United States Patent

[11] **3,623,458**

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El Monte, Calif.

[54] **STACKLESS OUTDOOR HEATER ADAPTED FOR SWIMMING POOLS**
17 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** ..... **122/264,** 126/85 R, 126/307 R, 126/350 R
[51] **Int. Cl.** **F22b 15/00,** F23j 11/00
[50] **Field of Search** ..... 126/67, 85, 85 B, 90, 110, 110 B, 116, 307, 307 A, 350, 93; 122/264

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ABSTRACT: The invention is a heating appliance of the stackless type particularly adapted for heating swimming pool water. Openings are provided at the upper part of the appliance for admitting atmospheric air for combustion and allowing it to mix with and dilute flue products before being discharged to keep the appliance cool. Around the upper part of the unit is a baffle member in the form of a collar preventing direct effect of wind velocity on the openings. The heater is provided with an air jacket with openings on one or more sides to admit air for combustion and to admit convection cooling air for keeping the unit cool. The openings are so arranged that when the unit is subjected to wind of various velocities the effect is to produce a controlled forced draft of combustion air which insures expelling the flue products from the unit. Baffling is provided to prevent access of driving rain into the flue products area and into the air jacket.

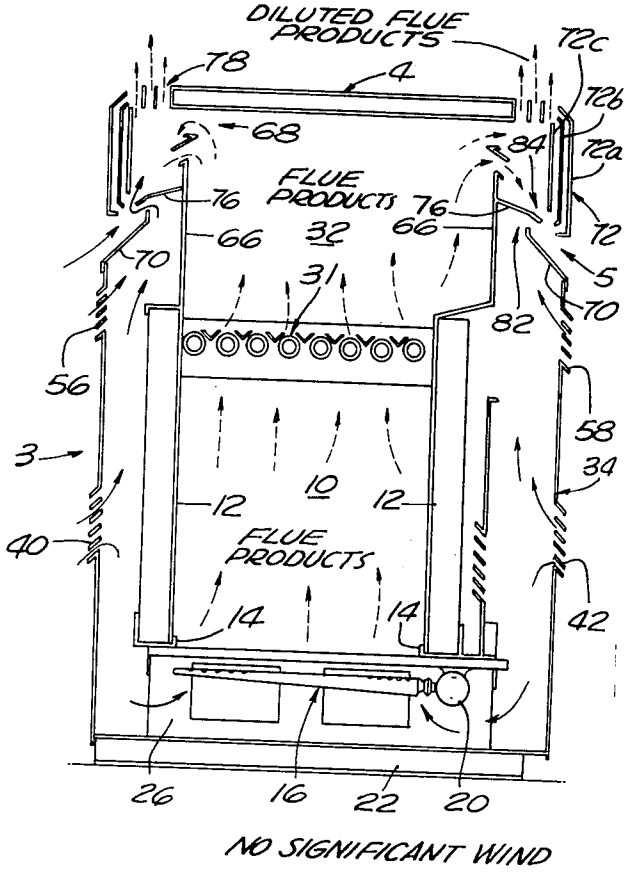


FIG. 1.

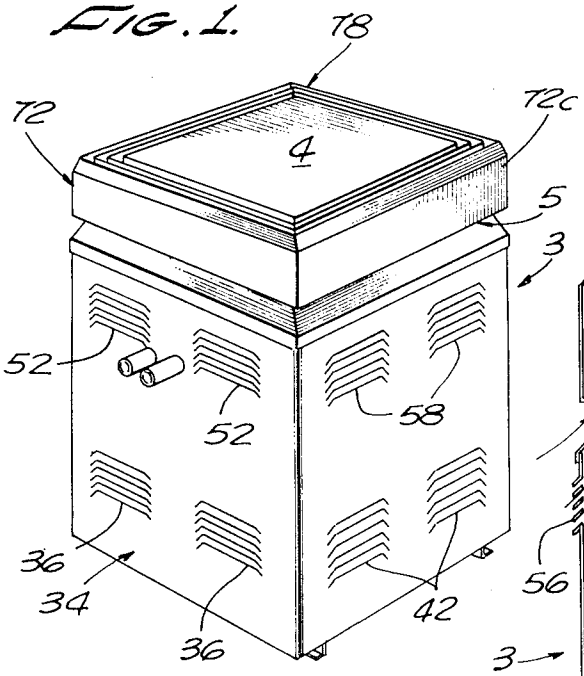
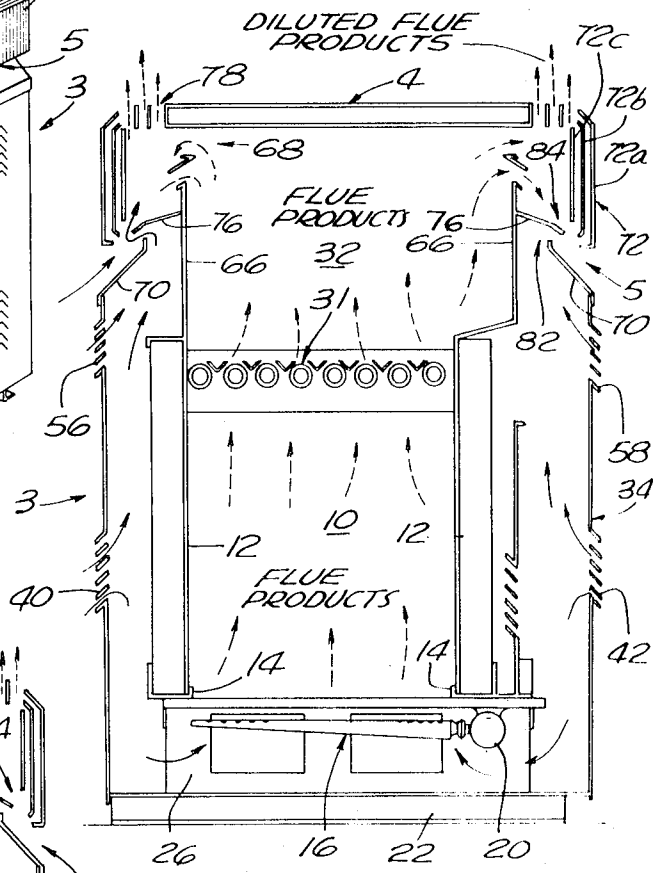


