April 14, 1942. R. B. EVANS 2,279,975

SPACE HEATER

Filed Aug. 18, 1939 2 Sheets-Sheet 1

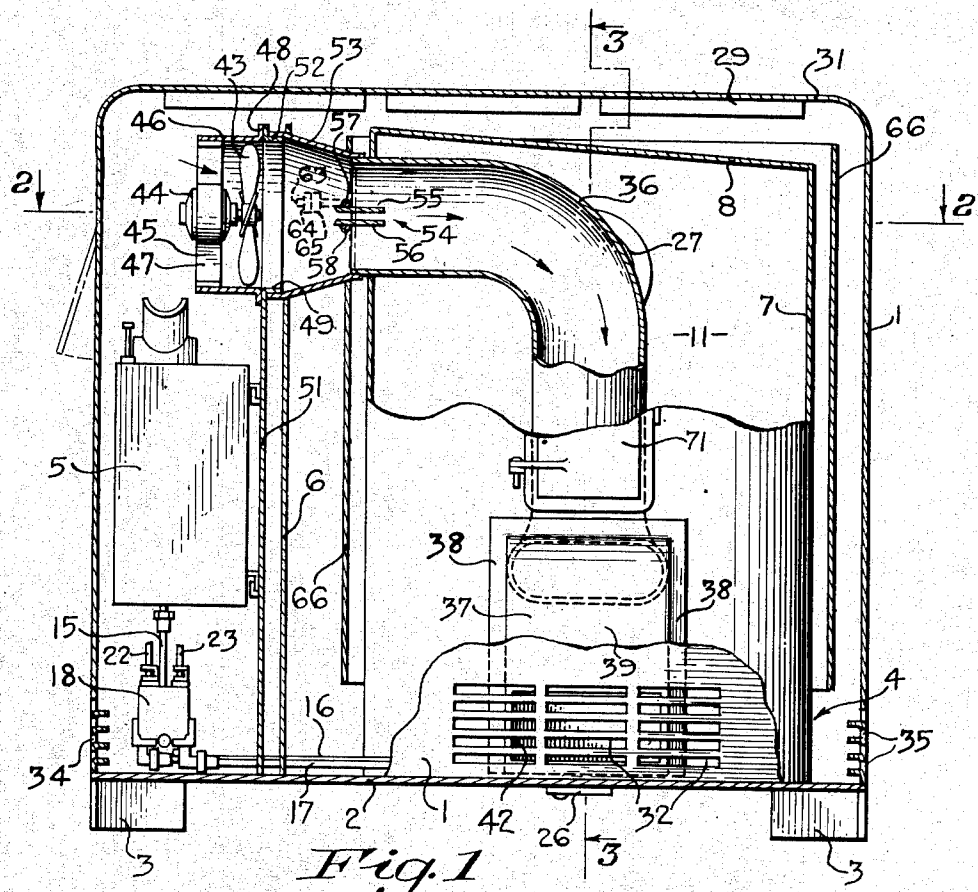


Fig. 1

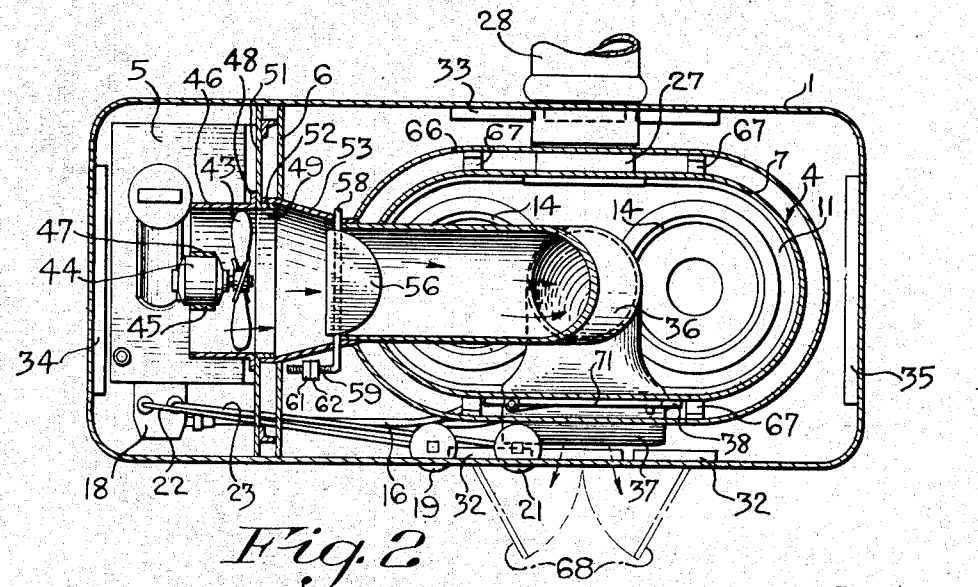


Fig. 2

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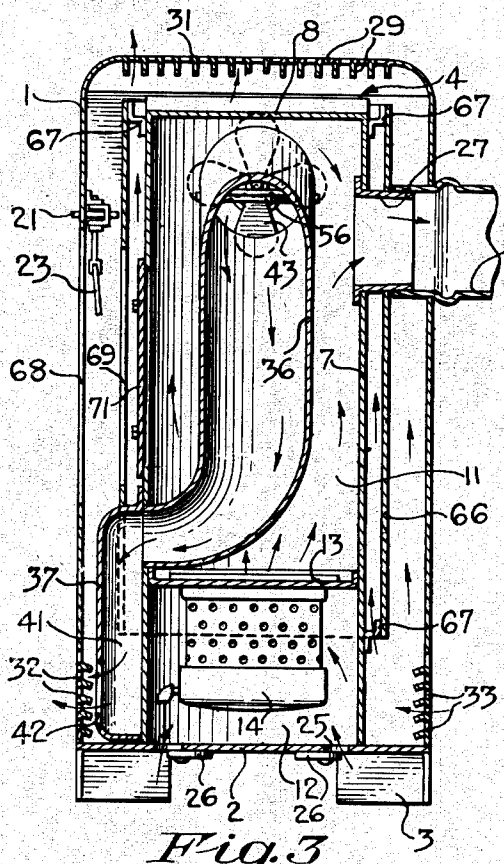


