April 23, 1957 C. H. MORROW 2,789,555

DRAFT HOOD

Filed July 26, 1952 2 Sheets-Sheet 1

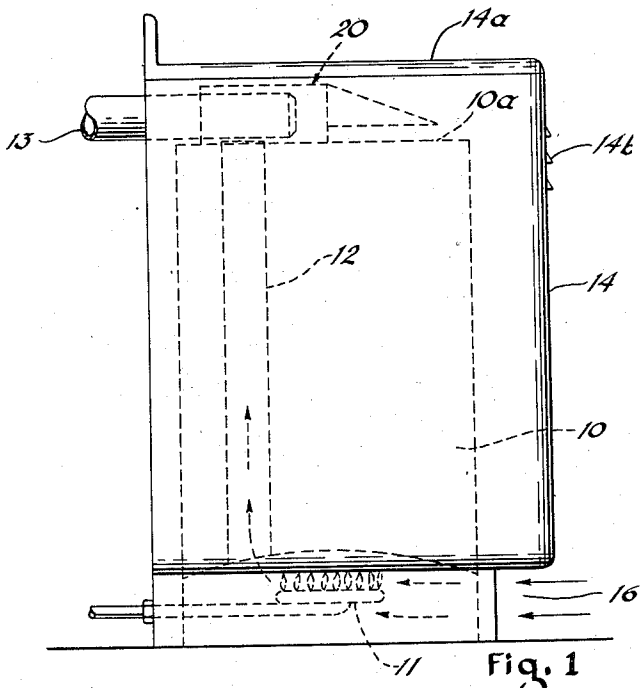


Fig. 1

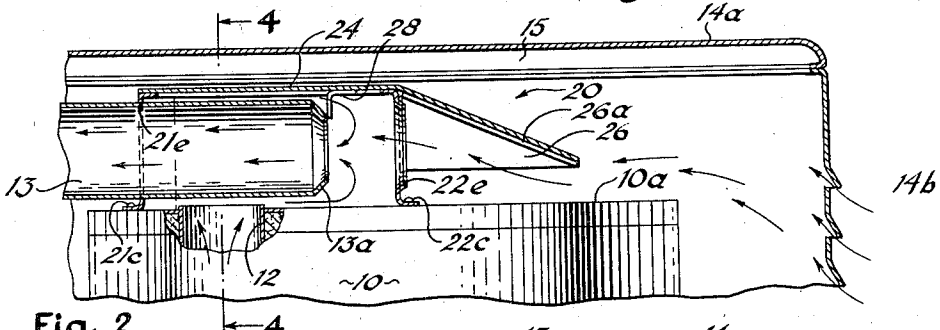


Fig. 2

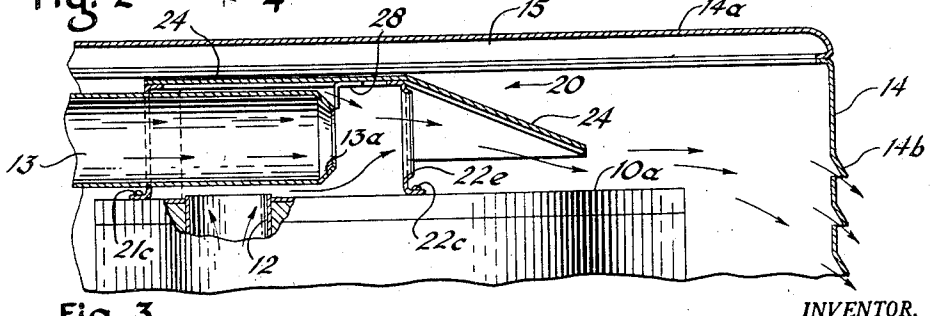


Fig. 3

INVENTOR.
Clarence H. Morrow
BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

