Oct. 12, 1965 R. E. CARLSON 3,211,079

VENT CAP FOR GAS HEATING STRUCTURE

Filed June 25, 1964 2 Sheets-Sheet 1

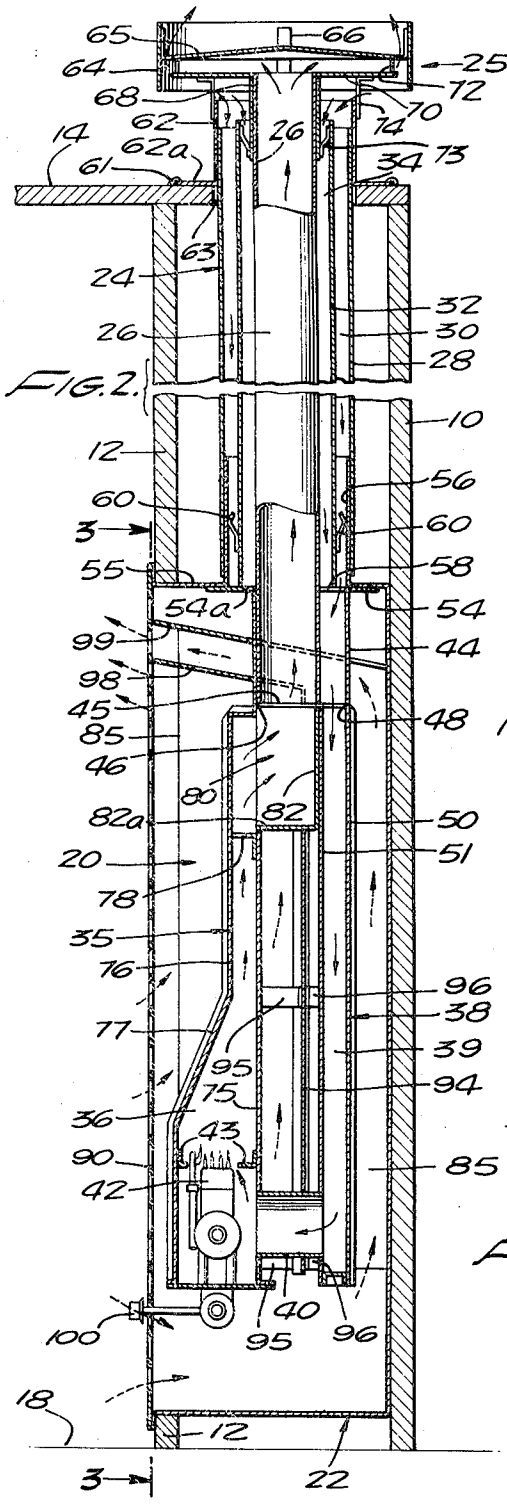


FIG. 2.

