with and around the lower portion of the rear wall of the smoke dome.

Due to the construction and arrangement of parts shown and described herein, I am enabled to produce a heater of the "fireplace unit" type which is extremely efficient in effecting a high interchange of heat between the air entering the housings of such units and the fireplaces employed therein; also that I am enabled to accomplish these results in constructions which are comparatively simple in construction and inexpensive of production.

Having thus described my invention, what I claim is:

1. In a metal air-heating apparatus, the combination of an exterior housing having front, rear, side, and top walls, a fireplace set within the housing and having rear and side walls spaced from the rear and side walls of the housing, the rear wall of said fireplace having a forwardly inclined portion, a smoke-receiving and heat-radiating dome above the said fireplace, a throat provided between the top of the rear wall of the fireplace and the lower end of the front wall of the said dome, and a damper pivoted to the upper end of the rear wall of the fireplace for controlling the said throat, the side walls of the fireplace extending above and rearwardly of the forwardly inclined portion of the rear wall of the said fireplace to a point approximating the top of the said rear wall, the portion of the bottom of the smoke dome located rearwardly of said throat having a bottom wall supported by the extensions of the side walls of the fireplace and provided with an air inlet opening and the smoke dome having therein an air-receiving and distributing tube having its bottom communicating with the said opening, the said tube being located within and interposed between the front and rear walls of the said dome and adapted to deliver air received from said inlet opening and passing through said tube, through an opening provided in the front wall of the said dome, a baffle located between the rear wall of the fireplace and the rear wall of the housing and having its lower end supported adjacent to the bottom of the housing, the said baffle extending vertically upwardly and thence forwardly to a point adjacent to but spaced below the opening in the bottom wall of the said dome and having side edges supported from the upper ends of the extensions of the side walls of the fireplace, and means for admitting air to the lower portion of the space between the said baffle and the rear wall of the fireplace, and a baffle located within the upper front portion of the housing and having its lower end supported in proximity to but in front of the said throat and extending upwardly therefrom substantially parallel with the front wall of the housing and thence rearwardly and upwardly and secured to the front wall of the dome above the opening in said wall, the sides of the last mentioned baffle being spaced from the sides of the housing, thereby to deliver air received from said tube into the housing.

2. In a metal air-heating apparatus, the combination of an exterior housing having front, rear, side and top walls, a fireplace set within the housing and having side walls and a rear wall the lower portion of which is spaced from and substantially parallel with the rear wall of the housing and the upper portion of which is inclined forwardly, the side walls of the fireplace extending upwardly and rearwardly of the inclined portion of the rear wall of the fireplace to a point as high as the top of the inclined portion of said rear wall, a smoke-receiving and heat-radiating dome above the said fireplace having a front wall, side walls, and a rear wall and communicating with the top of the fireplace by a throat at the bottom of the front wall of said dome, the dome having a bottom wall constituting a smoke shelf located rearwardly of said throat and having its ends supported upon the extended portions of the side walls of the fireplace, an air tube within and extending between the rear and the front walls of the dome, said air tube being generally of inverted V-shape,

the rear edges of the side walls of the tube being connected to the rear wall of the dome and the front edges being connected to the front wall of the dome, the smoke shelf being provided with an opening communicating with the bottom of said tube and the front wall of the dome having an opening between the junction of the side walls of the said tube therewith for the escape of heated air, and the dome being provided with an outlet connection for delivering products of combustion therefrom, means for admitting air at the rear of and in contact with the lower portion of the back of the fireplace and for permitting the same to circulate upwardly beneath the smoke shelf and through the opening therein, and a baffle having a vertical portion spaced from the front of the said dome and extending from a point below the opening in the front wall thereof and also having a rearwardly extending portion the rear edge of which is connected to the front wall of the dome, the baffle being of less width than the width of the upper portion of the housing whereby air delivered thereinto through the opening in the dome may be discharged around the ends of the baffle.

3. In the air-heating apparatus set forth in claim 2, a baffle having a vertical portion located between the rear wall of the fireplace and the rear wall of the housing and extending upwardly from the lower portion of the housing and also having a forwardly inclined portion extending above the forwardly inclined portion of the rear wall of the fireplace, with its upper end adjacent to the rear of the opening in the smoke shelf, a baffle having a vertical portion interposed between and spaced from the rear wall of the housing and the vertical portion of the second baffle and extending upwardly from the lower portion of the housing and having a forwardly inclined upper portion extending above and spaced from the forwardly inclined portion of the second baffle, the rear wall of the dome being inclined rearwardly and upwardly from the bottom thereof to a point in proximity to the rear wall of the housing and the upper end of the third baffle being secured to the rear wall of said dome above the bottom thereof, and a baffle secured at its upper end to the upper portion of the rear wall of said dome and extending in a vertical direction downwardly therefrom and being spaced from the rear wall of the housing with its lower end overlapping and spaced rearwardly from the upper end portion of the third baffle thereby to permit air flowing between the third baffle and the rear wall of the housing to pass in part between the fourth baffle and the rear wall of the dome and in part between the fourth baffle and the rear wall of the housing and thence into the space surrounding the dome.

