Oct. 16, 1962 G. H. FIEDLER 3,058,457

HEAT EXCHANGE ASSEMBLIES FOR HOT AIR FURNACE

Filed Sept. 17, 1958 2 Sheets-Sheet 1

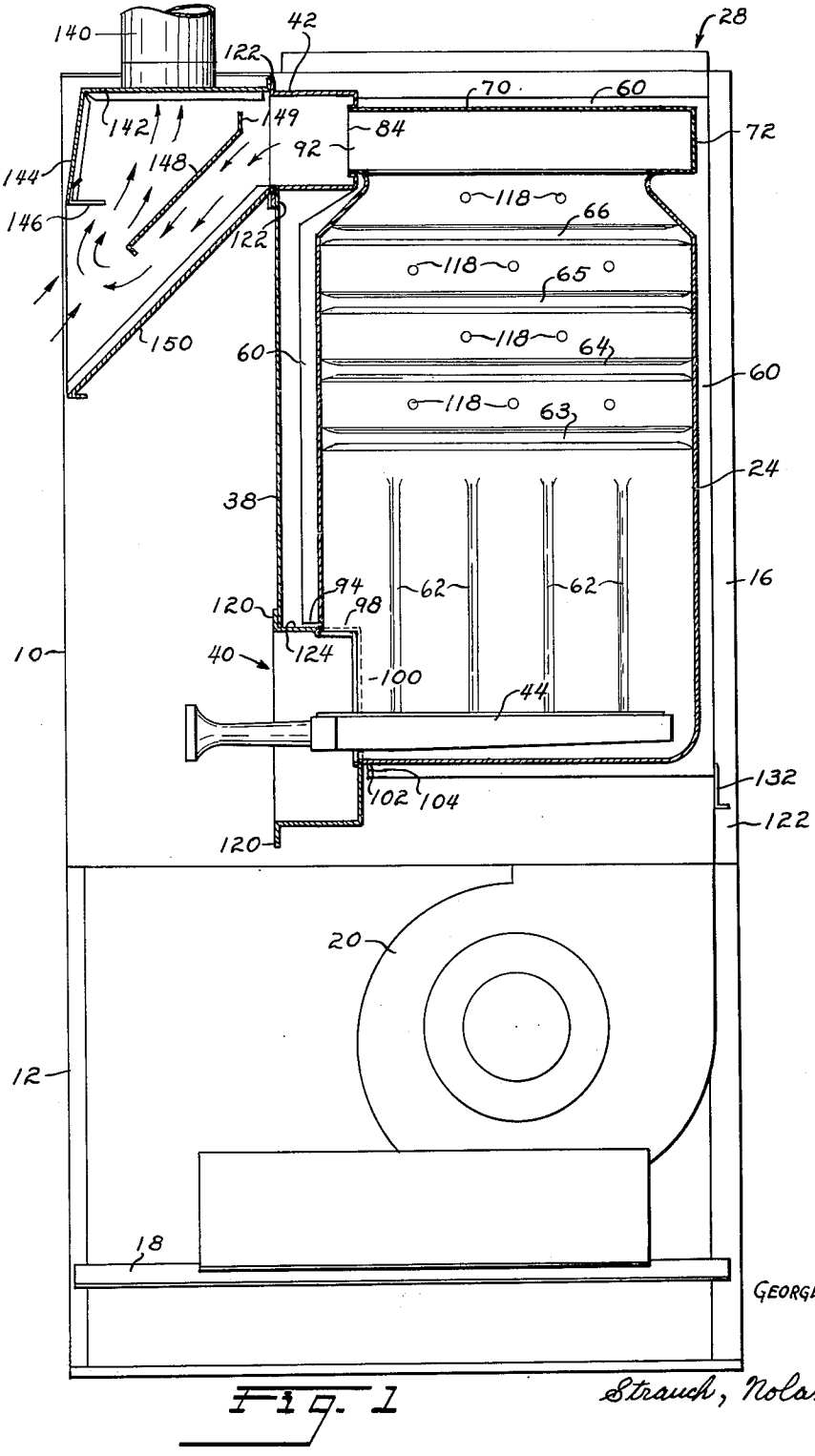


Fig. 1

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Fig. 2

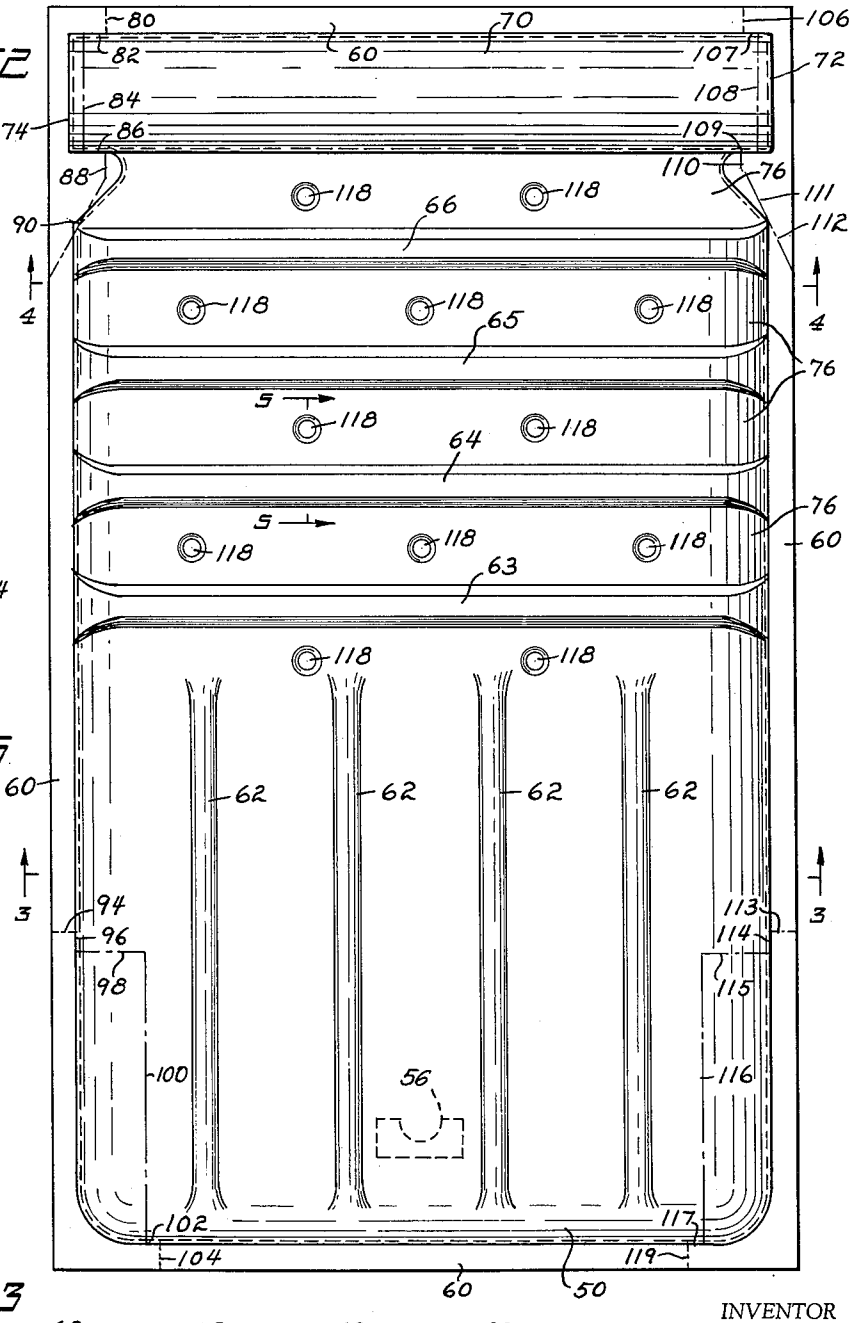


Fig. 5

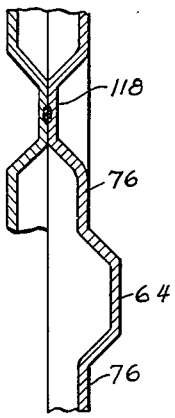


Fig. 3

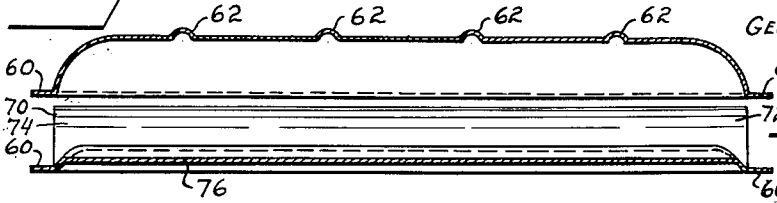


Fig. 4

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HEAT EXCHANGE ASSEMBLIES FOR HOT AIR FURNACE

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1 Claim. (Cl. 126—91)

This invention relates to a novel heat exchanger for use with gas fired burners.

A principal object of the present invention is to provide a novel heat exchanger which is so arranged as to be mounted vertically in a side-by-side relationship with adjacent heat exchangers. In addition to providing good heating efficiency of the room air directed over the outer surfaces of the heat exchangers, the novel heat exchangers are lightweight, rigid, free from buckling and inexpensive to manufacture.

These and other objects of the invention will become more fully apparent from the claim, and from the description when considered in conjunction with the appended drawings wherein:

FIGURE 1 is a side elevation view in section of the furnace incorporating the heat exchangers of the present invention;

FIGURE 2 is a plan view of one stamping of the heat exchanger as it is received from the forming die;

FIGURE 3 is an end elevation view in section of the heat exchanger stamping taken along line 3—3 of FIGURE 2;

FIGURE 4 is an end elevation view in section of the heat exchanger stamping taken along line 4—4 of FIGURE 2; and

FIGURE 5 is a partial section taken along line 5—5 of FIGURE 2 showing the manner by which the heat exchanger members are secured together.

Referring now to FIGURE 1 in the drawings, the furnace of the present invention is provided with a front upper side wall panel **10** which contains air admission apertures, which are preferably perforations, and a lower solid wall panel **12** which are both removable to provide access to the interior of the furnace from the front. The side walls as well as the rear wall **16** are made of aluminized steel. The air flow pattern for the warm air heating system is from the bottom of the furnace upwardly through filter **18**, through blower **20** which is driven by electric motor **22**, and upwardly around the outer surfaces of heat exchangers one of which is shown at **24** through duct opening **28** at the top of the furnace.

In front of the heat exchanger members **24** is an interior front panel **38** which as best shown in FIGURE 1 is supported between the upper side flange **120** on burner box **40** and the lower side flange **122** on flue collection box **42**. Separate burner elements **44** are provided for each of the respective heat exchanger members **24**.

Each heat exchanger member comprises a pair of substantially identical stampings such as that shown generally in FIGURE 2. A peripheral flat edge **60** is provided for securing two stampings together in a face-to-face relationship so that the lower portion along supporting ribs or embossments **62** will provide a burner receiving chamber. Above ribs **62**, four horizontally directed reinforcing ribs or embossments **63**, **64**, **65** and **66** are provided. As is most clearly shown in FIGURE 5, embossments **63–66** extend outwardly to provide an extended surface area to be exposed to the room air which passes upwardly across the outer surface of the heat exchanger members.