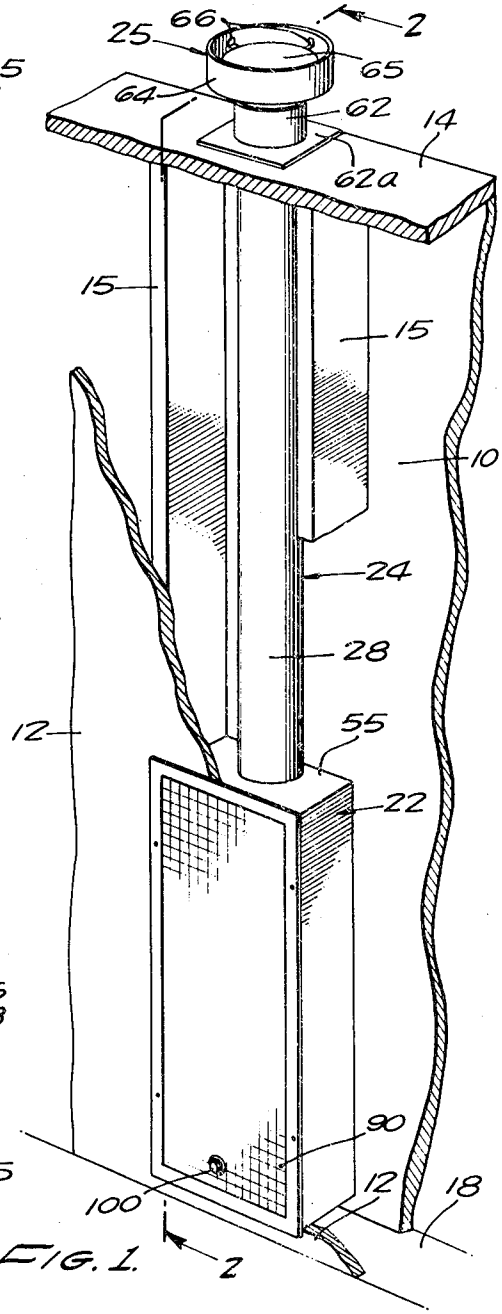


FIG. 1.

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VENT CAP FOR GAS HEATING STRUCTURE

Filed June 25, 1964 2 Sheets-Sheet 2

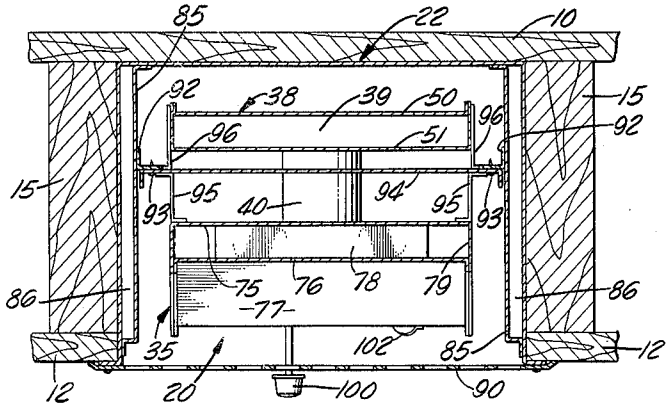


FIG. 3.

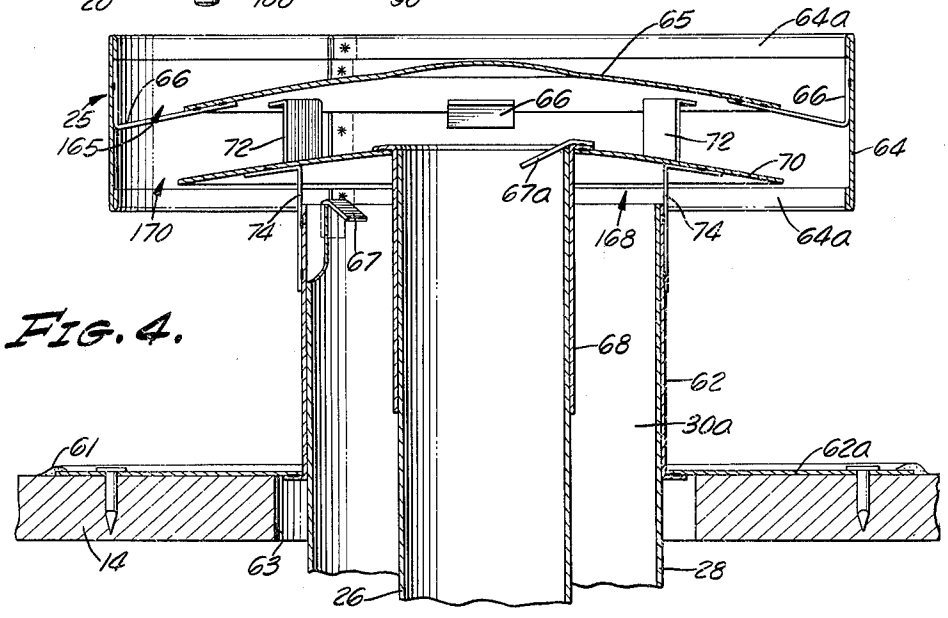


FIG. 4.

