Oct. 2, 1956 F. A. RYDER 2,764,972

VENTING SYSTEM FOR COMBUSTION HEATERS

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Fig. 3.

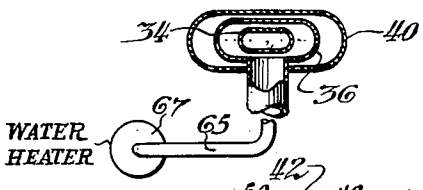


Fig. 1.

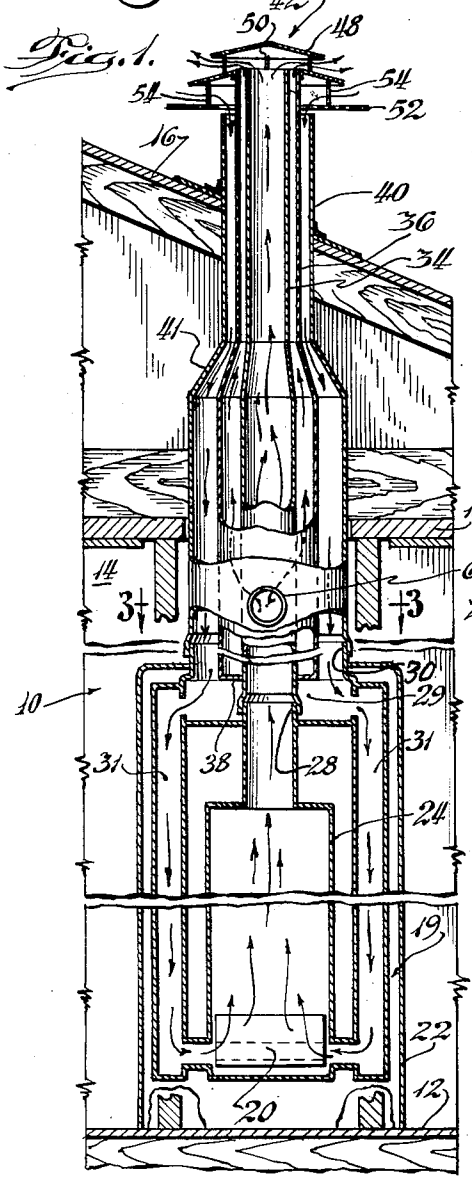
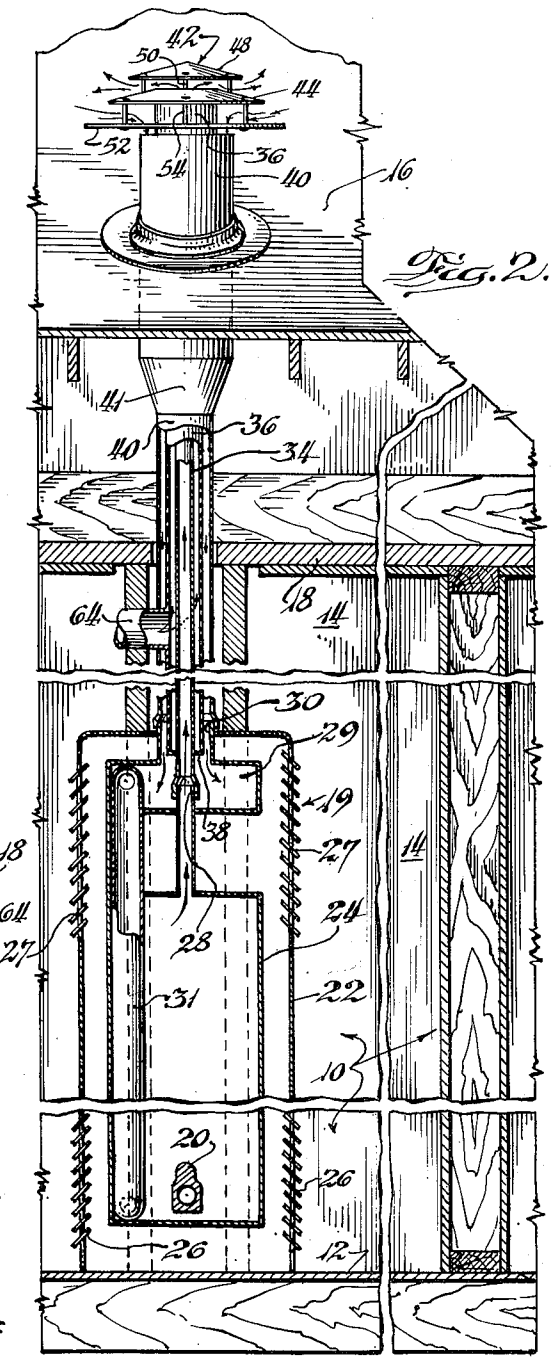