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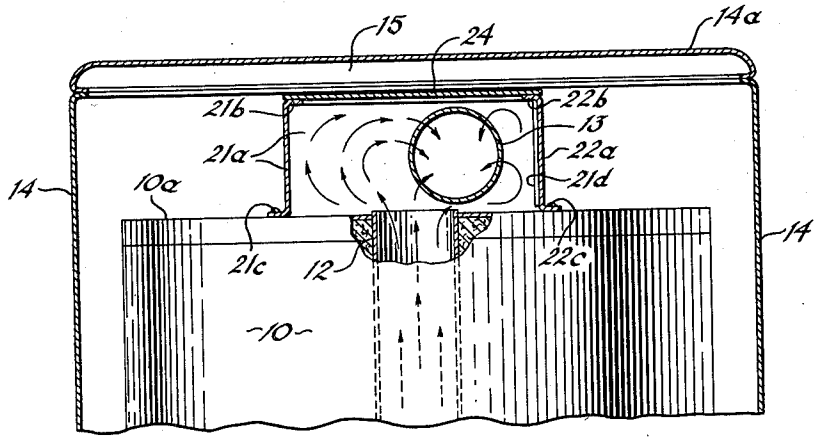


Fig. 4

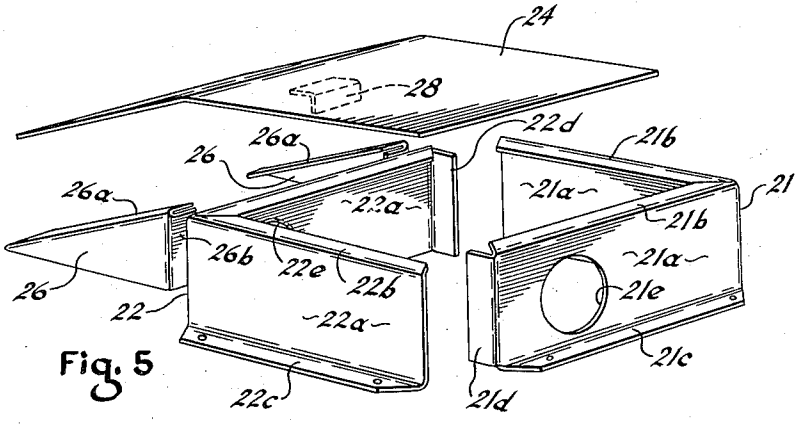


Fig. 5

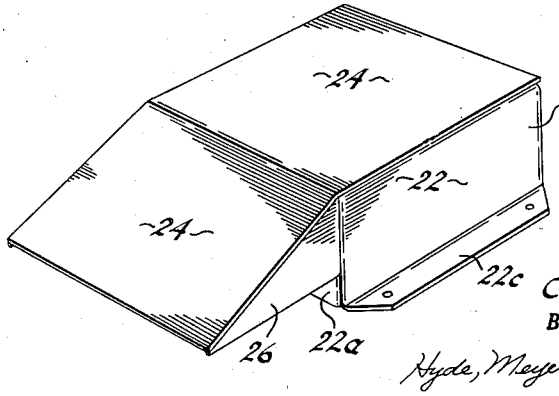


Fig. 6

INVENTOR.
Clarence H. Morrow
BY
Hyde, Meyer, Baldwin & Dorsan
ATTORNEYS

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2,789,555

DRAFT HOOD

Clarence H. Morrow, Shaker Heights, Ohio, assignor to The Hotstream Heater Company, Cleveland, Ohio, a corporation of Ohio

Application July 26, 1952, Serial No. 301,121

3 Claims. (Cl. 126—307)

This invention relates to improvements in a draft hood and more particularly to a draft hood of the injector type.

One of the objects of the present invention is to provide a draft hood having a means for utilizing downdraft to withdraw the products of combustion from a heater flue such as the flue of a gas-fired water heater.

A further object of the present invention is to provide an injector draft hood for a hot water heater characterized by its operating efficiency, structural simplicity and compact design for fitting in a confined space.

Other features of this invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Other objects and advantages of this invention will be apparent from the accompanying drawings and description and the essential features will be set forth in the appended claims.

In the drawings,

Fig. 1 is a side elevational view of a table-top hot water heater with, in dotted lines, a gas-fired water heating compartment, draft hood, and flues therein;

Fig. 2 is an enlarged vertical sectional view taken through the draft hood and flues in the upper portion of the water heater in Fig. 1 and showing the normal flow of the combustion products of the gas-fired heater, as caused by the normal chimney updraft;

Fig. 3 is a vertical sectional view, similar to Fig. 2, showing how a downdraft through the chimney flue will cause the injector draft hood to suck the flue gases from the heater flue;

Fig. 4 is a vertical sectional view taken along the line 4—4 of Fig. 2 portraying by arrows the flow of flue gases from the heater flue;

Fig. 5 is an exploded view of the draft hood wall structure; while

Fig. 6 is a perspective view of the draft hood wall structure removed from the water heating compartment normally forming its lower face.