Fig. 3

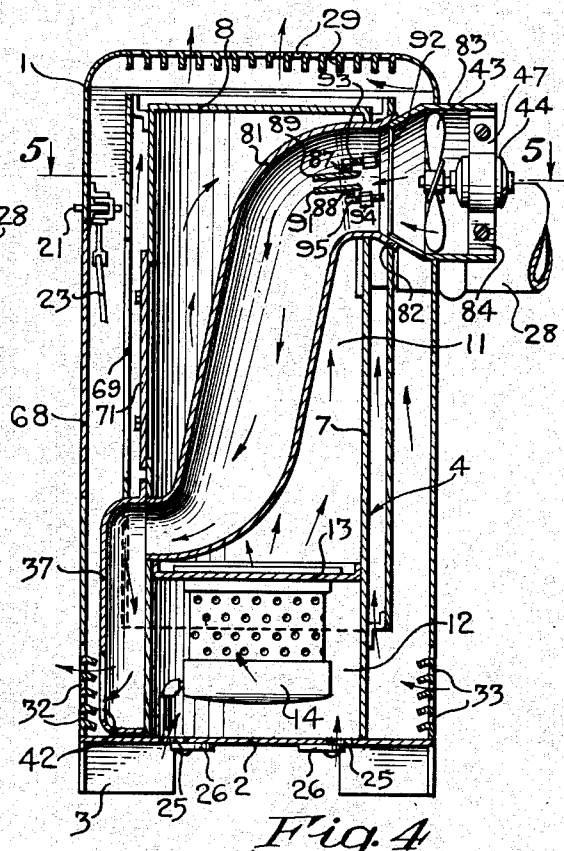


Fig. 4

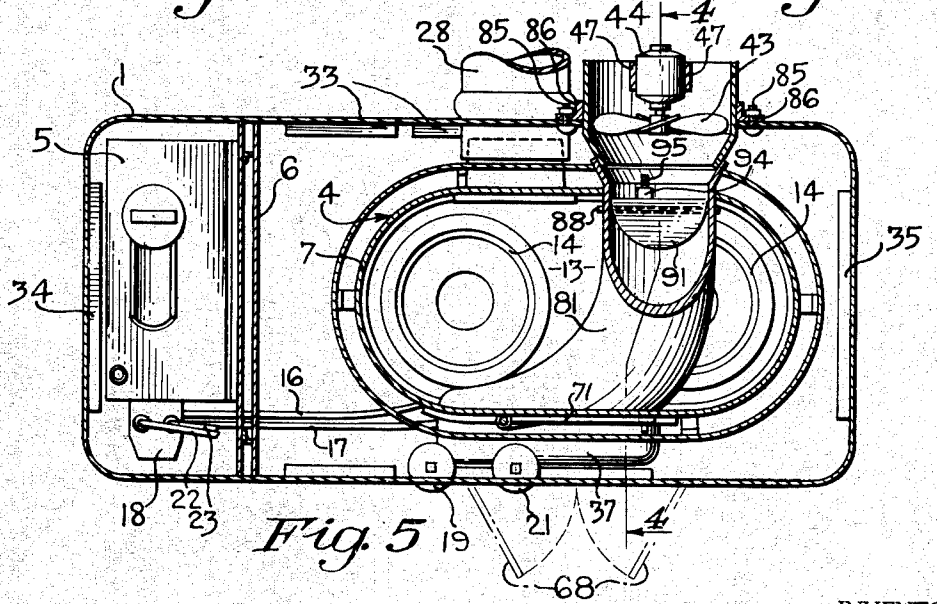


Fig. 5

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UNITED STATES PATENT OFFICE

2,279,975

SPACE HEATER

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Application August 18, 1939, Serial No. 290,878

16 Claims. (Cl. 126—110)

This invention relates to space heaters or the like, and particularly to the portable or movable, floor supported cabinet type of unit space heaters containing a combustion unit, such as an upright and direct fired, expansion heating drum, to heat air to a high temperature and an air circulating fan in said cabinet or casing for forcing the circulation of part of this high temperature air through rooms, small homes or the like. The remaining portion of the heated air is circulated by the natural upward convection current in said heater. Preferably, a high temperature, air heating duct having open ends extends down through the expansion drum so that it is surrounded by the products of combustion. A blower or fan discharges outside air into the upper end of this duct and forces it downwardly and out through the horizontally directed opening at the lower end which cooperates with an opening spaced slightly above the floor in the cabinet front and including vane means to deflect the high temperature air into a substantially horizontal stream across and close to but safely above the room floor. The heater may operate with natural upward convection at the same time.

This invention also relates to space heaters of the general character shown in the prior application of myself and Eugene F. Farrell, Serial No. 232,502, filed September 30, 1938, and embodies features disclosed and claimed therein. The general arrangement and structure of the cabinet, the doors, heating drum with its oil burners, fuel controls, the fuel tank mounted in a smaller upright side chamber having a convection air flow to cool the tank and formed by a