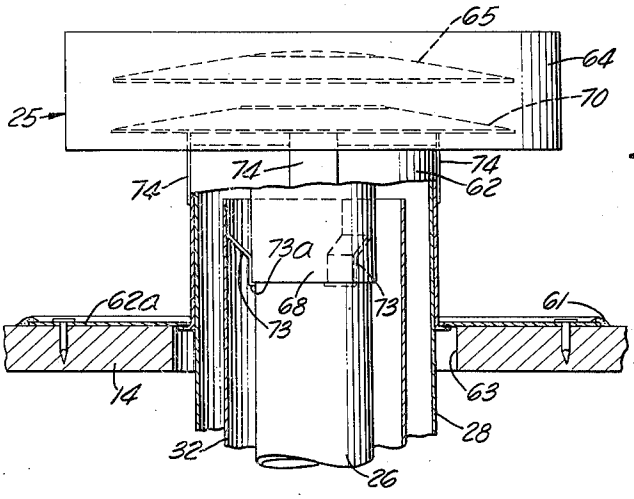


FIG. 5.

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VENT CAP FOR GAS HEATING STRUCTURE

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3 Claims. (Cl. 98—46)

This invention relates to gas fired heaters with sealed combustion chambers especially for house trailers, cabins, yachts, homes, cabin crusiers, sailboats and the like. This application is a continuation-in-part of my earlier application, Ser. No. 201,441, filed June 11, 1962.

With heaters of the type to which this invention is applicable, combustion air to supply the gas burners in the sealed combustion chambers is drawn from the outside air rather than from the interiors of the spaces being heated. With such heaters it is also the practice to vent the combustion chambers laterally from the upper portions thereof out through the building's sidewalls, and to draw the outside combustion air through a concentric air pipe surrounding the vent pipe.

Lateral venting with concentric horizontal piping has heretofore been deemed to be the only satisfactory construction for heaters with sealed combustion chambers, apparently because it has been thought that fresh combustion air flow to the combustion chamber could be satisfactorily accomplished only by horizontal flow at a low level from the exterior of the structure to be heated.

However, such heater constructions have various objections, including the sidewall venting, variable draft conditions, and hot vent caps at low levels outside.

It is a general object of this invention to provide a space heating and venting means which eliminate all such objections.

It is a particular object of this invention to provide a space heating structure which is vented through the roof and at the same time to employ a vent cap which retains the concentric piping arrangement of sidewall venting, the outside combustion air being brought down around the hot vent pipe from a position above the roof, rain being effectually excluded, and mixing of incoming air with exhaust gases being effectually prevented.

Still another object of the invention is to transfer the typical vent cap to an elevated position so that such vent cap, which often becomes quite hot, is not in a position to burn persons passing the side of the building , as where horizontal piping is vented.

A further object is to provide a vertical venting and piping arrangement extending through the roof wherein a vent cap structure is employed which not only diverts rain or water spray from entering the exhaust venting pipe, but also covers the cool air intake pipe to guard it against the entry of rain or spray.

Briefly outlined, the present improvement includes an upstanding two-element heating member disposed vertically in a shallow casing or housing often known as a "liner." The forward element of the heating member constitutes a sealed fire box or combustion chamber at the lower end of which a burner is positioned and at the upper end of which there is an outlet passage to a vertical flue or vent pipe mounted on the heating member and extending up through the building's roof to vent the combustion gases. The other element of the heating member is a flattened air chamber element disposed behind the fire box or combustion chamber, both elements being attached to an intervening radiation partition. This flattened chamber element is in the form of an air supply chamber enclosed on all sides and at its top and bottom, except that its top provides an intake opening for cool air and its forward wall at the bottom provides an opening connected by an air duct to the lower portion of the

combustion chamber to feed such cool air to the burner to support combustion. The upper end of the air chamber is provided with an air intake duct which leads downward from an annular space within a collar upstanding from the heater member and receiving the lower end of an outer concentric air intake pipe leading down from the roof around the exhaust pipe.