Before the draft hood here illustrated is specifically described, it is to be understood that the invention here involved is not limited to the structural details or arrangement of parts here shown since draft hoods embodying the present invention may take various forms. It also is to be understood that the phraseology or terminology herein employed is for purposes of description and not of limitation since the scope of the present invention is denoted by the appended claims.

While the draft hood of the present invention might be adapted to various types of heater unit flues or of flow passages, I have chosen to show the same as applied to a table-top gas-fired hot water heater where the draft hood must be fitted in a small space. The draft hood can be used equally advantageously in other units where space requirements make necessary a compact draft hood for use in a confined space.

A hot water heater may be found in the modern household kitchen instead of in the basement. This is especially true if the house is small and has no basement. Also, some automatic dishwashers require more and hotter hot water so that a hot water heater in the kitchen is very desirable. Also, in a kitchen, additional table-top working space is always desirable. This situation has led to the design of the table-top, gas-fired, hot water heater to serve as one of the component units harmonizing with or fitting in with the other component units in the modern kitchen, such as the stove, cupboards, sink, etc. However, the construction of this table-top hot water heater has been difficult to develop since the hot water heater must have ample water heating capacity, must be a compact completely self-contained unit, must be of attractive design, and must have its top located at table-top height while enclosing all of the component parts of the water heater.

Fig. 1 is a side elevational view of the table-top hot water heater showing the water heater heating compartment at **10** heated by an under-fired gas heating unit **11**. These parts are surrounded by an enclosing cover on at least three sides (front and the two adjacent sides thereto) and the top with the top work surface **14***a* serving as a table-top surface located at the convenient working height of about 36 inches from the floor. The bottom of the cover **14** is spaced above the floor so that the incoming air to the gas heating unit **11** will flow in the direction of the arrows through air inlet **16** to provide the flame with proper aeration, and then the combustion products will rise upwardly through the heater flue **12**, extending upwardly through the compartment and through the compartment top wall **10***a*. In normal flow, the combustion products will be pulled upwardly by a chimney draft from the heater flue **12** through the draft hood **20** up into the chimney flue **13** and then out through the chimney itself, as shown in Fig. 2.

The enclosing cover **14** also has louvers **14***b* on its front surface which will be described in more detail later in the specification and has a space **15** for holding insulation so that the heat from the water heating compartment **10** will not unduly heat up the table-top work surface **14***a*.

The draft hood, generally shown at **20**, is especially designed for fitting within the confined space between the water heating compartment top **10***a* and the table-top work surface **14***a* so that the table-top hot water heater is a complete unit in and of itself without any unsightly appurtenances thereto. This draft hood **20** also has another feature. During normal flow of the combustion products, the chimney draft will cause them to move upwardly through the heater flue **12**, the draft hood **20** and the chimney flue **13**, as shown in Fig. 2. However, when a downdraft occurs with the air moving in the opposite direction through the chimney flue **13**, as shown in Fig. 3, the draft hood **20** will act like an injector, ejector or jet pump, if properly designed, for drawing the combustion products out of the burner flue **12** with a suction equivalent to that caused by a chimney draft during normal flow. The downdraft will not impede the upward flow of hot combustion gases through the burner flue **12** and will not tend to smother the gas flame but instead it will suck out the combustion products so that the gas heating unit **11** is properly aerated.

The draft hood **20** is shown in Fig. 5 as including a box-like structure formed from die-cut, stamped plates. The box structure has two side plates **21** and **22** bent to form respectively side walls **21***a*, **21***a* and **22***a*, **22***a*. The respective side walls have inwardly bent top flanges **21***b* and **22***b* and have outwardly bent bottom flanges **21***c* and **22***c*. One of said side walls **21***a* and **22***a* on each side plate has inwardly bent end flanges **21***d* and

22*d* respectively. A top plate 24 is welded or otherwise secured to the top flanges 21*b* and 22*b* while the end flanges 21*d* and 22*d* are welded or otherwise secured to the adjacent side wall on the other side plate. The bottom flanges 21*c* and 22*d* are secured to the top surface 10*a* of the water heating compartment 10 which in turn forms the closing or sixth side of the box structure surrounding the lower end of the chimney flue 13 and the upper end of the burner flue 12.

