April 25, 1967 K. S. JENSON ET AL 3,315,657

AIR HEATER

Filed Dec. 31, 1963 3 Sheets-Sheet 1

Fig. 1.

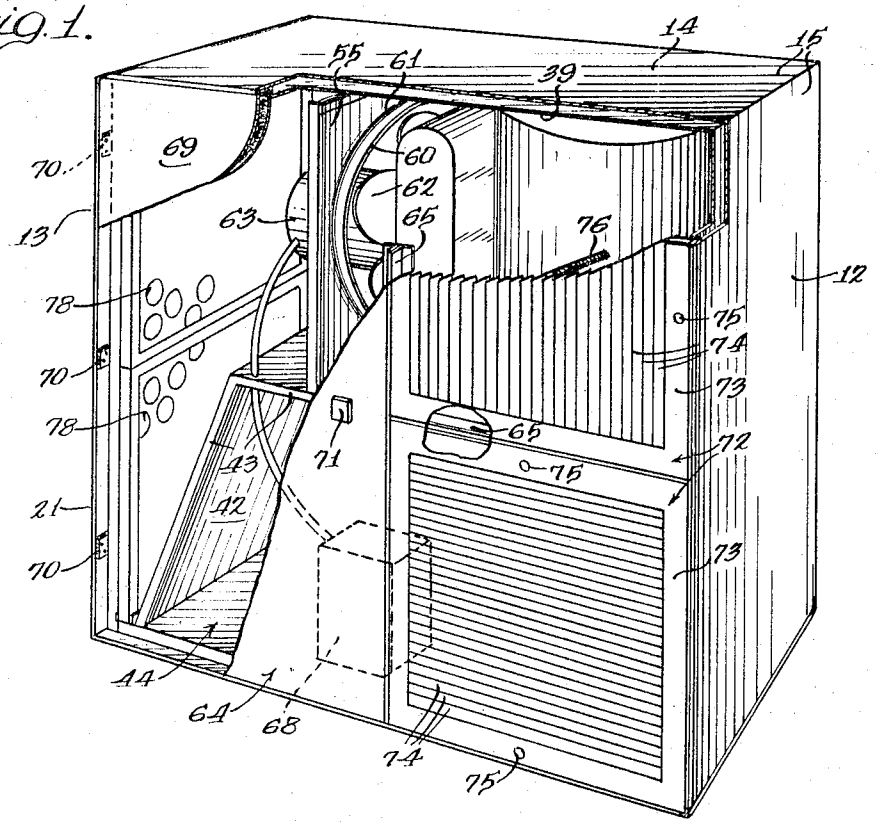
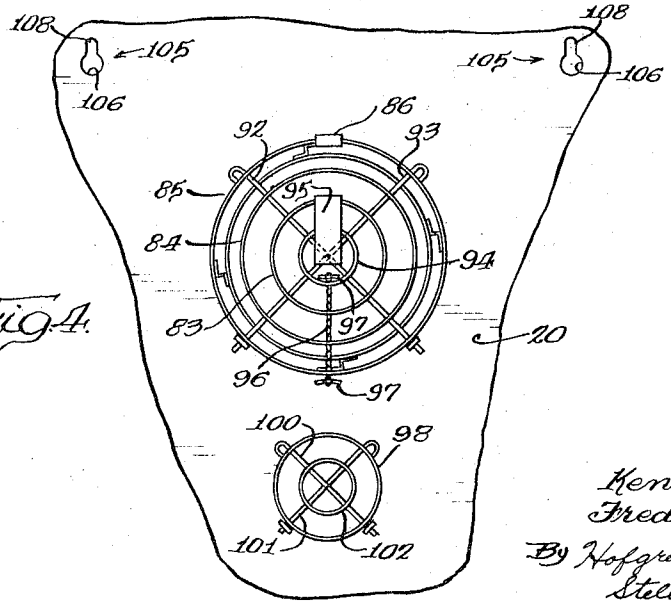



Fig. 4.