At the upper end of each of the heat exchanger stampings a semicylindrical section **70** is provided so that when the two stampings are placed together, the heat exchanger member will have a substantially cylindrical upper flue collection chamber for connection to flue box **42**. The stamping as shown in FIGURE 2 is formed with an enclosed rear wall **72** for the cylindrical upper flue collection chamber and also with an enclosed front wall **74** which is subsequently removed as will be explained below. In the spaces between horizontal embossments **63–66** and between embossment **66** and cylindrical wall section **70**, the flow of combustion products is restricted by the narrow passageway along walls **76** as shown in FIGURE 4. This passageway in a preferred embodiment is very narrow, being only about ½ inch between the two stampings.

The heat exchange section members **24** are then run through stamping presses which cut off the front upper portion containing front wall **74** starting at the upper end along edge **80**, forwardly along edge **82**, downwardly along edge **84**, rearwardly along edge **86**, downwardly along edge **88** and diagonally along edge **90** to thereby provide a front open end **92** which connects the flue collection chambers defined by cylindrical walls **70** with flue collection box **42**. Referring again to FIGURE 2, the forward lower end of the right side heat exchanger stamping is cut along edges **94**, **96**, **98**, **100**, **102** and **104** to provide an open section which fits onto the top and rear surfaces of burner box **40**. No cuts are made on the rear side of the stamping which corresponds with the right-hand side of the drawing in FIGURE 2 for the right side stamping.

To provide the left side heat exchanger stamping, the cutting press may be provided with complementary dies which are cut at the top of the stamping along edges **106**, **107**, **108**, **109**, **110**, **111** and **112**, and at the bottom of the stamping along edges **113**, **114**, **115**, **116**, **117** and **119**. No cuts are made on the rear side of the stamping which corresponds with the left-hand side of the drawing in FIGURE 2 for the left side stamping.

After the heat exchanger stampings are cut into the desired shape, opposing stampings are placed together face to face and a substantially continuous weld is provided around flanges **60** so as to provide a seal which prevents extensive escape of combustion products from the interior of the heat exchanger members **24**. Spot welds are provided at a sufficient number of dimples **118** to prevent popping and buckling of the members as the heat exchanger temperature increases or decreases.

As is apparent from the foregoing, only one die for each of the right side and left side stampings of the heat exchangers **24** is necessary. The die includes horizontal embossments **63–66** and dimples **118** which are so positioned that each of the dimples in the heat exchanger stampings meets to be welded together. Dimples **118** and the pattern thereof in welded securement to each other provide a three-fold function of preventing "oil-canning" of the sides of the exchanger under heat and pressure stresses, collectively with the embossments of forming alternate points of restriction and expansion for the combustion products, and of lengthening the time of travel of the combustion products through the heat exchanger by restricting the volume and velocity of the flow of combustion products thereby aiding the efficiency of the exchange of heat. The resulting tortuous flow pattern compelling the combustion products to remain in contact with the metal surface of the heat exchanger walls obviates the necessity of resorting to separate directional or restrictive baffles at the top of the flues and the consequent added material necessary when employing such baffles as was conventional practice heretofore.

In assembly, the heat exchanger stampings are first assembled into complete heat exchanger members **24** to be available for use in furnaces of a variety of sizes. For a small residential furnace of 75,000 B.t.u. output, 3 heat exchanger members are used. In 150,000 B.t.u. furnaces,

6 heat exchanger members are used. In intermediate furnace sizes, an intermediate number of heat exchangers are used.

Burner box **40** is provided with a front peripheral flange **120** which is mounted to be in substantial alignment with the front flange **122** on flue collection box **42** as shown in FIGURE 1. Upper surface **124** of burner box **40** is provided with a series of semicircular openings having edges **126** for receiving the forward cut-out surfaces along edges **94**, **96** and **98** of the heat exchanger stampings shown in FIGURE 2. In rear wall **128** of burner box **40**, a series of vertically directed openings having semicircular bottom edges are provided for receiving the lower surface **102** in front of edge **104** on flange **60** of the heat exchanger members.