Above the roof, the top of the exhaust pipe carries a vent cap under which the spent combustion gases are discharged, such cap having plate means arranged to prevent mixing of exhaust gases with incoming air and having special means such as a vertical ring for excluding rain or spray from the exhaust pipe and also guarding the air intake pipe to exclude rain or spray therefrom. Thus, pre-warmed cool air is fed from above the roof down through the annular space between the exhaust pipe and the air intake pipe where it enters the upper end of the air chambers whence it passes to the lower end of the combustion chamber, the spent combustion gases then rising through the outlet from the combustion chamber into the central exhaust pipe by which they are discharged through the roof by way of the vent cap which both excludes rain and prevents mixing of the spent combustion gas with down-draft cold air moving to the combustion chamber. Convection air rises around the combustion chamber in front of the radiation partition, and also rises around the intake air chamber which is heated by radiation from the combustion chamber via the radiation partition, such heated air passing forward and outward through the upper portion of a grill or front panel into the living space of the building, radiation heat being projected directly forward from the combustion chamber through the grill into such living space.

Further objects and features of the invention will become apparent to those skilled in the art upon reference to the following specification and the accompanying drawings wherein a presently preferred form of the invention is disclosed.

In the drawings:

FIG. 1 is a prespective view of the vent cap and heating structure of this invention disclosed as installed in a wall of a small building, portions of the wall being broken away;

FIG. 2 is a vertical section from front to back taken as indicated by the line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view through an intermediate portion of the heater;

FIG. 4 is a vertical section on an enlarged scale through the vent cap hereof; and

FIG. 5 is a similar view of a varied assemblage.

The present improvement is shown especially in the upper portion of FIG. 2 and in FIG. 4 which illustrates the arrangement of the vent cap and air supply and exhaust pipes upstanding from the top of the heater.

As indicated, the entire heating structure is arranged for installation within a wall of a house trailer or the like in which it is to be used. Whereas laterally vented gas heaters must be disposed in an outer wall, the present structure, being vented through the roof with the vent cap above the roof, may be mounted in an interior wall.

With particular reference to the drawings, a wall structure is illustrated as including a typical rearward wall panel **10**, a forward or inner wall panel **12**, a roof panel **14** or other roof structure, and a pair of upstanding supporting and spacing studs **15**, all of which are carried on an appropriate floor structure **18**.

A primary heating member or unit generally indicated at **20**, which is illustrated as an upstanding gas fired sheet metal structure, is supported in a rectangular housing or "liner" **22**, also metal, from which there upstands a pipe assemblage **24** having an outer vent cap assembly **25**

above the roof **14**. The pipe assemblage includes a central exhaust pipe **26** and an outer concentric air feed pipe **28** affording an annular cold-air conducting channel **30**. Desirably, there is also an intervening concentric radiation pipe **32** which provides an inner annular air channel **34**, whereby further to reduce the temperature of the air pipe **28**. These pipes **26**, **28**, and **32** are fixedly carried by the top of the heater unit **20**.