FIG. 2.



NO SIGNIFICANT WIND

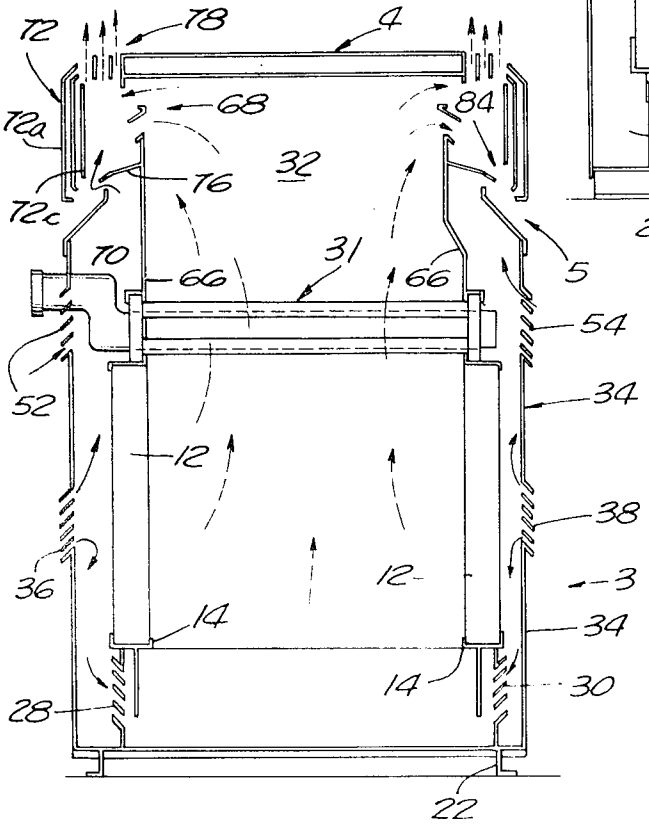


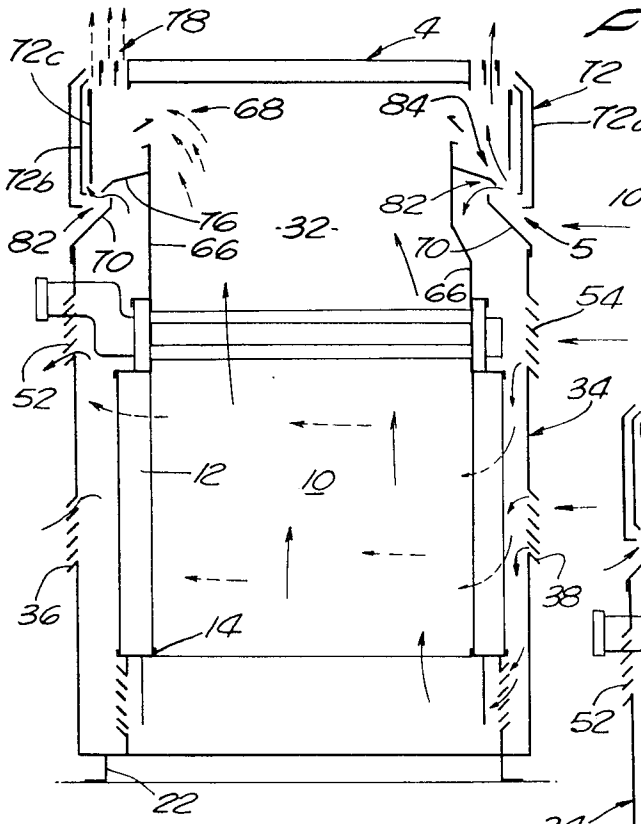
FIG. 3.