Fig. 2.



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Fig. 4.

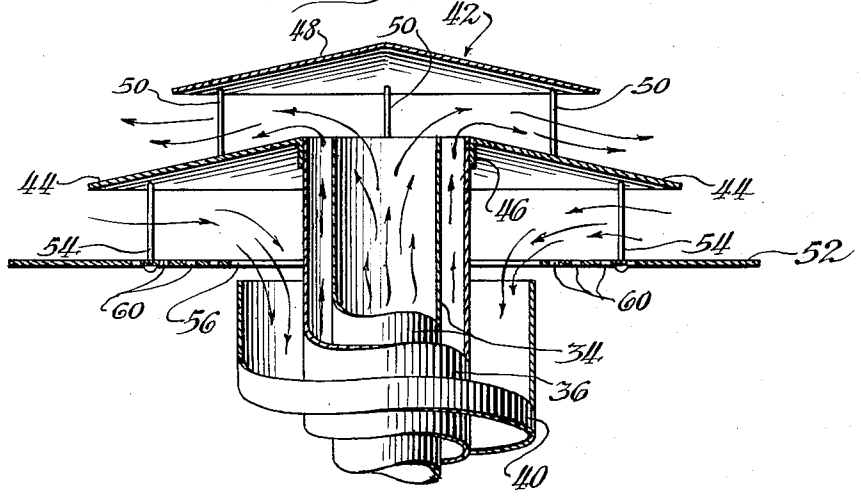
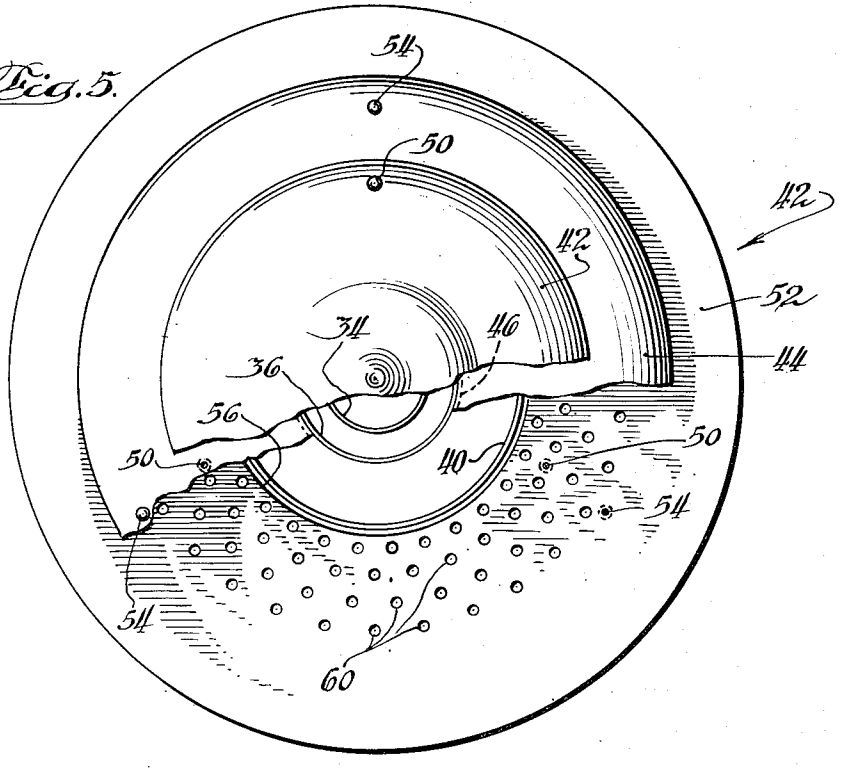


Fig. 5.