The heater unit **20** includes two spaced upstanding connected elements. The forward element **35** provides an enclosed combustion chamber **36** having a forward upper wall portion parallel to forward and rearward parallel walls of a rearward element **38** which provides an enclosed cold-air supplying chamber **39**. Both of these elements **35** and **38** are, in general, rectangular in design similar to the rectangular construction of the housing **22**, but they are appreciably smaller in order to be mounted in spaced relation in the housing **22** and provide adequate air circulation spaces around them. Also the elements **35** and **38** are rigidly connected. At their lower ends, this rigid connection is made through the medium of a connecting air tube **40** welded to the opposing walls of the two elements and providing a duct to feed cool air from the lower end of the air passing chamber **39** to the lower end of the combustion chamber **36** which contains at such lower end a burner **42** of any desired construction. The upper portion of the burner is disposed between two opposed baffles **43** which control the flame. The upper ends of the elements **35** and **36** are rigidly connected by welding thereto a metal rectangular approximately cubical box **44** whose bottom wall **45** is provided with a circular opening or port **46** around which is welded to the bottom **45** the lower end portion of the exhaust pipe **26**. Rearward of the circular opening or port **46**, the bottom **45** of such box is also provided with a transverse rectangular opening or port **48** which provides an air feed passage into the top of the air chamber **39** of the reaward element **38**.

The rearward element **38** provides a vertical elongated rectangular passage constituting the air chamber **39** formed between a back wall **50** and a front wall **51** of the element **38**, such passage extending from the inlet port **48** down to the air discharge duct **40** which feeds fresh air to the burner. The back wall **50** and the back wall of the box **44** are thus in substantial vertical alignment. In this manner, a constant supply of cool air is supplied from the annular channel **30**, and also from the annular channel **34** if the radiation tube **32** is used, down into the cool-air chamber **39** by way of the rectangular port **48** and thence via the duct **40** to the burner **42**.

The forward wall of the metal box **44** is in approximate vertical alignment with the back wall of the heater element **35**. Upon the top of the box **44** there is welded a nearly square or rectangular plate or top wall **54** which fits under the top **55** of the housing **22** when the parts are in the assembled relation illustrated. This plate **54** has welded on the top thereof a collar **56** over which the lower end of the outer air pipe **28** fits. The greater portion of the plate **54** is provided with a rectangular opening or port **58** located within the confines of the collar **56** and through which opening the lower portion of the vent pipe **26** extends to the bottom wall **45** of the box **44**. Also, descending fresh air enters through the opening **58** from the annular passages **30** and **34** and passes around the vent pipe **26** to the rectangular port **48** in the bottom **45** of the box **44** by which port **48** the air chamber **39** in the rearward element **38** is supplied. Thus, the approximately square plate **54** affords within the collar **56** a narrow forward shelf portion **54***a* immediately forward of the vent pipe **26** and desirably tangentially contacted thereby, and also lateral shelf portions. The inward edges of these shelf portions are welded to the top edges of the vertical walls of the box **44**.

In order to centralize the lower end of the radiation pipe **32**, a set of spring spacing clips **60** is provided, either on the inner wall of the collar **56**, or mounted on the lower end of the radiation pipe **32** as shown.

For mounting the upper end of the outer air pipe **28** in the roof **14**, a collar **62** having an attached flange **62***a*, as seen in FIGS. 1 and 4, is mounted and calked at **61** on top of the roof **14**, and an upper end portion of the outer air pipe **28** extending above the roof is within the collar. This collar **62** which thus also surrounds the upper ends of the vent pipe **26** and the radiation pipe **32**, acts to center the pipe **28** in the corresponding roof opening **63**. The vent cap **25** is shown as including a short cylinder or ring **64** which acts as a wind-guard and is carried around an upwardly tapered rain-shedding cap **65** in suitably spaced relation by clips **66** or the like. This tapered disc or conical cap **65** acts to distribute the spent gases rising through the vent pipe **26**, and also to exclude rain from the pipe **26** as well as from the pipes **28** and **32**. For these purposes a sleeve member **68** depends in suitable relationship below the tapered cap **65**, as by depending directly from a spaced large flange or annular plate **70** connected to the under side of the tapered cap **65** by spacing clips **72** or the like. The sleeve **68** fits over the upper end of the vent pipe **26**, any appropriate spacing means, such as spring clips **73**, being employed to retain concentric relationships between the sleeve **68**, the pipe **26** and the pipe **32**. The upper end of the collar **62** is secured by clips **74** to the plate **70** which thus imparts concentricity of the pipes **26** and **32** with the outer pipe **28**. Of these pipes, the vent pipe **26** is the longest and reaches the plate **70**. The outer pipe **28** may be the shortest and supplies cold combustion air. The pipe **32** may be intermediate in length as shown.