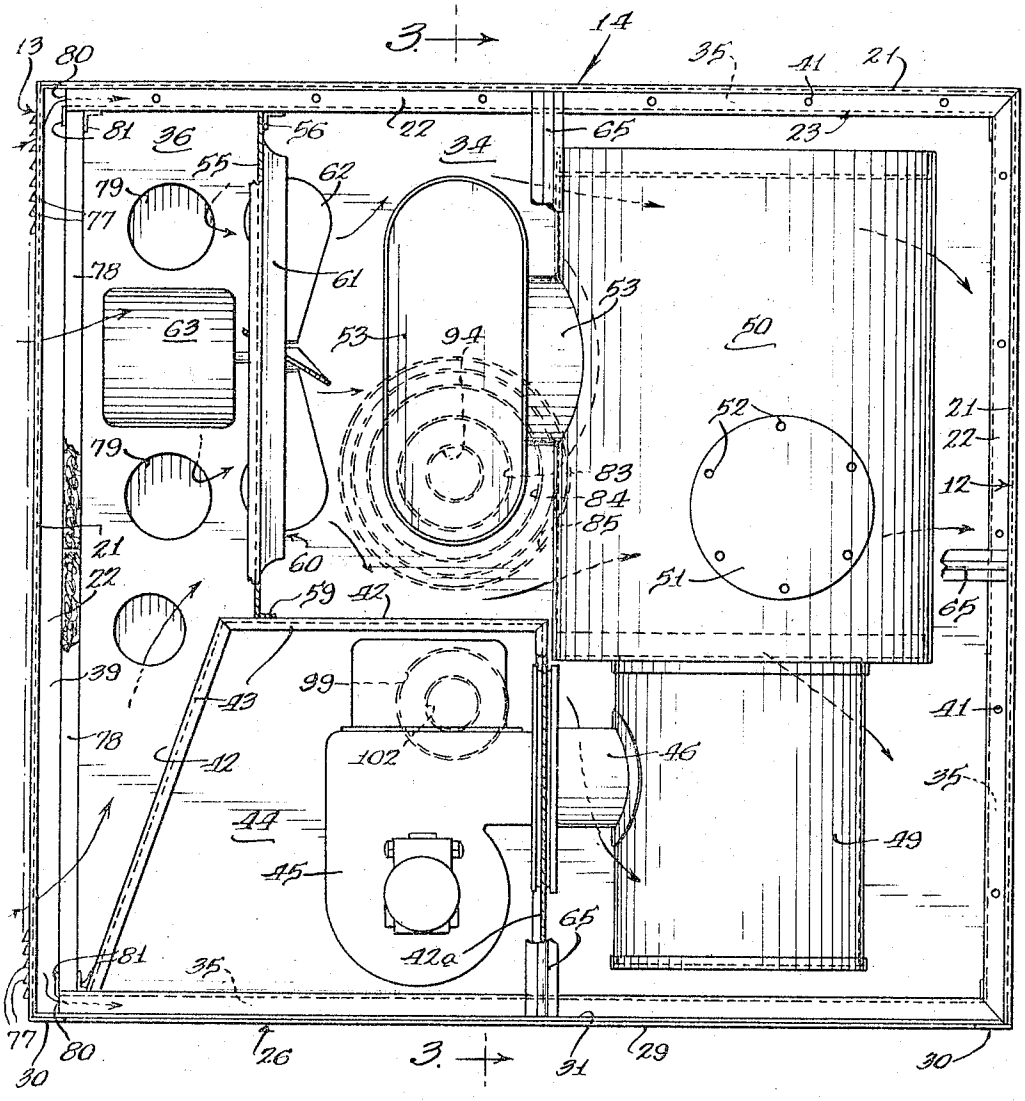

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AIR HEATER

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FIG. 2.