transverse shielding or insulating partition, and the like are, or may be, generally similar to this prior application. Also, the feature of providing a fan-forced stream of high temperature air horizontally across and close to but safely above the room floor and the additional feature of having an fan draw its air supply from the warmed air rising around the oil tank are common to this prior application.

In general, the objects of the present invention are to provide an improved and simplified space heater having a blower or fan-forced low level, but safe, discharge of high temperature air horizontally across but close to the room floor, to achieve the benefits of better heat distribution or the like from this low level discharge without dangerous or objectionable heating of the floor close to the heater cabinet. More particularly, the objects of this invention are to provide such a space heater, the cabinet of which contains an upright expansion drum for the products of combustion above the burners, the high temperature air heating duct extending downwardly through said drum, and having a blower (preferably an upright, horizontally directed, propeller-type fan located in the upper horizontal portion of said duct) to force air downwardly therethrough and out of the horizontally directed discharge positioned close to but spaced slightly above the room floor in the upright front wall of the cabinet.

Another object is the provision of normal upward convection circulation of heated air up through a large air heating passageway between said heating drum and cabinet walls simultaneously with the above-mentioned blower-forced, low level discharge.

Another object is the provision of means to prevent hot air circulating upwardly past the fan driving electric motor positioned in the upper end of said duct when the motor and fan are not running. Other objects are to provide particularly efficient conformations and arrangements for said high temperature, air heating duct.