By such means, spent combustion gases rising through the concentric central vent pipe **26** are discharged above the plate **70** and below the tapered cap **65**, and cool air is received under the plate **70** and through the annular channels **30** and **34**, which air descends through the openings or ports **48** and **58** to feed the fresh air to the chamber **39** in the rearward element **38** and supply the burner **42** by way of the duct **40** leading to the lower end of the combustion chamber **36**, as previously indicated.

Such a vent cap **25** as above described is shown on a much larger scale in FIG. 4 wherein the disc cap **65** is indicated as approximating a segment of a large sphere, as is the paralleling underlying annular plate **70**. In this larger scale figure, the ring **64** is seen as having downturned and upturned reinforcing upper and lower inner flanges **64***a* to stiffen the structure materially. The assembly of FIG. 4 indicates the omission of the intermediate or radiation pipe **32** of FIG. 2, thus providing a single annular downdraft channel **30***a*. However, where desired, as when maximum heat is to be generated by an appropriate burner, the intermediate pipe **32** may be retained as indicated in FIG. 5. Thus, these parts are concentric and have a common vertical axis. In these structures it is desirable to provide means for limiting relative upward movement of the exhaust pipe **26** in the sleeve member **68**, and of the outer air pipe **28** in the collar **62**. For these purposes, the top of the collar **62** is provided with at least one overhanging tongue or finger **67** welded to the outer wall of the collar **62**, against the under side of which tongue **67** the top of the outer pipe **28** may engage. Similarly, at least one overhanging tongue **67***a* is welded at the top of the sleeve member **68** against the under side of which the top of the exhaust pipe **26** may bear. These tongues **67** and **67***a* assure against relative movement of the pipes **28** and **26** above the tops of the collar **62** and the sleeve member **68** respectively, so as to avoid reduction of the air intake space under the plate **70** and of the exhaust discharge space under the disc cap **65**. In order to insure a similar elevational relationship when the intermediate radiation pipe **32** is used, the lower ends of the spring clips **73** may be provided with offset fingers **73***a* to catch under the lower edge of the sleeve member **68**.

In the particular form of heater illustrated in FIG. 2, the combustion element **35** includes a perpendicular rear wall **75** (approximately aligned with the forward wall of the box **44**) and a forward wall **76** which desirably includes a downwardly and outwardly sloping portion **77** so that the lower portion of the combustion chamber **36** is somewhat enlarged. Near the upper end of the chamber **36** a baffle **78** is disposed in transverse relationship whereby to deflect the spent combustion gases laterally around its ends (which, as seen in FIG. 3, are spaced from the side walls **79** of the element **35**) and facilitate heat absorption by the walls of the heater element **35**, as well as control draft. At the middle upper portion of the back wall **75**, an outlet **80** is provided above the baffle **78**. This outlet **80** communicates with a correspondly narrow partially cylindrical venting channel member **82** (FIG. 2) which is welded at its upper end around the circular port opening **46** to the bottom wall **45** of the box **44**.

In this manner spent combusion gases pass from the chamber **36** by way of the outlet or discharge passage **80** into the venting channel member **82** and thence to the vent pipe **26**.

As has previously been indicated, the forward heating element **35**, which is in the nature of a combustion chamber, and the rearward element **38**, which is in the nature of a cool air supplier, are rigidly connected together through the welded tubular duct **40** at their lower ends and through the sides of the overlying rectangular box **44**, and also through the medium of its bottom wall **45**, at their upper ends.