Bracket **132** is provided to be suitably secured to the lower rear portion of the heat exchangers **24** and to be supported on frame **122** of the furnace housing as shown in FIGURE 1.

For the assembly of a specific sized furnace, burner box **40** and flue collection box **42** are selected which have the desired number of openings for receiving a corresponding number of heat exchanger members. The lower rear surfaces of heat exchanger members **24** are connected to be supported in bracket **120** and the unit is then ready for assembly into the furnace frame. After the furnace assembly is completed, burners **44** may be readily inserted into the heat exchangers with bosses supported in the grooves of brackets **56** on the inner walls of the heat exchanger members. Suitable space is provided to insert the burners over the gas manifold **138** and through burner box **40** and the fuel inlet end of gas burner **44** is supported in a conventional manner on a gas manifold.

The burner support provides an arrangement whereby the burners may be pulled out easily for service and may be shipped in place without excessive wired-down provisions for transportation.

At the top of the furnace, there is further provided flue box **42** which connects all of the heat exchanger members to flue **140** which is adjacent front wall **10** of the furnace. The forward end **84** of flue collection cylinders **92** of each heat exchanger is secured as by welding to the rear panel surface of flue collection box **42**. Flue pipe **140** is supported on plate **142** which is suitably secured to flange **122** around flue box **42** and to the side walls of the furnace. Flue plate **142** has a front member **144** which extends downwardly along the perforated front panel **10** and contains an inwardly directed lip **146**. Baffle **148** is positioned directly below the opening of flue **140** and secured to the furnace side walls in an angular position so as to also extend in front of the cylindrical flue chambers **92** in each of the heat exchangers. Thus combustion products passing through flue chambers **92** are deflected downwardly by the lower surface of baffle plate **148** and then upwardly between lip **146** and plate **148** to flue **140**. A small space is provided above the upper end **149** of baffle plate **148** and flue plate **142** whereby some direct flow of combustion products to flue **140** is permitted. The perforations in front panel **10** in conjunction with the end of lip **146** and baffle plate **148** in front of flue **140** provide a direct air flow path up the chimney, and also prevent any downdraft from passing through the heat exchangers and extinguishing the flame.

Beneath baffle **148** is a further baffle plate **150** which extends from front perforated wall **10** back to flange **122** on the lower surface of flue box **42** and is secured to the furnace side walls. Beneath baffle plate **150** air is free to pass through the perforations in front panel **10** to enter through the burner box **40** inside the heat exchange members **24** and mix with the combustion products.

The air to be heated, on the other hand, all enters through filter **18** which is in the lower portion of the furnace beneath the heat exchangers and is forced upwardly by blower **20** across the outside surfaces of the heat exchanger members **24** and around the outside of cylindrical walls **70** of the flue collection chambers of the heat exchangers to pass through the warm air duct opening **28** at the top of the furnace.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claim rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claim are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

In a furnace of the type having separate air flow paths for combustion products and for air to be heated thereby, heat exchanger means comprising a pair of upright members of sheet metal of substantially uniform thickness formed from the same die secured together around the periphery thereof, said members having their facing walls spaced apart at their lower end to form a chamber for receiving an elongated burner element and at an upper end to form a flue outlet chamber, the facing walls of said members in the space between said chambers being positioned closely together to form a relatively narrow passage for said combustion products and containing a plurality of spaced, outwardly projecting horizontal, non-intersecting embossments, the embossments of one member being directly opposite the embossments of the other member, said embossments on each member being separated by substantially flat portions of said facing walls, inwardly projecting dimples in each of said flat portions along the length thereof between adjacent embossments, the dimples in each flat portion being arranged in staggered relation to the dimples in a next adjacent flat portion, said dimples of one member being secured to the corresponding dimples of the other member to prevent separation of said members and to provide restriction to the flow of combustion products, said embossments serving as means for reinforcing said members to reduce buckling noise and enhance the heat exchange between combustion products and air outside of said members to be heated.

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