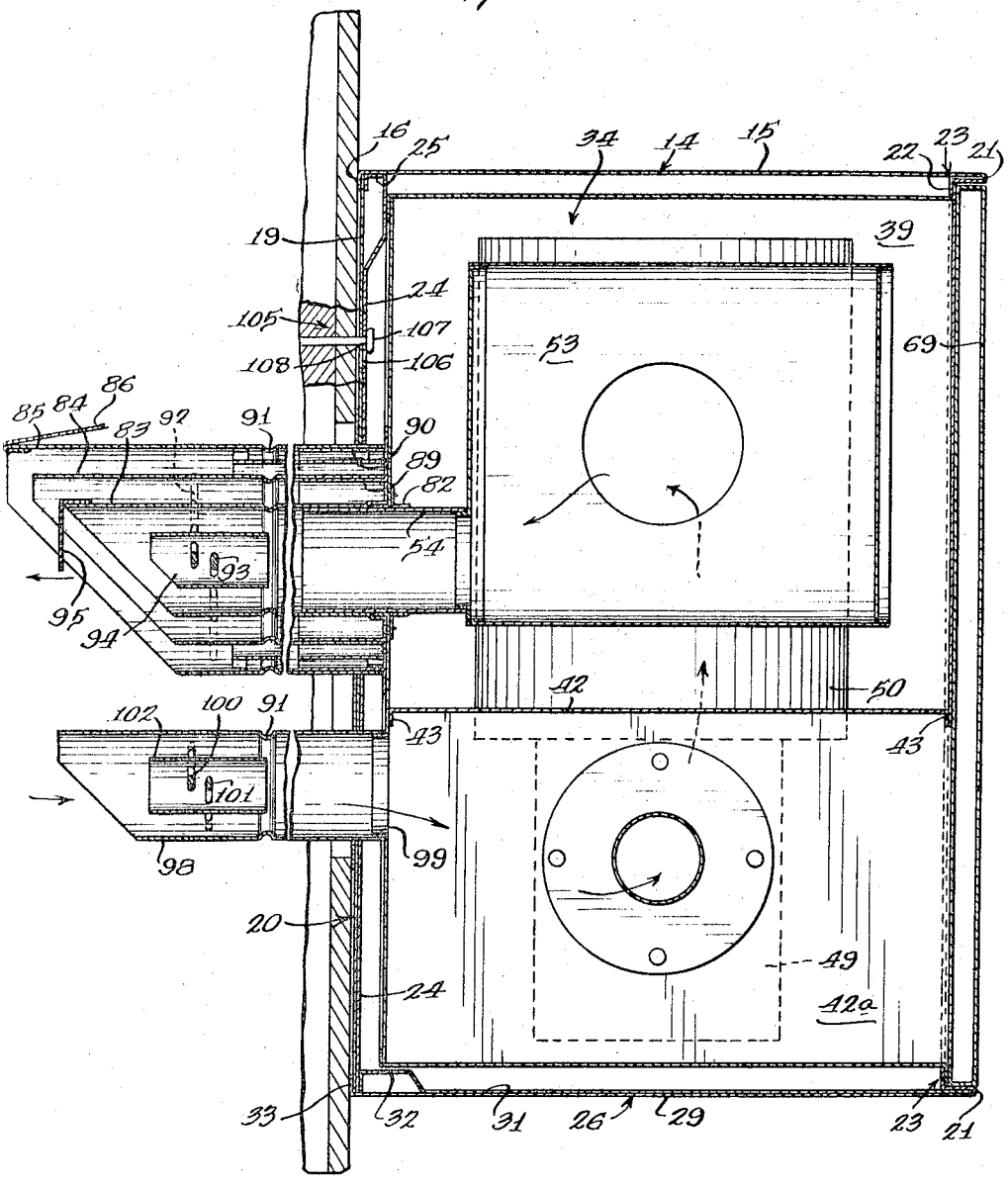


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AIR HEATER

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Fig. 3.



United States Patent Office 3,315,657 Patented Apr. 25, 1967



3,315,657

# AIR HEATER

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Original application Dec. 31, 1963, Ser. No. 334,693, now Patent No. 3,274,989, dated Sept. 27, 1966. Divided and this application Mar. 1, 1966, Ser. No. 530,849

2 Claims. (Cl. 126—116)

This invention relates to air heaters and is a division of our copending application Ser. No. 334,693, filed Dec. 31, 1963, now Patent No. 3,274,989, granted Sept. 27, 1966.