For the purpose of mounting the elements **35** and **38** in the housing or liner **22**, the side walls of the latter are provided with vertical channel members **85** (FIG. 3). These channel members provide vertical channels **86** for the passage of a portion of the air to be heated and taken from the living area of the trailer or other quarters in which the structure is installed. This air enters through the bottom of a grill **90** (FIGS. 1 and 2) secured at the front of the housing **22** and rises up around the heater unit **20**. That air which rises through the channels **86** serves as an insulating medium to cool the side walls of the housing **22**. The channel members **85**, which also act as supporting members for the heater unit, carry brackets **92**. To these brackets there is secured as by means of screws **93** a transverse intermediate supporting and positioning radiation plate **94**, this plate being cut away to accommodate the tubular cool air duct **40** at the bottom of the structure and to accommodate the lower end of the rectangular box **44** and the spent-combustion-gases discharge member **82**.

For the purpose of mounting the heating unit **20**, including the forward combustion chamber member **35** and the rearward cool air supplying member **38**, upper and lower brackets **95** are welded at their opposite ends to the positioning plate **94** and the back wall **75** of the combustion chamber element **35**. Similarly, upper and lower brackets **96** are welded to the back of the transverse supporting wall or plate **94** and to the front wall **51** of the air supplying element **38**. When the edges of the transverse plate **94** are secured to the brackets **92** by the screws **93**, the entire heating unit is rigidly secured within the housing **22**, and in spaced relation to all of the walls of the housing **22**. Thus, air entering the lower portion of the housing **22**, from the living space within the trailer being heated, rises partly through the lateral air channels **86**, and partly up around the forward combustion chamber element **35** both forward and rearward of the latter. Some of the air also passes in behind the supporting and radiation wall **94** and rises up around the air supplying element **38** which gathers considerable heat through the supporting and radiation wall **94**. Air which is heated convectionally by the combustion chamber element **35** passes outward through the upper portion of the grill **90**. Radiation heat also passes outward through the grill **90**.

For the purpose of better controlling the discharge of the heated air from the upper portion of the housing **22**, a pair of sloping baffles **98** and **99** are disposed above the heater unit **20**. The lower baffle **98** deflects the heated air rising aronud the combustion chamber element **35** outward through the grill **90**. This baffle **98** is disposed between the two channel members **85**. The upper baffle **99**, which also is disposed between the two vertical channel members **85**, cooperates with the underlying baffle **98** to provide in air discharge through an upper portion of the grill **90** for that portion of the air which rises around the air chamber member **38**. The upper baffle **99** extends to the back wall of the housing **22** and thus serves to deflect forward above it only that warmed air rising through the air channels **86** at the sides of the heating installation. Both these baffles are notched to accommodate the rectangular box **44**.

The construction of the burner **42** is not a part of this invention, and any efficient approved gas burner is usable. It includes a control knob **100** and, if desired, a pilot light and thermostat control. A swinging door or cap **102** (FIG. 3) for controlling access to a lighting hole may also be provided as indicated.

In the operation of the present structure, when the burner **42** is in operation, spent combustion gases rise to the top of the combustion chamber **36** and around the baffle **78**, whence they pass out through the vent opening **80** and the channel member **82** and thence up through the vent pipe **26** to be discharged through the vent cap **25** above the roof. At the same time cold air enters from above the roof through the lower part of the vent cap **25** below the annular plate **70** into the outer air pipe **28** and downward by way of the annular air passages **30** and **34**. Thence the cold air passes down into the rectangular box **44** around the lower end of the vent pipe **26** and enters the rectangular port **48** at the top of the air chamber **38**, whence it travels to the bottom of such chamber and from that point through the duct **40** into the bottom of the combustion chamber **36** to supply the burner **42**. By these means, only external air is used to support combustion, and air within the trailer is only recirculated over the heating elements for warming the living area of the trailer or other structure involved.