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FIG. 4.



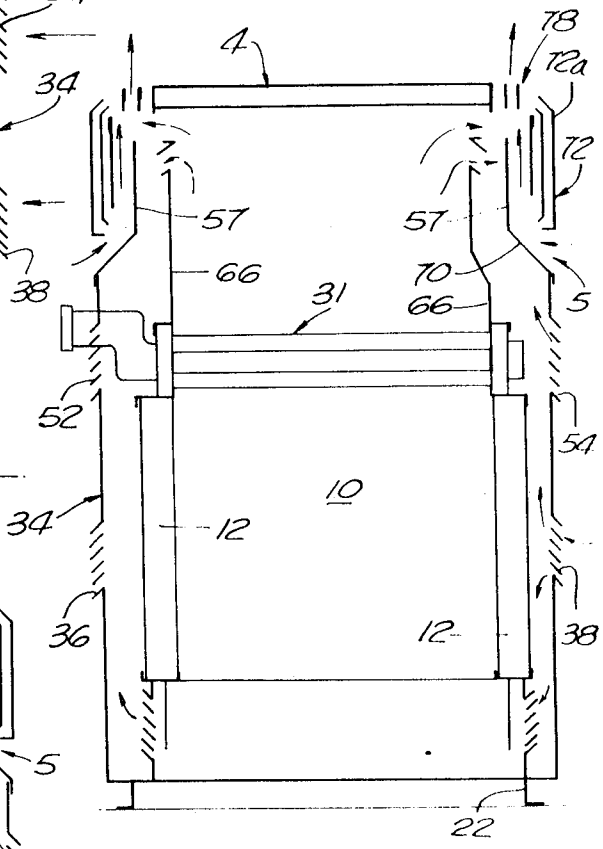


FIG. 6.

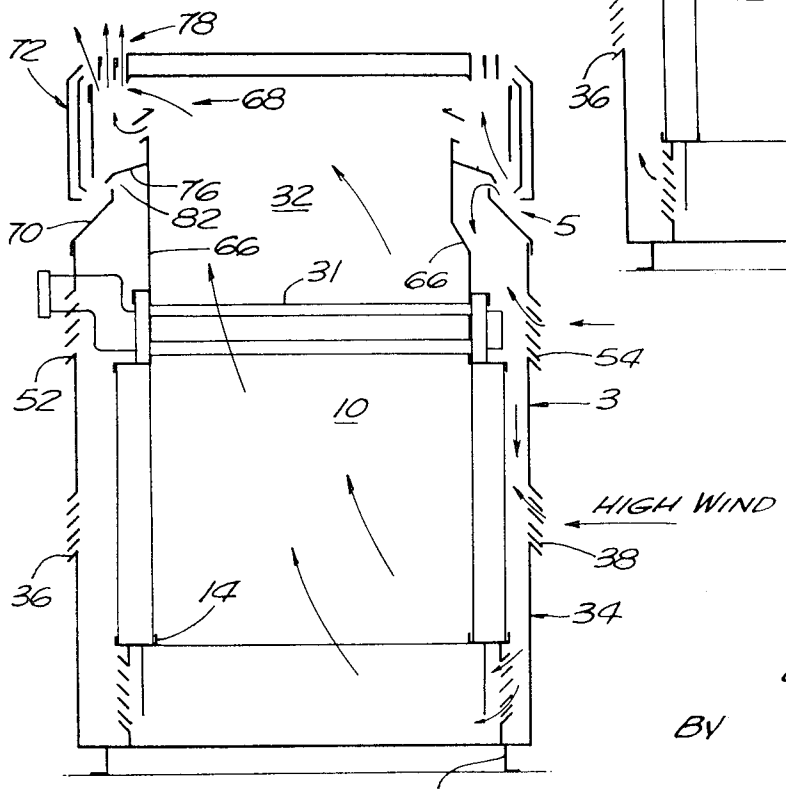


FIG. 5.

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FIG. 7.