Air heaters of the type installed and used within living areas of dwellings have in recent years come more and more into use. Such heaters include space heaters as well as heaters for heating the entire dwelling. Such an air heater is conveniently installed with an exhaust and/or intake conduit through a wall or ceiling structure. Hazards may be created by leakage of vent ducts. Where the burner is used for heating purposes, the efficiency of the heater may be decreased by flow of exhaust gases back into the burner intake. Another hazard is created by foreign objects or birds entering the exhaust conduits. Also, wind blowing directly at the exhaust conduit creates a reverse flow of combustion gases.

It is therefore the principal object of this invention to overcome or alleviate problems such as those discussed above.

It is another object of this invention to provide an air heater of the character described including an exhaust conduit comprised of a plurality of concentric tubular members which prevent leakage.

It is a further object of this invention to provide such an exhaust conduit which includes an inner cylindrical conduit suspended centrally of the innermost tubular member to prevent foreign objects or birds from entering the exhaust conduit.

It is still another object of this invention to provide an exhaust conduit of the character described which has deflector means to prevent the reverse flow of combustion air when the wind is blowing.

Another object of this invention is to provide a new and useful vent arrangement for use with such air heaters.

Other objects and advantages will become apparent from the following detailed description taken in connecnection with the accompanying drawings in which:

FIGURE 1 is a perspective view of a form of air heater of this invention;

FIGURE 2 is a view looking into the air heater of FIGURE 1 with the front door removed;

FIGURE 3 is a section through the air heater of FIGURE 1 along lines 3—3 of FIGURE 2, with the air heater mounted on and supported by a wall of a building; and

FIGURE 4 is a view of a portion of the rear of the air heater of FIGURE 1 showing a form of venting arrangement.

In general the embodiment of air heater illustrated in the drawings is of the type in which air is drawn in from a room or building to be heated and the air is passed in heat exchange with a combustion chamber wherein fuel is being burned. The heated air is then discharged back to the room or building and air is continuously passed through the heater while on, for heating purposes. The air for supplying the burner is drawn in through a separate intake system from outside of the room or building and the combustion gases and fumes are exhausted exteriorly of the room or building.

Referring to the drawings, as seen generally in FIGURE 1, the embodiment illustrated includes a hexahedral casing having outer walls on each of the six sides thereof.



As seen in FIGURES 1–3, the outer side walls **12** and **13** and top wall **14** are formed of a single sheet member **15** and have inwardly turned flanges **16** overlapping and abutting peripheral edges of an outer sheet member **19** of a rear wall **20**. The front edge of sheet **15** is folded inwardly within the casing at **21** and thence downwardly in an inward flange **22** providing a recess flange or angle member **23**, the purpose for which will be seen hereinbelow. Flange **22** forms one leg of the angle member **23**, the other leg terminating at fold **21**. The rear wall **20** includes sheet member **19** and an internal sheet support member **24** facially secured thereto and terminating at its upper end in a channel-like configuration at **25** for adding rigidity to the upper rear edge of the casing.

The bottom wall **26** of the casing includes a bottom sheet **29** abutting inwardly turned flanges **30** of sheet member **15**. Sheet **29** is backed with an inner sheet **31** and secured thereto, sheet **31** having a rearward channel-like portion **32** which is secured by one channel leg to sheet **24**. A rear flange **33** of sheet **29** turns upward overlying sheet **19** of rear wall **20**, sheet **19** being backed by brace or sheet member **24** which is secured to both flange **33** and sheet **19**. Inner sheet **31** is secured to the upper faces of flanges **30** and backs the abutting joint between flanges **30** and sheet **29**.

The front edge of sheet **29** also terminates in a recessed angle portion **23**, the bend at **21** clamping and holding the front edge of sheet **31** between the opposing surfaces of sheet **29** in forming the angle **23**.

A second casing wall structure is provided generally enclosing a combustion and air heating portion **34** of the illustrated air heater, except for the air intake and outlet passages thereof. The second casing wall structure is spaced inwardly from the outer casing structure to define a flow path **35** between the inner and outer casing structures in communication with an air intake chamber **36** for delivery of air to the heater from the room to be heated by the heater. The flow path **35** insulates outer casing top wall **14**, rear wall **22**, bottom wall **29**, and side wall **12** from the combustion and air heating portion **34** of the device so that these walls remain cooler than otherwise. End **13** and the front of the illustrated air heater include air inlets and outlets, respectively, for circulating air through the heater and are not provided with the insulating air flow path, i.e. not backed by the inwardly spaced inner casing.