The functioning and arrangement of the parts of the vent cap **25** eliminate possible mixing of exhaust gases with the incoming cold air and are such as to exclude rain and spray. This is true because the disc cap **65** is annularly spaced from the ring **64** sufficiently to accommodate all combustion gases which thus rise up along the inner wall of the ring **64** and because the annular plate **70** is annularly spaced from the ring **64** sufficiently to insure air draft up through the annular space **170** around the plate **70** and through the annular space **165** around the cap **65** under draft influence of the rising hot combustion gases. Thus, only rising cold air can enter the space **168** around the sleeve **68** and beneath the plate. **70**. Such rise of cold air to the space **168** may even be facilitated by the draft. For these purposes, the diameters of the cap **65** and the plate **70** are substantially equal.

At the same time, the ring **64** completely encloses the cap **65** and the plate **70**, its upper edge extending above the disc cap **65** and its lower edge extending below the plate **70** and being substantially even horizontally with the upper end of the outer sleeve or collar **62**. This arrangement effectually excludes all rain or spray from the vent pipe **26** and the collar **62**. This is true even with winds.

Thus, these arrangements make it possible to place a gas heater of the indicated type in an interior wall rather than only in an outside wall. In either instance, the heater is installed between studs **15** which are adequately heat-insulated by the various described rising-air passages

between the walls ofthe housing **22** and the heater elements **35** and **38**. In such a heater, the height of the combustion chamber **35** and the air chamber **38**, whose individual heights are about equal, is about twice their width; and the height of the box **44** extends such overall height about 20% or 25%. For example, in a typical common size, the height of the elements **35** and **38** is about eighteen inches and their width about eight to nine inches, while the box **44** adds approximately another four inches. Here, the thickness of each element **35** and **38** at their tops is about one inch, and they are spaced about two inches apart, with the radiation wall **94** disposed about equidistantly between them. This leaves adequate spacing, with a minimum of about one inch between the heater **20** as a whole and the walls of the housing **22**, which housing may have a width of about eleven or twelve inches and a depth of about six and one-half to seven inches. The vent pipe **26** typically is two inches in diameter, the outer air pipe **28** is four inches in diameter, and the intervening radiation pipe **32** is three inches in diameter. The ring **64** has a diameter of about eight and one-half inches and a width of about two inches, while the diameter of the disc **65** and the plate **70** is about seven inches. Spacings between the cap **65** and plate **70** of around three-fourths to one inch, and between the plate **70** and collar **62** of around one-half to three-fourths inch, insure good draft and cold air entry. These parts extend upward from the top of the heater to a position above the roof, and commonly add another five to six feet in overall height.

It is thus seen that I have provided an improved sealed-combustion-chamber gas heater and vent cap for boats, mobile homes, larger homes, and the like, which make it possible and desirable to vent gas-fired heaters up through the roof and to locate them in interior walls as well as outer walls.

The invention claimed is:

1. In a heater vent cap to be disposed horizontally above a roof:

a rain and wind excluding ring in horizontal disposition and arranged about a vertical axis;

an upwardly tapering disc cap secured within said ring in spaced relation from said ring radially to provide a substantially annular venting space, the top of said ring lying above said disc cap;

an annular plate disposed in spaced relation below said cap to provide between the plate and cap a horizontal venting space for combustion gases leading to said annular venting space, said plate also being spaced radially from said ring to yield a substantially annular draft space therearound;

a positioning sleeve secured about a central opening in said plate and extending downward to receive a vent pipe;

a mounting collar attached to said plate in spaced relation around said sleeve to provide a down-draft cold air passage between said sleeve and said collar; and

means mounting said plate in spaced relation above the top of said collar for admission of cold air to said passage.

2. A structure as in claim **1** including means on said collar and said sleeve to limit upward movement of pipes therein.

3. A structure as in claim **1** wherein the top of said collar is substantially horizontally even with the bottom of said ring to exclude rain.

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