Other and more detailed objects and advantages will be apparent from the following disclosure and the drawings, in which:

Fig. 1 is a front elevational view of a space heater embodying my invention, with most of the outer casing shown broken away to reveal underlying parts, some of said parts being shown in section;

Fig. 2 is a transverse section taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is a view, in vertical section, taken substantially on the line 3—3 of Fig. 1;

Fig. 4 is a view of another embodiment of my invention, in vertical section, and taken substantially on the line 4—4 of Fig. 5; and

Fig. 5 is a horizontal, transverse section taken substantially on the line 5—5 of Fig. 4.

The outer body or casing 1 is formed of sheet metal formed and secured in any conventional or desired manner. This casing 1 is of substantially rectangular transverse cross-section and is in the form of the so-called "low-boy" type of cabinet. The cabinet is supported at its corners and is spaced above the floor by feet 3 which are sheet metal stampings. The bottom plate 2 is suitably secured to close the bottom of the cabinet completely except for the combustion air intake openings 25 and the space under

the oil tank 5 or on the other side of the partition 6, which space is left open.

The tank 5 for liquid fuel, such as oil, is removably mounted by suitable clips on and spaced from the outermost plate 51 of the partition shield 6 formed of two spaced, suitably secured, sheet metal plates. Thus this tank 5 is insulated from the heat and is also cooled by the air which rises freely through the open bottom of this smaller upright chamber up and around the fuel tank. This tank 5 has a suitable swing-out filling spout and a level indicator, and access may be had thereto through a conventional door. The plates of the partition 6 are suitably secured to the base plate 2 and brace the shell 1.

The combustion-heating unit, designated as a whole by reference numeral 4, includes a sheet metal heating drum having a top 8 and upright side walls 7 supported and closed by the bottom plate 2. Supporting partition 13 is suitably secured to the wall 7 and carries conventional pot-type oil burners 14 in corresponding openings therein. The space in the drum above partition plate 13 forms an expansion chamber for the products of combustion, and the space below the drum forms a combustion chamber.

A sheet metal, radiation heat shield, or a drum-enclosing wall 66 is uniformly spaced about the drum 7—8 by suitable brackets or straps 67 so that this wall defines or separates two upwardly extending air heating passages, both of which communicate freely with the large area upper opening grilles 29. Note that this wall 66 terminates short of the bottom of the upright drum.

Oil is supplied to the burners 14 from the tank 5 through pipe 15 to a conventional regulating valve and level maintaining float unit 18 which is suitably mounted in the open bottom below the oil burners. The oil supply for each burner is regulated by a rotary valve, each of which is manually controlled by an inclined, upwardly extending shaft line 22 and 23 connected by universal joints and rotated by suitable indicia-carrying control wheels 19 and 21 which project out through the upper front wall of the cabinet. Pipes 16 and 17 carry the oil to each of the burners 14.

All of the above structure is substantially like that disclosed in the above-mentioned prior application.

Base plate 2 has combustion air inlet openings 25 which may have regulating means such as the pivoted, adjustable plates or dampers 26. The products of combustion expand and give off heat in the expansion chamber and rise up to and through the flue or stack connection 27 in the upper end and back of the drum wall 7. This connection 27 extends through a suitable opening in the wall 66 and is received in a conventional stove pipe fitting 28 which extends in through a corresponding opening in the shell or cabinet wall 1 and communicates with the usual chimney or stack. The cabinet top 31, which may be formed integral, as shown, or as shown in the above-mentioned prior application, has large area openings formed by the stamped grille 29.

The lower end wall of the cabinet shell 1, adjacent and underneath the oil tank 5, has an air inlet grille 34 which may be formed integral with the shell wall by stamped vanes, as shown. This opening provides an additional inlet for cooling air to rise up around the float valve unit 18 and the oil tank 5 to cool them, and then to rise out through the top openings 29 or else, when the fan is running, to be all or partly drawn into the duct 36, depending upon the power of the fan 43. It will be apparent that this separate, upwardly extending and smaller chamber having an open top and an open bottom and containing the oil tank and the oil controls will have a natural chimney action or convection circulation to keep the oil tank and oil controls cool.

The bottoms of the cabinet walls also have large area openings formed by the grille 35 on the other end and the back grille 33. These openings provide a large area so that air may freely enter the bottom of the upwardly extending air heating passageways formed between the drum wall 7 and the radiation shield 66 and between the shield 66 and the cabinet walls 1. Air will rise up through these passageways by normal convection circulation and discharge through the open top formed by grilles 29.