The inner casing, indicated generally at **39** is composed of a plurality of sheet members secured together by overlapping flanged edges to form an enclosure spaced inwardly from walls **12**, **14**, **20** and **29** sufficient to define the air flow passage **35** between these walls and casing **39**. Casing **39** includes out-turned flanges **40** which are secured to legs **22** of angles **23** by machine screws **41**, or the like. Casing **39** is also welded to channel member **25** and may rest on or be welded to channel member **32**. Channel members **25** and **32** extend the length of the rear wall **19**, blocking air communication between the portion of passage **35** along wall **19** and the portion of passage **35** along top wall **14** and bottom wall **29**.

Casing **39**, it will be noted, is open at the end disposed toward end **13** of the outer casing of the device. A sheet metal member **42** is configurated to define an air chamber **44** and has down-turned or inwardly turned flanges **43** along the front and rear edges thereof. Rear flanges **43** are secured to the interior surface of the rear wall of casing **39**. Air chamber **44** is the intake chamber for receiving air to be used by a burner **45** mounted by suitable means within chamber **44**. Burner **45** is illustrated in the form of an automatic "gun-type" power burner, a type of burner used in central heating plants. Such a burner is electrically controlled for ignition and shut-off and is capable of drawing surrounding

air and creating sufficient power draft for burning of the fuel, in this case, oil. The oil is introduced to the burner in normal manner by feed lines (not shown), flame and combustion gases being discharged from burner 45 through outlet passage 46 into a pot portion 49 of a furnace 50 defining a combustion chamber internally thereof. Furnace 50 is provided with a service port cover 51 bolted in place as at 52. The combustion gases from combustion chamber 50 are passed through an outlet duct or passage 53 terminating in tubular projection 54 for exhausting such combustion gases from the device. Force for draft at the burner and for exhausting the gases is provided integrally in the burner structure.

Upstanding from sheet 42 is a sheet member 55 extending the depth of the air heater casing, and, with sheet 42 and casing 39 defining air intake chamber 36 to the left thereof, as viewed in FIGURE 2, as a chamber separate from the air heating chamber 34. The sheet 55 is secured along its top edge to flange 56 projecting downward from the portion of casing 39 spaced inwardly from wall 14.

The lower edge of sheet 55 is secured by flange 59 to sheet 42 and the rear edge is secured to the rear wall of casing 39. An opening 60 is provided through sheet 55 surrounded by a skirt 61 defining a throat opening 61 extending inwardly into chamber 34. Mounted within the throat member 61, coaxial therewith, is a blower or fan having a plurality of blade members 62 driven by a motor 63 suitably mounted in chamber 36 by brackets (not shown).

The front wall of the illustrated air heater device is shown generally by reference numeral 64. Vertical and horizontal brace members 65, each having a cross-sectional T-shape, are interconnected across the front of the casing and are secured at their ends to each other or to angle legs 22, providing continuation of the recessed flange or leg 22 vertically spanning the front and horizontally spanning a portion of the front, forming a frame structure of front wall 64. A door 69 is mounted by hinges 70 to the rearward folded portion of wall 13 adjacent fold 21. Door 69 is provided with a handle 71 and is openable and closable on hinges 70. Door 69 is provided with a snap-catch (not shown) of conventional design for securing the door in closed position, but releasable for opening the door. The inner surface of door 69, when door 69 is closed, is flush against and abuts angle 43 and the forward edge of plate 55 to generally seal chamber 36 from chamber 34 except via port 60. The inner surface of door 69 also seals off and forms the front wall of combustion air chamber 44, preventing use of appreciable amounts of room air for combustion purposes. Door 69 may conveniently be double-walled and may include insulation between the two walls, if desired. Door 69 is provided for gaining access to the burner 45, blower 63 and the electric system for controlling the blower and burner, for repair thereof, and for the replacement of filter elements as will be described hereinbelow.