4. In the air-heating apparatus set forth in claim 2, the extended portions of the sides of the fireplace having openings therein below and adjacent to the ends of the bottom wall of the dome, a vertical baffle interposed between each side of the housing and the adjacent side of the fireplace and extending as high as the opening in such adjacent side, a baffle having a vertical portion interposed between and spaced from the rear walls of the housing and fireplace and having a forwardly inclined portion spaced from the forwardly inclined portion of the rear wall of the fireplace and having its upper edge adjacent to the rear of the opening in the bottom wall of the dome and its upper side edges in proximity to the rear of the openings in the extensions of the sides of the fireplace.

5. In the air-heating apparatus set forth in claim 1, the dome being provided with a pocket comprising a wall extending upwardly from the lower end of the portion of the front wall which forms the front of the throat, a wall extending rearwardly from the top of the upwardly extending wall and a substantially vertical wall extending downwardly from the rear end of the last-mentioned wall to the front of the bottom wall of said dome and in juxtaposition to the upper end of the back of the fireplace, the last three walls forming the bottom of the portion of the airtube which projects forwardly beyond the bottom wall of the dome and the pocket formed by said last three walls being adapted to receive and retain therein the damper when the latter is in its open position.

6. In a metal air-heating apparatus, the combination of an exterior housing having front, rear, side and top walls, a fireplace set within the housing and having sides spaced from the side walls of the housing and having a rear wall the lower portion of which is spaced from and substantially parallel with the rear wall of the housing and the upper portion of which is inclined forwardly, the sides of the fireplace being formed by and between walls extending upwardly to a point as high as and rearwardly of the top of the inclined portion of the rear wall of the fireplace, a smoke-receiving and heat-radiating dome having front, bottom, side and rear walls and positioned above the said fireplace, a throat lying between a wall adjacent the front and top of the fireplace and the front of the bottom of the dome for delivering products of combustion from the fireplace into the said dome, the bottom wall of the said dome being located rearwardly of said throat and constituting a smoke shelf having its ends supported upon the rearwardly and upwardly extending portions of the side walls of the fireplace, an air tube within and extending between the rear and front walls of the dome, said air tube being generally of inverted V-shape and the rear edges of the side walls of the tube being connected to the rear wall of the dome and the front edges being connected to the front wall of the dome, an opening provided in the smoke shelf communicating with the bottom of the said tube, an opening through the front wall of the dome interposed between the junction of the side walls of the said tube therewith for the delivery of heated air from said tube, and the smoke dome being provided with an outlet connection for delivering products of combustion therefrom, and means for admitting air to the interior of the housing and enabling it to circulate upwardly in contact with the back of the fireplace and beneath the smoke shelf and through the opening therein; means for enabling the air to circulate upwardly in contact with the back of the fireplace and beneath the smoke shelf and through the opening therein comprising a baffle interposed between the back of the fireplace and the rear wall of the housing and supported with its lower end adjacent to the bottom of the fireplace, the said baffle extending upwardly from its support and comprising al ower portion which is spaced from and substantially parallel with the rear wall of the fireplace and an upper portion which is inclined forwardly from the lower portion and which is spaced from the upper portion of the rear wall of the fireplace with its upper end in proximity to the rear portion of the opening in

the smoke shelf and having the side edges of its upper portion supported from the rearwardly and upwardly extending portions of the sides of the fireplace, and each of said portions having an opening therein adjacent to the smoke shelf for supplying air therethrough to the opening in said shelf.

7. In a metal air-heating apparatus, the combination of an exterior housing having front, rear, side and top walls, a fireplace set within the housing and having sides spaced from the side walls of the housing and having a rear wall the lower portion of which is spaced from and substantially parallel with the rear wall of the housing and the upper portion of which is inclined forwardly, a smoke-receiving and heat-radiating dome above the said fireplace with its bottom extending substantially the full width of the top of the fireplace, the said dome comprising front and side walls, a rear wall located rearwardly of the top of the rear wall of the fireplace, and a bottom wall constituting a smoke shelf and extending from the rear wall of the dome forwardly to the top of the rear wall of the fireplace, the bottom of the front wall of the dome being spaced forwardly from and extending parallel with the upper end of the fireplace, a substantially vertical smoke hood extending transversely of and downwardly from the front of the fireplace sides, the upper edge of said hood being in substantially the same horizontal plane as the top of the back of the fireplace and the said smoke hood extending the full width of the top of the fireplace, an upwardly and inwardly inclined wall extending from the upper end of the said hood with its upper end located above and spaced forwardly from the upper end of the rear wall of the fireplace to form a throat therewith extending substantially the full width of the bottom of and communicating with the smoke hood in front of said smoke shelf, a damper hingedly supported at one side of the throat and adapted, when

closed, to extend across the said throat, the said damper extending substantially the full length of the said throat, the sides of the fireplace being formed by walls which extend upwardly and rearwardly of the top of the back of the fireplace and into engagement with the bottom wall of and into engagement with the bottom wall of the dome and the dome being provided with an air inlet opening in the bottom wall intermediate of the ends thereof and intermediate of the extended side walls of the fireplace, the front wall of the dome having an air outlet opening therein, an air tube within said dome and extending between and connecting the air inlet opening and the air outlet opening thereby to deliver heated air through said tube and said dome, and a baffle in front of the front wall of said dome and comprising a lower substantially vertical portion extending upwardly from a point below the opening in the front wall of said dome and a rearwardly extending portion engaging the front wall of said dome above the opening therein, the lower portion of said baffle extending across the front wall of the dome and the sides of the baffle being spaced from the side walls of the housing.

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