In addition to these lower openings, there is a relatively long and narrow opening at the lower front of the cabinet formed by a series of grilles or horizontal slots 32. Preferably, these grilles are formed integral with the side walls of the cabinet 1 by cutting and bending in the metal to form air-directing vanes which are slightly upwardly inclined in order to straighten out or to give a slight upward direction to the fan-forced air issuing from the lower end of the duct so that it will issue from the front of the heater in a substantially horizontal stream and will not strike the floor close to the heater while it is still at a high temperature, all as hereinafter described. It will be noted that grilles 33, 34 and 35 may be formed in the same manner, if desired for the sake of manufacturing simplicity.

Since the opening formed by the grilles 32 is spaced from the lower portion of the duct at 37, it will be apparent when the fan is not operating air may enter this opening 32 to rise up through the two passageways by normal convection circulation as described above, so that when the fan is not running these grilles 32 will supplement the air intake for convection circulation.

Access to the burners and the interior of the drum 7—8 is had through a conventional door 71 in the drum, opening 69 in the wall 66, and a pair of doors 68—68 in the front of the cabinet 1.

A high temperature, air heating duct or conduit 36 extends downwardly through the expansion drum 7—8. As shown in Figs. 1, 2 and 3, the upper portion of this duct 36 extends substantially horizontally, parallel to the front of the cabinet, and adjacent the drum top 8 to about the middle of the drum 7—8 between the two burners 14 where it makes a gradual bend downwardly and extends down over and between the two burners 14. It then turns forwardly and at the same time changes its cross-section from a uniform circular cross-section to a wide, thinner cross-section to match the corresponding opening in the top of the connection portion 37. This connection portion 37, forming the lower end of the duct, extends straight down in front of the burner and is relatively wide and shallow so that it will have approximately the same cross-sectional area and yet will fit into the front of the cabinet without necessitating a deepening of the cabinet. It will be noted that this duct is of substantially uniform cross-sectional area and has gradual bends so that it will offer low resistance to air flow. The upright lower portion 37 is suitably secured by a flange or rim 38 to

the wall 7, as shown in Figs. 1, 2 and 3, and has an integral face 39 and side portions 41. The lower end of the face has a horizontally-directed discharge opening 42 which is somewhat smaller than the cross-sectional area of this duct so that it will be relatively restricted to thus give a horizontal directing or jet effect to the air stream discharged therefrom which issues through the grilles 32, the upwardly turned vanes of which give it a slight upward-directing effect to correct for any tendency of the air stream to move downwardly and strike the floor close to the cabinet due to the downward movement of the air in the portion 37. Thus, the high temperature air is discharged close to the floor in a substantially horizontal stream which is spaced just high enough above the floor to avoid striking the floor and causing objectionable or dangerous over-heating thereof until this stream has moved out a sufficient distance from the heater so that it is cooled by other air and the like. The blower to produce the downward flow of air through this duct 36 is preferably an upright propeller-type fan 43 driven by an electric motor 44, both of which are mounted in a cowling portion 46 forming the open upper end of the duct. The motor 44 is mounted in the short duct portion 46 by straps 47 forming a spider 45. An annular rim 48 on the cowling duct portion 46 secures it around the edges of a corresponding aperture 49 in the inner partition plate 51. This plate 51 has an inwardly extending skirt or flange 52 around this same aperture 49 fitting inside of and supporting a corresponding cylindrical portion of a tapered duct member 53, the inner end of which extends through a corresponding opening in the wall 66 and has a straight portion fitting over the outer end of the duct member 36. Thus it will be apparent that members 46 and 53 form a part of the duct 36 extending horizontally past or through the partition 6 into the smaller chamber above the oil tank to draw in the slightly warmed air rising up around the oil tank and along partition 6.