The flues 12 and 13 have their ends located within the box structure in fluid communication with each other. The chimney flue 13 extends through aperture 21*e* in the side plate 21 and butts up against a locating lug 28 welded or otherwise secured to the top plate 24 (Fig. 2). The end of the chimney flue 13 extending within the draft hood has a chamfered end 13*a* forming an aperture smaller than the inside diameter tubular flow passage through said chimney flue 13. The flues 12 and 13 have their ends contained within the draft hood angularly disposed with respect to each other (not coaxially or parallel aligned). They are shown as being at right angles to each other in the present disclosure not only for compactnes to fit within the small space between the top 10*a* and the table-top surface 14*a* but also to provide a good injector design. It should be noted that the lower chamfered end 13*a* of the chimney flue is spaced downstream or to the right with respect to the normal gas flow (Fig. 2) in said chimney flue 13 from the upper end of the heater flue 12, and the two flues may be designed, as shown in Fig. 4, to have the gas flow emerging from heater flue 12 to impinge against the side of the chimney flue 13 without having the gas flow blocked so that good injector action takes place.

The draft hood 20 has another aperture 22*e*, bell-mouthed in form, in the side plate 22 aligned with but spaced from the lower chamfered end 13*a* of the chimney flue 13. The flow cross sectional area of this aperture 22*e* is larger than that of the lower chamfered end 13*a* of the chimney flue. Of course, the upper end of the heater flue 12, as shown in Figs. 2 and 3, is in fluid communication with the space between the chamfered end 13*a* of the chimney flue and the aperture 22*e* so that good injector action can take place.

When a downdraft occurs and the gases move in the direction of the arrows in Fig. 3, the air from the downdraft must be thoroughly mixed with the combustion product gases before being permitted to enter the room. A portion of the top plate 24 is downwardly inclined toward the right in Fig. 3 to form a deflector plate with enclosing spaced and inclined side walls 26, 26, which are mirror images of each other, secured to the top plate 24 by inwardly directed top flanges 26*a*, 26*a* (Fig. 5) and secured to one of the side walls 22*a* by inwardly directed edge flanges 26*b*, 26*b*. It should be noted that the lower distal edges of the deflector plate and of the inclined side walls 26, 26 are spaced above the heating compartment top 10*a* so that the gases flowing in the direction of the arrows in Fig. 3 can flow outwardly to the right through this escapement and then leave the table-top hot water heater through the louvers 14*b* for dissipation into the surrounding air.

The operation should now be readily apparent. During normal flow, the gases move in the direction of the arrows in Figs. 1 and 2 under the influence of the suction created by the chimney draft in the chimney flue 13. The incoming air moves through the air inlet 16 to properly areate the gas flame of the heating unit 11. The combustion products are carried upwardly through the heater flue 12 into the injector draft hood 20. If any excess air is needed to satisfy the chimney pull, it will readily flow in through the louvers 14*b* into the draft hood 20, and then the excess air along with the combustion products will move to the left in chimney flue 13 and out the chimney. This structural relationship of the parts will assure that the heating unit 11 is properly areated so that the carbon dioxide in the flue gases in burner flue 12 will be about 7½ to 8%, the normal amount for satisfactory combustion.

When the occasional downdraft occurs, the gases will flow in the direction of the arrows in Figs. 1 and 3 and there will be no tendency to smother the gas flame in the heating unit 11 or to impede the upward flow of hot gases through the burner flue 12. The occasional downdraft will cause a reverse flow of air downwardly through the chimney and to the right in the chimney flue 13. As this air passes through the aperture created by the chamfered lower end on the chimney flue 13 and travels over to the bell-mouthed aperture 22*e*, it will suck the flue gases containing the combustion products from the heater flue 12 by the conventional injector principle. The air in the downdraft will thoroughly mix with the combustion products to eliminate any odor therefrom and will be deflected outwardly through the louvers 14*b* in the direction of the arrows of Fig. 3.

When the relative proportions of the injector parts are proper, the suction on the combustion product gases in the heater flue 12 will always remain approximately constant under either normal flow or reverse flow so that the aeration of the gas-fired heater 11 will remain approximately constant and the percentage of carbon dioxide in the gases in heater flue 12 will remain approximately constant for optimum combustion efficiency. As mentioned before, the carbon dioxide should be about 7½ to 8% for normal, satisfactory combustion. Under these conditions, the suction created by the chimney on the chimney flue 13 would be approximately the same as the suction created by the injector action of the draft hood when a downdraft occurs.