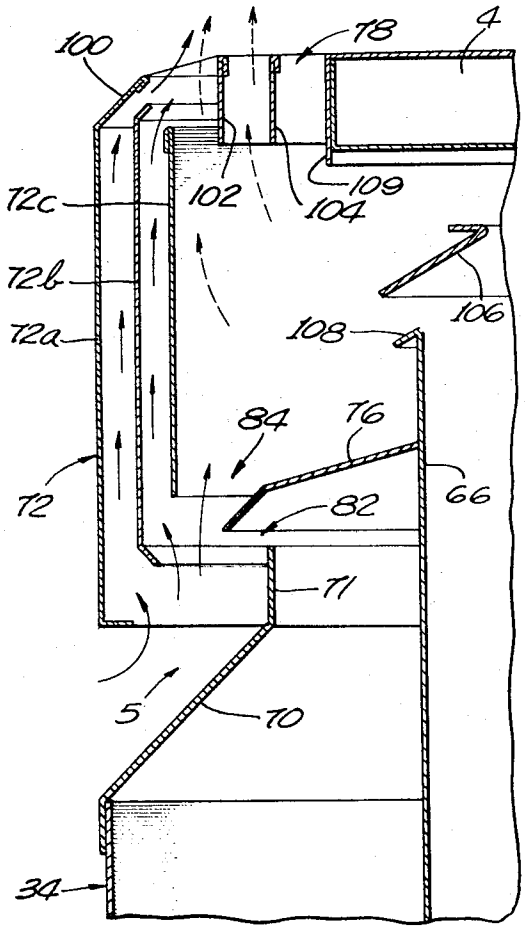
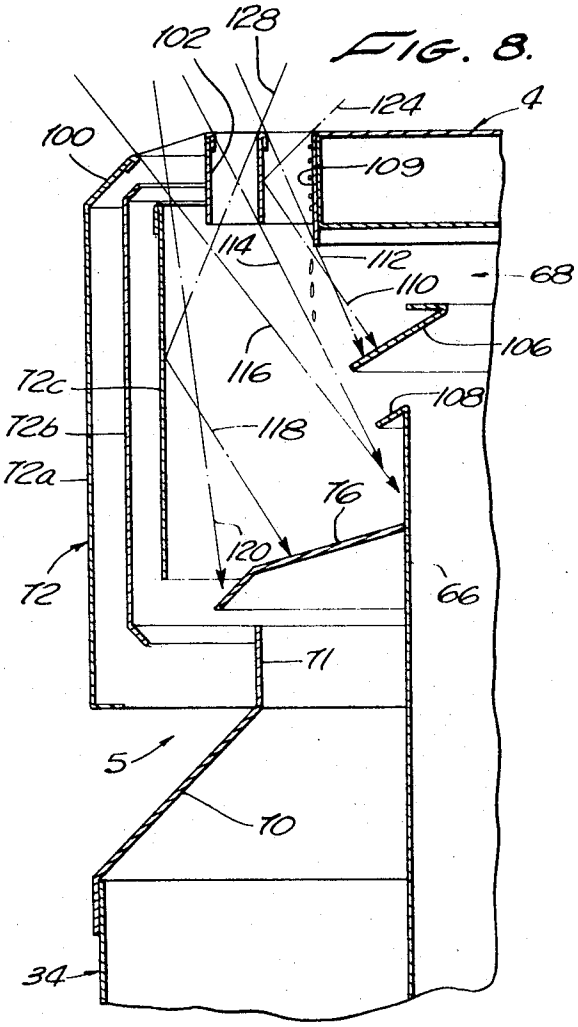


FIG. 8.



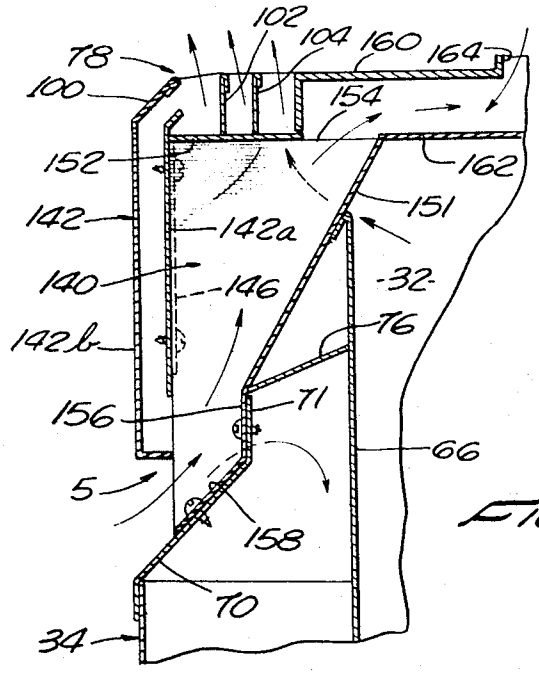


FIG. 9.

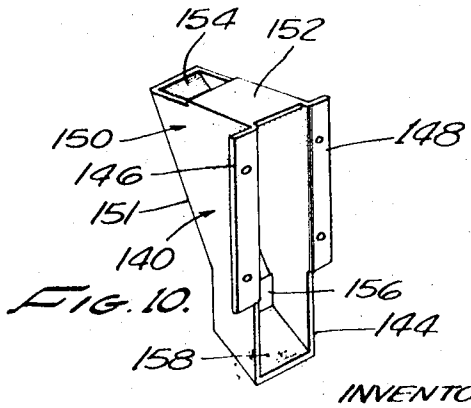


FIG. 10.