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VENTING SYSTEM FOR COMBUSTION HEATERS

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Application August 13, 1952, Serial No. 304,105

2 Claims. (Cl. 126—307)

The present invention relates to venting systems and more particularly to an arrangement for venting a space heater and some other auxiliary equipment, for convenience referred to frequently hereafter as a hot water heater which may be located within a building, particularly where the heater is of the sealed type, that is, the type in which air for combustion is brought in directly from outside the building through a duct connected to the heater so that there is no opening within the building to the combustion side of the equipment.

One of the objects of the present invention is to provide a system for venting a sealed heater to the outside along with an arrangement for venting accessory equipment such as a gas fired hot water heater, for instance, without requiring the installation of duplicate venting facilities.

Another object is to provide a venting system for a sealed heater and an open type hot water heater or the like, such that the incoming combustion air space for the sealed heater serves to insulate the duct walls against hot products of combustion from the sealed heater and from the hot water heater or the like.

Still another object is to provide a balanced venting system for a sealed heater which also serves to vent products of combustion from additional equipment without affecting conditions within the balanced vent system.

Yet another object is to accomplish all of the above at relatively low cost, in a simple straightforward manner and without the use of special insulating material.

Other objects and advantages will become apparent from the following description of a preferred embodiment of my invention which is illustrated in the accompanying drawings.

In the drawings, in which similar characters of reference refer to similar parts through the several views:

Figs. 1 may be considered as a somewhat diagrammatic vertical sectional view through a portion of a house, and the heater and venting system therefor so as to show the structure of the venting equipment and its association with the dwelling and heater;

Fig. 2 is a view similar to Fig. 1 but taken at right angles thereto, also in a vertical plane. In Fig. 2 a portion of the venting system toward the upper end thereof is shown in elevation;

Fig. 3 may be considered as a horizontal, transverse sectional view taken substantially along the line 3—3 of Fig. 1 looking downwardly as indicated by the arrows;

Fig. 4 is an enlarged vertical medial sectional view of the outlet and inlet fitting shown toward the top of Figs. 1 and 2; and

Fig. 5 is a top view of the fitting illustrated in Fig. 4 with portions thereof broken away so as better to illustrate the underlying structure.

A type of contemporary gas-fired house heater coming into increasing prominence has fittings for attachment to ducts which deliver incoming combustion air and which receive the products of combustion. Thus, the entire combustion system is sealed from the air within the space to be heated and is vented at both ends outside the building.

The advantages of this arrangement are several. One of these is that, since all of the air for combustion is drawn in from outside the building, passed through the combustion side of the heater, and then exhausted through the duct work, there is no possibility for contamination of the air within the building by products of combustion. This arrangement also has the advantage that it is not necessary to mix diluent air from the space to be heated with the products of combustion before exhausting these products to the atmosphere. In other words, no draft diverter fitting is necessary. The efficiency is therefore much better inasmuch as there is no necessity to exhaust large quantities of warm air from the dwelling through the flue system and replace this heated air with cold air drawn in from outside the building.

This has the ancillary advantage that since large quantities of cold air need not be drawn into the dwelling to replace that used for combustion and for exhaust dilution, there is much less occasion for cold uncomfortable drafts around leaky doors and windows.