Of course, the different parts of the injector draft hood could have various sizes to provide satisfactory draft action. It has been found that satisfactory operation occurs when the parts are dimensioned as follows: Chimney flue 13 having a $2\frac{15}{16}$ inch inside diameter, the aperture at chamfered end 13*a* having a 2⅜ inch inside diameter, the bell-mouthed aperture 22*e* having a 3 inch inside diameter with a bellmouth extending ⅛ inch in the axial flow direction, and a 2 inch spacing between the apertures 13*a* and 22*e* with the draft hood box structure being about 8 inches square and 3½ inches high in inside dimensions.

Various changes in details and arrangement of parts can be made by one skilled in the art without departing from the spirit of this invention or the scope of the appended claims.

What I claim is:

1. In a gas-fired heater having a confined space between the top of the heating compartment and the top surface of the heater and also having a heater flue for carrying away the combustion products from a heating unit for said compartment and a chimney flue having its lower end in fluid communication with the upper end of said heater flue and angularly disposed therewith, an injector draft hood surrounding said flue ends and adapted to be located in said confined space, normal flow of combustion products caused by chimney updraft being from said heating unit upwardly through said heater flue, through said injector draft hood and through said chimney flue, reverse flow being caused by a downdraft flowing downwardly through said chimney flue and injector to suck the flue gases from said heater flue, the lower end of said chimney flue being spaced downstream with respect to the normal flow in said chimney flue from the upper end of said heater flue so that the flow emerging from said heater flue impinges against said chimney flue, said injector hood having an aperture aligned with but spaced from the lower end of said chimney flue and in flow communication with the atmosphere.

2. In a table-top hot water heater having a gas-fired water heating compartment and a heater flue in said compartment for conveying away the products of combus-

tion and an enclosing cover over said compartment with a louver in one side wall and with a table-top height top surface and a chimney flue having its lower end in fluid communication with the upper end of said heater flue and right angularly disposed therewith, an injector draft hood adapted to surround said flue ends and adapted to be located in said confined space, said draft hood having an aperture in flow communication with the atmosphere through said louver and adapted to be aligned with but spaced from and in flow communication with the lower end of said chimney flue, the upper end of said heater flue adapted to be in flow communication with said space in said hood between said aperture and the lower end of said chimney flue, normal flow of combustion products caused by chimney updraft being from said compartment upwardly through said heater flue, through said injector draft hood and through said chimney flue, reverse flow being caused by a downdraft flowing downwardly through said chimney flue and injector to suck the flue gases from said heater flue, a deflector plate secured at its upper edge to the rest of said draft hood above said aperture on the reverse flow outlet side thereof while having its lower distal edge adapted to be spaced above the top of said heating compartment, whereby during reverse flow the air in the downdraft will thoroughly mix with the combustion products in the injector, will emerge through said aperture and will be deflected toward said louver by said deflector plate.

3. An injector draft hood for operatively connecting a heater flue of a hot water heater heating compartment and a chimney flue, comprising interconnected wall portions adapted to form a chamber surrounding the upper end of said heater flue and the lower end of said chimney flue when mounted in operative position with a flat surface of the heating compartment forming the closing side thereof, one of said wall portions extending generally vertically from said flat surface and having an

aperture in flow communication with the atmosphere of generally the same cross sectional configuration as said chimney flue and axially aligned with but spaced from and in flow communication with the lower end of the chimney flue, normal flow of combustion products caused by chimney updraft being upwardly through said heater flue, through said injector draft hood and through said chimney flue, reverse flow being caused by a downdraft flowing downwardly through said chimney flue and injector to suck the flue gases from said heater flue, a deflector plate secured at one edge to the rest of said draft hood above said aperture and extending away from said aperture and toward said surface so that its distal edge is spaced above said surface of said heating compartment to form a flow path therewith, whereby during reverse flow the air in the downdraft will thoroughly mix with the combustion products in the injector, will emerge through said aperture, and will be deflected by said deflector plate generally outwardly along said flat surface, whereby said draft hood forms a compact unit with said flat surface.

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