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STACKLESS OUTDOOR HEATER ADAPTED FOR SWIMMING POOLS

SUMMARY OF THE INVENTION

The invention is a heater for outdoor use, more particularly adapted for heating swimming pool water, although it could be adapted to other types of utilization.

A primary feature of the heater is that it is stackless and is constructed to be pleasing in design and appearance.

Significant in the construction of the invention is that it embodies all of the necessary characteristics whereby to meet the requirements of and approval of the American Gas Association. Among such characteristics are, of course, those of safety, which include that the heater must be able to operate while remaining within external temperature limitations. The heater must of course be capable of operating over a relatively wide range of wind and weather conditions, having reference to wind velocity and direction of driving rain, etc.

The primary object of the invention is to meet the foregoing basic requirements in an efficient, practical and economical way, as well as to provide further improvements whereby further specific objectives are realized. The specific nature of the invention and the manner in which the objectives are realized are made clear in the detailed description of preferred forms of the invention herein.

The specific objectives of the invention as embodied in a heater of this type are the following:

To provide a stackless water heater having the capability of maintaining a limited external temperature.

To utilize the principle of having openings for incoming combustion air adjacent to outlet openings for flue products, with the improvement of baffle means to protect these openings from the direct effect of wind velocity.

To improve the control of temperature of the heater by providing for mixing of inlet air with outgoing flue products, and by induced convection flow of air.

To provide for improved operation under variable wind conditions by means of baffles and louvred openings in the jacket of the heater whereby to produce a limited forced draft under increasing wind conditions and to limit the amount of induced forced draft under more excessive wind conditions.

Another object is to provide means to insure the evacuation or expelling of flue products from the heater under variable wind conditions.

Another object is to provide means to create a venturi effect to insure evacuation of flue products.

Another object is to provide for baffle arrangements in a heater of the type described to insure that even under conditions of driving rain, significant water or moisture will not be allowed to enter the combustion and heating area or the air jacket of the heater.

Further objects and additional advantages of the invention will become apparent from the following description and annexed drawings, wherein:

FIG. 1 is a perspective view of a preferred form of the invention;

FIG. 2 and 3 are the side and front views respectively of the preferred form of the invention, with arrows indicating the movement of air and flue products under conditions of no significant wind;

FIG. 4 is a similar schematic view of the same form of the invention, with arrows indicating the flow of air and flue products under conditions of wind of approximately 10 miles per hour;

FIG. 5 is a similar schematic view of the same form of the invention, with arrows indicating the flow of air and flue products under conditions of relatively high wind;

FIG. 6 is a sectional schematic view of a modified form of the invention, wherein baffles are provided to produce a venturi effect to assist in evacuating the flue products area;

FIG. 7 is a detail cross-sectional view showing the baffling arrangement whereby the openings are protected from the direct velocity of the wind;

FIG. 8 is a detail sectional view like that of FIG. 7, showing how driving rain is prevented from entering the appliance by the baffling arrangement;

FIG. 9 is a detail sectional view of a modified form of the invention, wherein the outer collar is supported by brackets which provide combined support brackets and air ducts;

FIG. 10 is a detail perspective view of one of the bracket-air ducts of FIG. 9.

Referring now more particularly to FIGS. 1 through 5 of the drawings, these figures are a perspective view and front and side views of a preferred form of the heater, and schematic views with arrows indicating the different operation under different conditions of wind.

The heater, or "boiler" is shown generally at 3, being rectilinear, having a flat top 4. Front, back and side louvre openings are provided as will be described. Numeral 5 designates a peripheral air intake opening which will be referred to more in detail presently.

Numeral 10 designates a combustion chamber having sidewalls 12 of typical heat and flame resistant material supported in the support frame or members 14. At the lower part of the combustion chamber are the burners 16, and this may be typically a gas burner, connected to a gas manifold 20. The base of the heating unit or appliance is designated at 22. A shield or jacket is provided around the combustion zone as designated at 26, it having louvres as shown at 28 and 30 for admission of combustion air.

At the upper part of the combustion area is the water heating unit comprising tube bundle 31.

Surrounding the combustion chamber, flue products collector 32, and water heating unit is a jacket or shroud 34, which is spaced outwardly as shown from the combustion zone and flue product area. In the sides of this jacket, spaced downwardly from the upper part thereof are louvre openings 36 and 38. Similar louvre openings 40 and 42 are provided at the front and back at the same level. The jacket 34 extends upwardly to a point above the tube bundle 31 to an intermediate point relative to the flue product area 32, which is above the tube bundle or water heating unit 31.