In the drawings I have indicated a portion of a dwelling or other building by the numeral 10. Essentially this structure is comprised of a floor 12, walls 14, a roof 16 and an interior ceiling and supporting structure 18. The heater, which is shown diagrammatically, is indicated generally by the numeral 19 and is of the sealed type. It comprises generally a burner 20 enclosed within a heat exchanger 24 which in turn is contained in a cabinet 22. Air to be heated enters lower louvres 26 in the cabinet and passes upwardly around the heat exchanger and thence outwardly through a set of upper louvres 27. The heat exchanger is heated by hot products of combustion produced by the burner 20 and the exhaust leaves the heater by way of a central outlet fitting 28 at the top thereof. There is a larger fitting 30 surrounding the opening at 23 to which the combustion air is delivered, this air passing downwardly into a plenum chamber 29 and thence by two branch ducts 31 along the sides of the heat-exchanger to the burner 20.

Inasmuch as the present invention is directed to the venting system rather than to the sealed heater per se, no additional details of the heater need be given beyond the fact that the cabinet 22 is positioned within an inside wall and directly heats the rooms on both sides thereof. It should be understood, however, that it is a characteristic of a heater of this type to be sensitive to chimney conditions. This is because there is a direct connection to the flue and to an air inlet duct without there being any atmospheric break in the system such as the customarily used draft diverter fitting. It is necessary, therefore, that the particular heater be balanced with the duct work for bringing in the combustion air and for exhausting the products of combustion so as to achieve a proper air flow rate through the heater combustion side. Further, it is necessary to provide a special arrangement or fitting at the outside terminations of the combustion air inlet and outlet ducts so as to maintain these openings at the same pressure, regardless of wind velocity. Otherwise the strength and direction of the wind would have a marked effect upon the rate of combustion air flow, and under some conditions would cause back drafts which would extinguish combustion or at least make it unreliable and inefficient.

The particular combination inlet and outlet fitting used for the purpose of illustrating the present invention forms the subject matter of my copending application Serial No. 278,811, filed March 27, 1952, and entitled "Sealed Heater Venting System."

Referring to the heater end of the system, it will be seen that there is a sheet metal flue 34 which is connected by a fitting to the heater outlet fitting 28 and

which conducts products of combustion to a position above the roof of the structure. This flue is enclosed within a second sheet metal duct **36** which surrounds the flue **34** throughout substantially its full length and is sealed at its lower end to the flue **34** by an annular ring or similar member **38**. The members **34** and **36** are in turn enclosed within a third concentric larger sheet metal duct **40** which has a fitting for attachment to the heater at the fitting **30** and which leads to a position above the roof slightly below the level of the ducts **34** and **36**. In order to dispose the ducts **34**, **36** and **40** within the ordinary wall space, the lower portions of these ducts are flattened as best seen in Fig. 3 and are connected to the upper cylindrical portion by a transition section **41**.

At their upper ends the three ducts, **34**, **36** and **40**, terminate at an inlet and outlet fitting indicated generally by the numeral **42** and best illustrated in Figs. 4 and 5. From these figures it will be seen that the three ducts **34**, **36** and **40** extend into a position well above the roof of the building, with the two inner ducts **34** and **36** rising to the same height, these two being approximately two and one-half inches or so above the upper end of the outer duct **40**. All of these ducts are supported sufficiently rigidly with respect to each other in any suitable fashion and the vent fitting **42** is carried by the upper end of the intermediate duct **36**. It comprises a convex frusto-conical sheet metal deflector **44** which has a circular periphery and which is extruded downwardly as at **46** at its center so that this extrusion fits the outside surface of the intermediate duct **36**. It may be secured thereto in any suitable manner such as by sheet metal screws or soldering for instance. This deflector may be considered as being a disc which slopes downwardly to the periphery with respect to the central portion at an angle of approximately 12½° or so. In the specific example shown it has an external diameter of approximately ten inches, whereas the intermediate tube **36** to which it is fitted is approximately three inches in diameter. The upper end of the outlet flue pipe **34** is flush with the top surface of the deflector **44** and the opening is protected by a sheet metal top member **48** which is circular in outline and generally conical in form. The angle of the cone is such that the top and deflector surfaces are approximately parallel, that is, the conical surface slopes downwardly from the apex at an angle of approximately 12½°. It is axially aligned with the deflector, is approximately seven and one-half inches in diameter, and is supported approximately one and one-quarter inches above the deflector by several sheet metal brackets **50** which are spot-welded or otherwise suitably attached to the top surface of the deflector **44** and the lower surface of the top member **48**.