The electrical system for control of the burner is illustrated as mostly mounted within box 68; the system includes the usual connections for controlling the burner and blower by a thermostat removed from the heater, e.g. mounted on a wall of the room. Box or electrical system 68 is mounted on wall 42*a* in chamber 44 and is thereby isolated from the hotter chamber 34; also, sheet member 42, of which wall 42*a* is a portion blocks substantial heat exchange between the outlet chamber 53 from furnace 50 and the electrical system. With door 69 closed the peripheral edges thereof are facially disposed against flanges 22 and an arm of T-frame member 65. Thus, door 69 is used to close and substantially seal a plurality of chambers from each other without employing permanent seals of compositions which may deteriorate with use. Front wall 64 also includes a pair



of grill panels illustrated as being of generally square configuration and shown generally by reference numeral 72. Each grill panel includes a frame 73 supporting a plurality of parallel vanes 74 having a distinct curvature for directing air passing therebetween laterally of the vanes, vanes 74 being secured against movement in the illustrated form. Handles 75 are provided on each of grill panels 72. A tension spring 76 is provided for each panel 72, anchored at one end to a generally centrally disposed portion of panel 72 and anchored at the other end to the interior surface of casing 39 spaced inwardly from wall 12. Tension spring 76 biases grill member 72 inward against a framework defined by flanges 22 and an arm of T-braces 65. Either or both of the grill members 72 may be grasped by handles 75, pulled outward and reorientated 90° in rotation or in multiples of 90° in rotation and reinserted, spring 76 being sufficiently resilient to permit withdrawal of the panels 72 for reorientation thereof and having sufficient strength to retain panel 72 in the position shown in FIGURE 1 after reorientation. Thus, by reorientating panels 72 as desired, warm air passing from chamber 34 outwardly through vanes 74 may be directed upward, downward, or to either side or in any combination of two such directions.

Opening of door 69 and removal of grills 72 gives access to the complete interior of the device for servicing of component in any of the chambers thereof. The rear wall of casing 39 is provided with a plurality of ports 79 for communicating the air space 35 between casing 39 and rear wall 20 with chamber 36. The portion of space along rear wall 20 is in air communication with the portion of air space 35 along end wall 12, but is blocked by channel members 25 and 32 from communication with the portions of air space 35 along top wall 14 and bottom wall 29. The left edge, as viewed in FIGURE 2, of the rear wall of casing 39 abuts and is secured to side wall 13 adjacent an edge thereof peripherally of the louvers 77 in wall 13. The top and bottom walls of casing 39 stop short of wall 13 at the left in FIGURE 2. Thus, the ends of the portions of air chamber 35 lying beneath top and bottom walls 14 and 29 are open for receiving air, as at reference numeral 80, from the slot ports defined in wall 13 by louvers 77. It will be seen that a pressure drop at ports 79, e.g. created by blower 62, would tend to draw air through open ends 80, along walls 14 and 29, thence into the portion of air space 35 beneath wall 12, into the portion of air space 35 beneath rear wall 20 and through ports 79 into chamber 36. A flowing blanket of air beneath walls 12, 14, 20 and 29 is thereby created. This flowing blanket of air insulates the walls from the combustion and air heating chamber portion 34 of the device providing external surfaces of the thusly insulated walls which are cool to the touch.

However, the total supply of air to chamber 36 is not obtained from the insulating blanket of flowing air. Substantial amounts of air are also drawn in through end wall 13. Accordingly, louvers 77 provide a plurality of flow slots through wall 77. Wall 13 is backed by filters 78 so that air passing between louvers 77 passes through filters 78 into chamber 36, filters 78 being held in place by peripheral flanges projecting inwardly from the top, rear and bottom walls of casing 39 and forming a frame 81, the filters being contained between flanges 81. The filters 78, however, do not extend across openings 80 of air space 35. For removal of the filters, door 69 is opened and filters 78 may be slid out from the front of the casing for cleaning, replacing or the like. Reinsertion of the filters will be apparent. Door 69, when closed, seals against the front edge of filters 78.