In the sides of the jacket 34 toward the upper part of the wall are additional louvred openings 52 and 54 and similar louvred openings 56 and 58 are provided in the front and back of the jacket.

The heater unit or appliance has a top 4 as referred to which is flat as shown. Above the tube bundle 31 and combustion chamber sides 12 is a sidewall or baffle structure 66, the top edges of which are spaced below the top 4. These walls enclose the flue product area 32 and provide for the flue product outlet 68 adjacent to the flat top 4.

At the top of the jacket 34 the walls taper inwardly, as designated at 70, completely around the upper part of the appliance and there is a collar or baffle 72, preferably comprising spaced vertical walls 72*a*, 72*b*, and 72*c*, for a purpose which will be described more in detail presently. The lower edge of the collar 72 is below the level of the upper edges of the inwardly tapering surfaces 70 of jacket 34. The outside of this collar preferably is flush with the outside of the jacket 34, and the upper edge of this collar is spaced from the periphery of the top 4 as shown.

Adjacent to the top edge of the tapering surface 70 is a baffle 76 that extends out from the flue product chamber wall 66 and depends downward to a position adjacent to but spaced from the top edge of the tapering surface 70. It will be observed that the collar 72 forms a peripheral opening between itself and the top 4 which is an outlet opening of the flue products, as designated at 78. The space between the bottom of the collar 72 and the tapering surface 70 provides an opening which is the opening 5, FIG. 1. The space between the tapering surface 70 and the baffle 76 provides an air opening at 82 and the space between baffle 76 and the collar 72 provides an air opening 84. Collar 72 prevents direct effect of wind velocity on openings 5 and 78. It may be extended further downward to a position below opening 5.

Next will be described the operation of the unit or appliance under conditions of no significant wind; limited wind conditions of approximately 10 miles per hour, for example; and conditions of relatively high wind.

NO SIGNIFICANT WIND

The airflows are indicated by the arrows in FIGS. **2** and **3**. Combustion and circulating air enters through the baffled openings **36**, **38**, **40**, and **42**. Combustion airflows downwardly to enter the combustion area to mix with the gas for combustion. The remaining air entering through these louvred openings flows upward within the jacket **34** by convection. The importance of the louvred openings **36** to **42** should be appreciated. In prior structures provided only with combustion area inlet openings at an upper level, these structures suffered from the disadvantage that the incoming air coming in contact with hot surfaces had a tendency to flow upward not downward, thus reducing the available draft and reducing heater capacity. This drawback is overcome in the structure of FIG. **3**. Outside air also enters through the louvred openings **52**, **54**, **56**, and **58**, which mixes with the convection air arising inside of the jacket **34**, and this combined air moves upwardly to the opening **82**, where it mixes with outside air entering through the opening **5**, and these combined flows then move upwardly inside of the collar **72**, mixing with and diluting and cooling the combustion products flowing out through the opening **68**. These combined flows then exit through the opening **78**. Thus, it may be observed that under conditions of no significant wind, appropriate air is admitted for purposes of combustion. The convection air flowing upwardly within the jacket **34** is operative to keep the appliance cool. This convection flow mixes with additional outside air coming in through the openings, further contributing to the cooling effect. The dilution of the flue products with these combined convection and inlet airflows maintains the upper area of the appliance cool, and this cooling effect is contributed to by the convection flows between the spaced sidewalls **72***a*, **72***b*, and **72***c* of the collar **72**. This is illustrated more in detail in FIG. **7**.

By making the horizontal dimension of the collar **72** greater, insulation may be used in this element to further contribute to the desired effect of limiting temperature, although it is preferred to utilize the construction shown in which the horizontal dimension of the structure is lessened.

LIMITED WIND CONDITIONS

FIG. **4** illustrates the airflow and the operation of the unit under conditions of limited wind of, for example, 10 miles per hour. It should be realized that it is necessary that the flue products can be evacuated from, that is, expelled from the unit under all conditions of wind. As shown in FIG. **4**, with the wind coming from the right, the air enters through the opening **5** and is diverted by the baffle **76** and the enclosing wall **66**, so that part of it now tends to flow downwardly within the jacket **34**, to produce a limited forced draft sufficient to insure that the flue products will be expelled from the flue product area. As will be observed in FIG. **4**, with the wind coming from the right some air discharges from openings **52** and **36** on the opposite side. Discharge of flue products is mainly from opening **78** at the opposite or leeward side but nevertheless the unit is maintained at a desired exterior temperature.