An air intake baffle member **52** is disc shaped and is supported in a horizontal position below the deflector **44** by several sheet metal brackets **54** spot-welded or otherwise suitably attached between these members. The brackets are of such lengths that the air intake baffle is approximately one and one-quarter inches below the outer edge of the intermediate deflector **44**. The central portion of the air intake baffle **52** is cut out to form a circular opening **56** which surrounds the tube **36** and is vertically spaced about one-quarter inch above the top of the air intake duct **40**. In the illustrated example this hole **56** is approximately five and three-eighths inches in diameter and is somewhat larger than the external diameter of the air intake tube **40** which in the present instance is about five inches.

The annular zone of the air intake baffle plate immediately surrounding the opening **56** is perforated to provide a multiplicity of holes **60** approximately three-sixteenths inch in diameter extending therethrough. These holes are symmetrically arranged along circular concentric center lines approximately one-half inch apart with the first or innermost row of holes being spaced outwardly from

the edge of the opening **56** about one-quarter of an inch, although there are in the specific device shown one hundred twenty-six of these holes arranged in four rows. A suitable arrangement is to put thirty holes in the innermost row, thirty-one in the second row, thirty-two in the third and thirty-three in the fourth.

In the above description of a particular embodiment of the invention, specific dimensions have been given for the purpose of illustration only, and their use should not, therefore, be considered as limitative of the invention. The particular device shown and described is intended for use with a heater of about 50,000 B. t. u. per hour capacity and should preferably be scaled upwardly or downwardly for larger or smaller heaters.

The device and system so far described function in the following manner: Under still air conditions, products of combustion rise up the innermost tube **34** and pass upwardly substantially evenly in all directions around the cap member **48**. Conversely, air for combustion is drawn inwardly in all directions through the space between the baffle **52** and the deflector **44** and passes downwardly within the annular space provided between the ducts **36** and **40**. There is ample space between the inlet and outlet passages through the vent fitting to prevent mixing of the products of combustion with the incoming air. This is partly because the incoming air moves principally in a radially inwardly direction whereas products of combustion pass around the edge of the roof member **42** with an upward component inasmuch as these hots gases have less density than the surrounding air.

Under conditions of wind, when the wind is blowing from any angle excepting from directly above, that is in a downwardly direction, the exhaust products will leave the device at one side whereas the incoming air will pass inwardly at the opposite side. Nevertheless the inlet and outlet air are in such close proximity to each other that the static pressure created by the wind is substantially the same at both openings and thus there is little tendency for up-drafts and no tendency for downdrafts due to wind velocity. It has been shown that this is true regardless of the direction of the wind up to winds of whole gale force. At extremely high wind velocities, that is of the order of sixty miles an hour or so, there is some tendency for the carbon dioxide concentration in the flue gases to drop slightly but the concentration does not fall lower than approximately five per cent and this compares extremely favorably with a concentration of about eight and one-half per cent which is obtainable when the system is operating in still air. The change in air flow through the system, therefore, under these extreme wind conditions is almost negligible, but is sufficiently in the right direction to insure against downdrafts which might extinguish the pilot or main burner.