It is desirable to provide means to prevent upward flow of the high temperature air past the electric motor 44 when the motor and fan are not operating to force the air downwardly. This means may be in the form of a damper 55 comprising upper and lower semi-circular portions 55 and 56 mounted on pivots or horizontal shafts 57 and 58 passing through the walls of the duct member 53. The lower shaft 58 is bent at its one end to provide a crank portion 59 which is screw threaded to adjustably carry counterweights 61 and 62 which also serve as a nut and lock nut. Similarly, the outer end of the upper shaft 57 is bent to form a crank 63 screw threaded to adjustably carry nut and lock nut counterweights 64 and 65. The counterweights 64 and 65 slightly over-balance the damper sector 55, and the damper sector 56 slightly over-balances the counter-weights 61 and 62, so that upon failure or stopping of the fan the upper damper 55 will be swung upward and to the left and the lower damper 36 will be swung downward and to the left by gravity acting on these unbalanced weights to close substantially the member 53 of the duct and thus prevent the high temperature air rising therethrough by convection from striking the motor. The counterweights 61 and 62 may be the same as the counterweights 64 and 65 but positioned a different distance out from the pivot shaft to exert different moments.

The taper of the duct member 54 permits a somewhat larger fan to be used for a given duct size and also increases the velocity of the air acting on these damper members 55 and 56.

Figs. 4 and 5 show another or second embodiment of this invention in which most of the structure and arrangements are essentially the same as those illustrated in the embodiment of Figs. 1, 2 and 3. Accordingly, such parts carry the same reference numerals and are not further described. The duct or conduit 81 extends downwardly and forwardly through the drum 7—8 and its lower connections and portions are the same as shown in Figs. 1, 2 and 3. However, the upper portion of this duct extends to one side of the center of the drum 7—8 so that it may pass through the back upper end of the drum 7—8 alongside of the stack connection 27—28. The upper end of the conduit or duct 81 passes through the drum walls 7 and is conically flared at 82 where it passes through wall 66. A corresponding tapered end of duct section 83 is secured in this flared end 82. This duct section 83 forms a cowling for a fan 43 which is mounted as disclosed in Figs. 1, 2 and 3.

In this embodiment of the invention, the means to prevent upward convection circulation of high temperature air past the electric motor are essentially the same as those disclosed in Figs. 1, 2 and 3. Pivot shafts 87 and 88 journaled in the sides of the upper end of the duct 81 rigidly carry damper segments 89 and 91 which, when the fan is not running, normally assume an upright position to close this portion of the duct. A counterweight 92 is adjustable on a threaded rod 93 extending out in the plane of the damper sector 89 to bias this sector so that it will move upwardly and to the right upon stopping of the fan. The counterweight 94, adjustable on a threaded rod 95, does not quite balance the sector 91 so that upon stopping of the fan this sector is moved by gravity downward and to the right.

It will be apparent that the fan may be used to circulate air in a room when the burners are not being used in the summertime or the like.

While only two embodiments of this invention are illustrated and described in detail herein, it is to be understood that various changes and modifications may be apparent to those skilled in the art without departing from the spirit and scope of this invention, and therefore the same is only to be limited by the scope of the prior art and the appended claims.

I claim:

1. A unit space heater comprising an upright, floor supported cabinet casing having a lateral opening in its lower portion, an upright, direct fired, heating drum therein, a relatively short, high temperature air heating duct having a substantially straight intermediate portion extending downwardly through said drum and having bent upper and lower ends opening through the sides of said drum, and blower means to circulate high temperature air down through said duct and out said lateral opening in the lower portion of said upright casing, which opening is positioned close to but safely above the floor to prevent local overheating thereof by said high temperature air.

2. A room heater comprising an upright combustion heating unit, an upright, floor supported cabinet inclosing said upright combustion heating unit and having an opening in its lower front

portion, a propeller type fan, an air heating duct extending downwardly through said heating unit to be heated thereby and having an upper intake opening and a lower, laterally directed, long, narrow, discharge opening positioned to discharge out through said corresponding opening in the lower front of said upright cabinet, the upper end of said duct being circular and containing said propeller-type fan to force air downwardly therethrough, and the lower end merging into a wide and shallow cross-section to correspond to its lower opening, said duct being of substantially uniform cross-sectional area.

3. A unit space heater comprising an upright, floor supported casing having an open top and lower openings, a direct fired, upright, expansion drum spaced within said casing to form an upright air heating passageway communicating with said openings so that air will enter the lower openings and rise and discharge through said open top by normal convection circulation, a smaller, separate, air heating duct extending downwardly through said drum and having an upper air intake and a lower lateral air discharge opening through the lower portion of the casing side wall, a grille embodying air flow directing vanes associated with said discharge opening in said casing wall, and a blower at the upper end of said duct to force air down it and out its discharge opening.