HIGH-WIND CONDITIONS

FIG. **5** illustrates the flows under high-wind conditions. It should be appreciated that in typical conventional prior art appliances of this general type, the combustion air inlet opening must be considerably larger than the flue product opening to insure that the wind that enters through the combustion air opening will drive the flue products out of the unit against the prevailing wind. This has resulted in an appliance that was extremely high, and the openings presented an unsightly appearance. Further the openings often must be covered with expanded metal or wire mesh to prevent birds from building nests in these areas. This reduces the net area and makes the problem more complex and detracts from the appearance. In these conventional structures the large openings allow the unit to be susceptible to variations of wind velocity. All of these drawbacks are overcome in the herein invention and advantages are gained as will become apparent.

Referring to FIG. **5**, the louvres perform an additional function. Some of the air entering through the opening **5** is diverted downwardly as previously described in connection with the operation at limited wind condition. Under high wind the louvre openings **36** through **40** and **52** through **56** divert some of the entering air into a vertical direction. This upward flow of air tends to counter some of the downward flowing air through the upper opening **5** and this prevents an abnormal amount of airflow delivered to the burner while still maintaining a balance between entering air and flue product discharge so that it is insured that the flue products are evacuated from the flue product area.

MODIFICATION - FIGURE 6

Referring to FIG. **6** this figure shows a modified form of the invention which does not have the opening **82** between the tapered surface **70** and baffle **76**. Extending upwardly from the inner edge of baffle **70** is a continuous upright baffle member **57**. Wind entering through the upper opening **5** now moves upwardly between the baffle member **57** and the inner baffle member **72***a* forming a nozzle or venturi effect which produces a negative pressure on the inboard or inward side of the baffle member **57** which serves to evacuate the flue products from the flue product area and to discharge them through the opening **78**. In this form of the invention combustion air is provided through the louvre openings **36** through **40** and **52** through **58** and forced draft such as described in connection with FIGS. **4** and **5** is created by means of the nozzle or venturi as described to insure that the flue products are expelled from the flue product area and evacuated from the appliance.

FIGS. **7** and **8** are partial detail views showing the structure at the upper end of the appliance. Baffling is provided to prevent driving rain from entering the unit and having access to the flue product area or to the jacket area. It will be noted that at the upper end of the wall **72***c* there is an inwardly tapered surface **100**. In the opening **78** surrounding the top **4** are provided the vertical baffle members **102** and **104**. Positioned in the flue product area or zone is a splitter baffle **106** which is above the upper edge of the flue product area wall **66** as shown. An outwardly depending flange or lip **108** is provided at the upper edge of the wall **66**. Depending from the lower edge of the top wall **4** around its periphery is a flange or lip **109**. This baffling arrangement is such that even in a driving rain the water cannot gain access to the flue product area or the area within the jacket **34**. This result is illustrated by the geometry of the baffling arrangement made clear by the lines **110** through **128**, FIG. **8**. These lines demonstrate that downcoming rain, whether coming straight down, or at any angle to the baffles **102** and **104** will strike baffle surfaces so that it is deflected from the flue product area and the area within the jacket **34**. As can be observed, any rainfall coming straight down will be deflected by the baffle surface **76**. Rainfall coming at an angle will be deflected by baffles **102** and **104**, or lip **109** so as to be further deflected by baffle **106**, vertical wall **66**, baffle **76** or baffle member **72***c*. The lip **109** forms a drip lip so that water dripping from the top members **4** is prevented from dripping into the flue product area.

FIGS. **9** and **10** show a modified form of the invention wherein the upper or outer collar is supported by brackets which are combined collar supports or support brackets, and cooling air ducts, i.e., the brackets themselves form cooling air ducts as will be described. FIG. **9** is a cross-sectional view showing one of the support brackets in position supporting the collar and FIG. **10** is a perspective view of one of the brackets. The combined bracket and cooling air duct shown in FIG. **10**

is designated generally by the numeral **140**, the collar being designated at **142**. The collar may be supported by eight of the brackets **140** for example, two on the front, back, and on each side of the unit. The outer face or edge **144** of the bracket is rectangular as shown having extending mounting flanges **146** and **148** by which baffle member **142***a* may be attached by screws as shown in FIG. **9**. The bracket member **140** has an inner part which tapers to become deeper as designated at **150**. The bracket has a top **152** and a top opening **154**. The bracket has a vertical inner side as may be seen at **156** in FIG. **9** and another tapered or slanting surface **158** as may be seen in FIG. **9**. The combined bracket and duct is installed as shown in FIG. **9** with the slanted surface **158** juxtaposed against the surface **70** and attached thereto and with the vertical surface **156** juxtaposed against the upright end part **71** of surface **70** and secured thereto. The baffle **76** fits against the inner surface of bracket **140** at the lower end of the slanted surface portion **151** as shown and this surface abuts against the upper bent over edge of the enclosing wall **66** as shown.