Rarely does the wind ever blow straight downwardly but even under these conditions the top member **48** protects the outlet opening and therefore shields the exhaust ducts against downdrafts. The top member also helps to prevent rain water or snow getting into either the inlet or outlet duct openings. Of course when the wind is directly downwardly or has a strong downward component, exhaust products are forced downwardly over the edge of the deflector **44** and it might be thought that they would under some conditions mix appreciably with the inlet air. It has been found, however, that the annular space between the air intake baffle **52** and the air intake tube **40** permits air to flow upwardly to the center of the space between the baffle and the deflector. Under these conditions the perforations **60** prevent there being too great a pressure differential between the upper and lower surfaces of the baffle **52** at the region about its center. Because the adjacent surfaces of the members **48** and **44** are parallel, no venturi effect is produced at the outlet opening of the vent when the wind

blows therethrough. The members 44 and 52 together, however, produce a slight reverse venturi effect at the inlet opening and thus an extremely slight but appreciable positive pressure is produced in the inlet duct relative to the outlet under high wind conditions. Because of the fact that the products of combustion reach the vent at a comparatively high temperature, the vent stays warm enough to prevent an accumulation of snow or ice thereon which might otherwise interfere with air flow through the device. Also, rain water cannot reach the outlet because of the cap 48 and any which might otherwise accumulate upon the horizontal surface of the baffle 52 and run inwardly so as to fall through the opening 46 into the inlet pipe 40 is prevented from so doing because the diameter of the hole 56 is sufficiently larger than the diameter of the duct 40 to permit water to drip through the baffle opening outside the edge of the duct 40. Water also of course drains through the holes 60 and falls away harmlessly.

Frequently when a space heating system for a dwelling is installed, there is also need for other heating equipment of the combustion type. For example, a gas fired hot water heater falls in this category and as will appear presently, it is significant in so far as the present invention is concerned that the heat output of such ordinarily used accessory equipment, is far less than the heat output of the space heating equipment. Nevertheless some venting facilities are required, and the present invention takes care of this requirement without substantially adding to the cost of the venting facilities needed for the space heating equipment.

By referring to the drawings it will be seen that there is a spud or horizontal duct section 64 which connects through the side wall of the intermediate duct 36 so as to extend horizontally through the outer duct 40. This horizontal spud 64 constitutes an inlet fitting and is provided with the intention that it be connected to the exhaust gas outlet 65 of a gas-fired hot water heater 67, for instance, so as to cause the products of combustion of this accessory equipment to flow into the annular space between the vertical ducts 36 and 34. After rising to a position above the roof, these products of combustion reach the fitting 42 within the opening in the deflector 44 but outside the pipe 34. The products of combustion from this heating accessory and from the space heater therefore merge beneath the cap 48 and flow outwardly around the rim thereof, and as previously described these products of combustion do not mix with the incoming air passed into the mouth of the outermost duct 40.

In considering the above arrangement, it will be appreciated that the products of combustion in the innermost flue 34 will be at a relatively high temperature and therefore there will be a tendency for the wall of the duct 34 to be quite warm. This duct, however, is surrounded and spaced from the intermediate duct 36 which may or may not be carrying products of combustion depending upon whether or not the water heater, for instance, is operating. Even assuming that the water heater is operating, however, these products of combustion will be at a temperature somewhat lower than those in the central duct 34, because the heat output of the hot water heater will ordinarily be less than that of the space heater, and in addition the hot water heater usually will be connected to the horizontal spud 64 by a draft diverter fitting such that some diluent air is mixed with the products of combustion before they find their way into the annular space between the ducts 34 and 36. Whether or not a draft diverter fitting is used and whether or not the surface of the duct 36 is heated both by products of combustion from the hot water heater and to some extent by the products of combustion of the space heater, it will be apparent that both of these ducts are enclosed within a sheath of downwardly moving air in the annular space between the ducts 36 and 40.

Because heat is exchanged from the surface of the duct

36 to the down flowing space heater combustion air, the temperature of the duct 36 cannot rise sufficiently to raise the temperature of the outside duct 40 to a dangerous level under any conditions which might prevail within the system. Even if the hot water heater is operating and the space heater is not operating, such that there will be no substantial flow of incoming combustion air downwardly within the annular space between the ducts 36 and 40, nevertheless, this air space, even if dead, serves as sufficient insulation to prevent the surface temperature of the duct 40 rising to an unsafe level. Under all conditions, therefore, the duct system is safe to install directly against ordinary woodwork or building paper without the use of any special insulation. The installation problem and the cost of the equipment is therefore greatly reduced over that ordinarily needed, since all of the parts of the duct system are formed as simple sections from sheet metal and yet they fit within an ordinary wall space and serve to vent both the space heating equipment and such other supplemental equipment as may be needed.