The filters 78 are packed filters having fibers sufficiently compacted to create resistance to flow into chamber 36 therethrough. With blower 62 drawing air from chamber 36, filters 78 serve to provide a pressure drop across

the filters. As a result, air is readily drawn into and through air space **35** and into chamber **36**, maintaining the blanket of air beneath the outer wall of the air heater device. Air is also drawn into chamber **36** through filters **78** and the resistance to flow, or pressure drop, created by filters **78** is sufficient to provide the desired or proper amount of cooling air flowing through chamber **35** for the desired cooling effect on the heater outer walls.

Outlet duct **54** projects through and is secured to the rear wall of casing **39** by means of a circular angle member **82** secured to the outer surface of duct **54** and the inner surface of casing **39**. A plurality of concentric tubes **83**, **84** and **85** is provided with tube **83** slidably fitted over tubular duct **54**. Tube **83** is the central tube of the plurality. A brace **86** is hooked at one end around the outer end of tube **85** and can be mounted at its other end to suitable building structure for supporting the outlet end of the assembly of concentric tubes. A flue shield liner is mounted within tube **85** by suitable spacer mounting brackets. Tube **84** projects through the liner. Two concentric flanges **89** and **90**, each concentric with duct **54**, are secured to the outer surface of the rear wall of casing **39** and project outwardly through rear wall **19**, as does duct **54**. Tubes **84** and **85** are slidably received over flanges **89** and **90** respectively forming a telescoped assembly between tubes **83** through **85** secured to duct **54** and flanges **89** and **90** by force fit.

Cross braces **92** and **93**, illustrated as long bolts, impale each of tubes **83** through **85** generally along diameters thereof, bolts **92** and **93** being illustrated as disposed along different angular dispositions with respect to each other, e.g. at right angles to each other.

Bolts **92** and **93** also impale an inner tube member **94**, suspending tube **94** generally centrally within tube **83**. Bolts **92** and **93** receive nuts at their straight ends and serve to maintain general concentric disposition of tubes **83** through **85** which are also supported concentrically by exhaust duct **54** and flanges **89** and **90**. Attached to and extending part way across the end of tubes **83** there is provided a deflector member in the form of a rigid flap **95**, the function of which will be more evident hereinbelow. Deflector **95** is secured to the upper surface of the outer end of tube **83** by a flange portion welded to tube **83**.

A chain **96** extends through small aligned holes in the lower wall portions of each of tubes **94** and **83** through **85**. Chain **96** is held generally taut and secured at opposite spaced ends by cotter keys **97** which retain the chain in position by functioning as stops against the inner surface of tube **94** and the outer surface of tube **85**. Chain **96** aids in holding the tubes **94** and **83** through **85** in concentric disposition and prevents incorrect placement of the tubes during installation.

As gases are exhausted through duct **54** there may be some leakage between duct **54** and the tube **83** telescoped thereover, the connection therebetween being a forced fit or sliding connection. For this reason, concentric tube **84** is provided surrounding tube **83** to conduct gases which may leak through the connection outwardly away from the area adjacent wall **20** and casing **39** where such gases may be carried into the air intake system and eventually be discharged into the room or building being heated. For like purpose, concentric tube **85** is provided surrounding tube **84** to direct any gases which may leak between flange **89** and tube **84** outwardly away from wall **20**.

Disposed below the combustion gas exhaust system described above is the combustion air inlet system which includes a tubular member **98** telescoped and force fitted over a flange **99**. The flange **99** defines the inlet duct for air being drawn into chamber **44** for use by burner **45**. Cross brace members **100** and **101**, in the form of bolts and nuts, suspend inner tube member **102** generally concentrically within tube **98**.

Cross brace members **92**, **93**, **100** and **101**, in addition to functioning for bracing purposes also help to block passage of objects inwardly through ducts **54** and **99** during operation of the device or otherwise. The centrally mounted tubes **94** and **102** are also provided for preventing birds from entering and building nests.

The purpose of the deflector **95** is to prevent reverse flow of combustion gases when the wind is blowing directly at the discharge end of tube **83**. With wind blowing directly against the open ends of tubes **83** and **98**, deflector **95** creates a cross flow of air which increases or aids the discharge of combustion gases from tube **83** because the wind can enter inlet tube **98** easier than outlet tube **83**.