The airflows and flows of products of combustion are as shown in FIG. **9**. Referring to the air that can enter through the opening **5**, some of this air can pass between the brackets **140** and it can enter into the space within the jacket **34** as shown in FIG. **9**. Part of this air can pass through the interior of the duct forming brackets **140** as shown by the arrows and it can pass up through the openings **154** into a space between double walls **160** and **162** and then it can pas out of a stack **164**. Thus this air serves to cool the top of the unit.

Part of the air coming in through opening **5** can also pass up between the baffle members **142***a* and **142***b* for assisting in keeping the upper part of the unit cool.

The flue products from the area **32** can pass between the air duct brackets **40** as shown by the arrows and then can pass out through the opening **78** between baffles **102** and **104** as previously described. Some of the air entering through the opening **5** as will be observed, as in previous embodiments, can mix with flue products to dilute them and cool them as they pass upwardly and out through the opening **78**.

From the foregoing those skilled in the art will readily understand the nature and construction of the invention, its operation and the manner in which it achieves and realizes all of the objectives and advantages as set forth in the foregoing as well as the many additional advantages that are apparent from the detailed description.

The foregoing disclosure is representative of preferred forms of the invention and is to be interpreted in an illustrative rather than a limiting sense.

What is claimed is:

1. A heating appliance having a combustion chamber, a flue products chamber and fluid heating unit, the appliance having first openings near the upper part thereof for admitting air into the appliance and having other openings near the upper part thereof for discharge of flue products and means including an imperforate top portion of said appliance providing passageways connecting at least some of said first openings and said other openings whereby some of said air mixes with and dilutes said flue products.

2. A structure as in claim **1**, including an air jacket on said appliance and passageways for admitting combustion air into said jacket, through said first openings.

3. A heating appliance having a combustion chamber, a flue products chamber and fluid heating unit, the appliance having first openings near the upper part thereof for admitting air into the appliance and having other openings near the upper part thereof for discharge of flue products and passageways connecting at least some of said first openings and said other openings whereby some of said air mixes with and dilutes said flue products, an air jacket on said appliance and passageways for admitting combustion air into said jacket, through said first openings, and openings positioned at the lower part of said jacket for admitting air thereto, whereby convection air rises in the jacket and mixes with entering air and flue products.

4. A structure as in claim **3**, said lower openings being positioned to provide for controlled forced draft of combustion air downwardly in the jacket under conditions of limited or high wind to which the appliance is exposed.

5. A structure as in claim **4**, including additional openings in the said jacket intermediate the first openings and the lower openings whereby to assist in the control of the forced draft for combustion under wind conditions by producing controlled downward movement of combustion air within the jacket.

6. A structure as in claim **2**, wherein the said openings in the jacket are provided on all sides thereof.

7. A structure as in claim **2**, wherein the said openings for discharge of flue products are in the top of the heater, and means whereby to prevent driving rain from having access to the flue products chamber and to the inside of the jacket.

8. A structure as in claim **7**, said last-named means including baffles positioned to deflect the rain.

9. A fluid heating appliance as in claim **1** comprising baffle means adjacent to said first openings to protect them from the direct velocity of the wind.

10. A structure as in claim **9**, wherein said baffle means is in the form of a collar around the upper part of the appliance.

11. A structure as in claim **10**, wherein said collar comprises spaced vertical walls providing passageways for vertical movement of convection air for keeping the upper part of the appliance cool.

12. A structure as in claim **10**, including brackets supporting said collar, said brackets being constructed to form air ducts adapted to carry cooling air upwardly to be discharged through openings in the top of the appliance.

13. A structure as in claim **12**, the brackets providing channels between them, and means providing openings to admit air to the said channels to mix with and dilute products of combustion.

14. A structure as in claim **1**, including baffle means positioned adjacent to the uppermost of said first openings whereby to create a flow of air producing a venturi effect in a manner to create a negative pressure serving to evacuate flue products from the flue product area of the heater.

15. A heating appliance having a combustion chamber, a flue products chamber and fluid heating unit, the appliance having first openings near the upper part thereof for admitting air into the appliance and having other openings near the upper part thereof for discharge of flue products and passageways connecting at least some of said first openings and said other openings whereby some of said air mixes with and dilutes said flue products, baffle means adjacent to said first openings to protect them from the direct velocity of the wind, said baffle means comprising spaced walls forming passageways for convection air for cooling the upper part of the appliance.

16. A heating appliance having a combustion chamber, a flue products chamber and fluid heating unit, the appliance having first openings near the upper part thereof for admitting air into the appliance and having other openings near the upper part thereof for discharge of flue products and passageways connecting at least some of said first openings and said other openings whereby some of said air mixes with and dilutes said flue products, the appliance having a flat top, said other opening being at peripheral edges of the top.

17. A structure as in claim **16**, comprising a collar extending around the upper part of the appliance, said first openings being formed at least in part by said collar.

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