Although in the arrangement illustrated the vent system is shown connected to a recessed wall type heater, it is of course equally adapted for use with heaters of other types as for instance concealed furnaces connected by ventilating air duct work to the space to be heated, or hot water or steam type space heaters.

When accessory equipment of any type having exhaust products is used in conjunction with any such space heating equipment and the vent system forming the subject matter of this invention, the accessory exhaust fitting is connected to the spud 64 so as to achieve the benefits described above.

In the event that supplemental equipment, such as the hot water heater mentioned is not required in a particular installation, the inlet opening to the spud 64 is simply closed by a suitable cap. In this event the intermediate space is filled with substantially dead air. This acts to prevent too great a rate of heat exchange between the heater exhaust and incoming air which might otherwise cool the exhaust below the dew point.

To aid others in practicing my invention I have described a specific embodiment thereof, but it will be appreciated that variations may be made therefrom without departing from the scope or spirit of my invention.

Having described my invention, what I claim as new and useful and desire to secure by Letters Patent of the United States is:

1. A dual heating and venting system including a sealed heater and a second heater, said sealed heater having a combustion air inlet fitting and an exhaust outlet fitting and being substantially sealed from the atmosphere between said fittings, said second heater having an exhaust outlet fitting, said venting system comprising means forming outer, intermediate and inner mutually spaced substantially concentric ducts adapted to extend to a position above the roof of a building at their upper ends and extending at their lower ends to the vicinity of said heaters, the upper ends of said ducts being open and adapted to communicate with the atmosphere, said duct system having means providing an inlet fitting communicating with the space within said inner duct and connected to said sealed heater exhaust outlet fitting, said duct system having means providing an outlet fitting communicating with the space between said outer and intermediate ducts and connected to said sealed heater combustion air inlet fitting so that cold outside air flows downwardly through the space between said outer and intermediate ducts at substantially the same mass flow rate as hot exhaust gas flows upwardly through the space within said inner duct, said duct system having means providing a second inlet fitting communicating with the space between said intermediate and inner ducts and connected to said exhaust outlet fitting for said second heater, and means providing a fitting secured at the upper ends of said ducts and adapted substantially to prevent down-

drafts in said ducts under variable atmospheric conditions and to provide a covered outlet for the spaces between said ducts and the space within said inner duct.

2. A dual heating and venting system including a sealed heater and providing a vent for a second heater, said sealed heater having a combustion air inlet fitting and an exhaust outlet fitting and being substantially sealed from the atmosphere between said fittings, said second heater having an exhaust outlet fitting, said venting system comprising means forming outer, intermediate and inner mutually spaced substantially concentric ducts adapted to extend to a position above the roof of a building at their upper ends and extending at their lower ends to the vicinity of said sealed heater, the upper ends of said ducts being open and adapted to communicate with the atmosphere, said duct system having means providing an inlet fitting communicating with the space within said inner duct and connected to said sealed heater exhaust outlet fitting, said duct system having means providing an outlet fitting communicating with the space between said outer and intermediate ducts and connected to said sealed heater combustion air inlet fitting so that cold outside air flows downwardly through the space between said outer and

intermediate ducts at substantially the same mass flow rate as hot exhaust gas flows upwardly through the space within said inner duct, said duct system having means providing a second inlet fitting communicating with the space between said intermediate and inner ducts and adapted to be connected to said exhaust outlet fitting for said second heater, and means providing a fitting secured at the upper ends of said ducts and adapted substantially to prevent downdrafts in said ducts under variable atmospheric conditions and to provide a covered outlet for the spaces between said ducts and the space within said inner duct.

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