The heater device may be conveniently installed by setting the device on a supporting surface at the desired location and connecting the burner and electrical system in the usual manner to fuel line and thermostat. Means illustrated at **105** (FIGURE 3) are also provided for mounting the device in a position suspended from a wall, desirable where floor space is limited. Accordingly, each mounting **105** includes a circular hole **106** in rear wall **20** of sufficient size to clear the head of a bolt **107** or screw or the like. A slot **108**, at least as wide as the shank of bolt **107** and narrower than the head of bolt **107**, extends upwardly from hole **106**. A plurality of such mountings is provided, each at a different location in rear wall **20**, preferably near the top of wall **20**. In installing, bolts **107** are secured into the wall at positions spaced in accordance with the spacings of holes **105**, with the heads of bolts **107** protruding slightly. The heater is lifted to the wall and holes **105** are guided over the bolt heads and the bolt shanks are directed into slots **106**. Burner and electrical connections, etc. are then made to the mounted device.

In operation of the device, motor **63** and burner **45** are started in the usual manner and air is drawn by burner **45** through intake duct **99** into combustion air chamber **44**, thence through burner **45** and the resulting flame and combustion gases are ejected into combustion chamber **50** and are exhausted through ducts **53** and **54** and **83** exteriorly of the room or building. Passage of air through chamber **44** serves to keep electrical system **68** cool. Meanwhile, fan **62** draws air from chamber **36** and forces the air through chamber **34** in heat exchange with furnace or combustion chamber **50** and thence outward through grill members **72** for direction of air into the room as desired. The air is heated in chamber **34**. Fan **62** draws air into chamber **36** through louvers **77** and thence in separate paths to chamber **36**, one path through filter **78** and the other path through the air space **35** beneath the surfaces of walls **12**, **14**, **20** and **29**. Thus, there is provided a separate flow system, including two flow paths, for drawing air from a room and heating and returning the air and a separate flow system for drawing air from exteriorly of the room for burning fuel by the burner for heating the air by heat exchange with the first flow path, the combustion gases being exhausted exteriorly from the room or building. The air entering chamber **36** via flow path **35**, is, in effect, predominately passed in heat exchange with chamber **34** for preheating the air prior to its entry into chamber **34**, thereby improving the efficiency of the heating operation while maintaining cooler exterior casing walls.

We claim:

**1.** A gas conduit for passage of gases relative to an air heater comprising, a plurality of tubular conduit members of different diameters positioned one within the other in spaced-apart relation, and means for holding said conduit members in spaced-apart relation including a pair of rods at approximately right angles to each other and each extending diametrically of and loosely through openings in the walls of the tubular members, the rods being of a length to have the rod ends extending beyond the outer perimeter of the outermost tubular member whereby the angular relation of the rods holds the tubular members in associated relation and the rods can be manipulated externally of the conduit, and means on the rods engage-

able with the outermost tubular member for holding the rods in position.

2. An air heater comprising a housing; an air heating chamber within said housing adapted for passing air therethrough; a furnace system defined by a walled conduit extending through said air heating chamber in heat exchange therewith, said furnace system including a combustion chamber having wall means in heat exchange with the air heating chamber, burner means for burning fuel in said combustion chamber in the presence of air, air intake means for drawing air into said burner means, outlet means for discharging combustion gases from said combustion chamber, separate conduit means communicating with said air intake and outlet means, projecting through a wall of said housing and adapted for installation through a wall structure for communication with air on the other side of such wall structure, each of said conduit means comprising, a plurality of tubular conduit members of different diameters positioned one within the other in spaced-apart relation, and means for holding said conduit members in spaced-apart relation including a pair of rods at approximately right angles to each other and



each extending diametrically of and loosely through openings in the walls of the tubular members, the rods being of a length to have the rod ends extending beyond the outer perimeter of the outermost tubular member whereby the angular relation of the rods holds the tubular members in associated relation and the rods can be manipulated externally of the conduit, and means on the rods engageable with the outermost tubular member for holding the rods in position.

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