4. A unit space heater comprising an upright, floor supported casing having an open top and lower openings, two liquid fuel burners spaced side by side in the bottom of said casing, an upright expansion drum for the products of combustion over said burners and spaced inwardly from said upright casing to form an upwardly extending, air heating passageway communicating with said lower openings and open top for normal, upward convection air circulation therethrough, a high temperature, air heating duct having an upper air intake and extending through said drum and downwardly and forwardly over and between said burners and having a lower discharge opening, blower means associated with said duct to force air downwardly therethrough and out an opening in the lower front portion of said casing corresponding to the lower opening of the duct.

5. A room heater comprising an upright, floor supported cabinet, an upright, direct fired heating unit therein, a high temperature air heating duct having open upper and lower ends and extending downwardly through said heating unit, a fan and coupled electric motor in the upper end of said duct to force air downwardly therethrough, and means movable responsive to the non-operation of said fan to prevent hot air circulating up said duct and upwardly past said motor to overheat it.

6. A unit space heater for rooms or the like comprising an upright, floor supported cabinet having an open top, and the width of which is appreciably greater than its thickness from front to back, an inner, upright partition shield extending from front to back toward one end to form two unequal size, open top chambers, a liquid fuel tank, a lower burner means, an upright expansion drum, the smaller chamber having bottom openings and containing said liquid fuel tank spaced inwardly so that cooling air may rise up around said tank by convection, the larger chamber having lower openings and inclosing said lower burner means connected to said tank and said upright expansion drum for the products of combustion above said burner means, said drum being spaced inwardly to form with said cabinet an upwardly extending air heating passageway communicating with said lower openings and said open top for upward convection circulation of heated air, a high temperature air heating duct having open upper and lower ends and extending downwardly through said drum and having a blower to circulate air downwardly therethrough, the upper end opening into the upper portion of said smaller chamber above the oil tank to receive the warmed air rising therein, and the lower end opening laterally into the room through the lower portion of the cabinet.

7. The organization set forth in claim 6 in which the upper end of said duct extends horizontally past said partition into said smaller chamber.

8. The organization set forth in claim 6 in which the lower end of said duct opens into the room through the front of said cabinet close to but spaced above the floor.

9. A unit room heater comprising an upright, floor supported cabinet, the width of which is greater than its depth from front to back, an upright, direct fired, heating unit therein, a relatively short, high temperature air heating duct having open upper and lower ends and having a substantially straight intermediate portion extending downwardly through said drum, the upper portion of said duct extending substantially horizontally and parallel to the cabinet front into the upper portion of said heating unit, and the lower portion of said duct extending forwardly to open through the lower front of said cabinet.

10. A unit room heater comprising an upright, floor supported cabinet, an upright, direct fired, heating unit therein, a relatively short high temperature air heating duct having open upper and lower ends and having a blower to force air downwardly therethrough, the upper portion of said duct extending substantially horizontally through the back of said heating unit, the intermediate portion being substantially straight and extending downwardly and forwardly in said heating unit, and the lower opening of said duct discharging its high temperature air out through an opening in the lower front of said cabinet.

11. The organization set forth in claim 10 in which the blower is an upright propeller-type fan located in the upper horizontal portion of said duct outside and back of said heating unit.

12. A unit room heater comprising an upright, floor supported cabinet, burner means of appreciable height in its lower portion and an upright expansion drum for confining the products of combustion over said burner means, a high temperature air heating duct having an upper intake opening and extending through said drum downwardly and forwardly, spaced over said burner means, and having a shallow, wider, upright lower portion extending straight down in front of said burner means inside of said cabinet, a discharge means for the lower end of said duct discharging through the upright cabinet front adjacent the bottom of said burner means and the room floor, and blower means to force air down through said duct and out its lower discharge means.

13. A unit room heater comprising an upright, floor supported casing, an upright, direct fired, heating drum therein and having a stack connection through its upper back wall, a relatively

short, high temperature air heating duct having a substantially straight intermediate portion extending downwardly through said drum, having bent and open upper and lower ends, and having a blower to force air downwardly therethrough, the upper portion of said duct extending through the upper back wall of said drum close alongside of said stack and the lower opening discharging its high temperature air out through the lower portion of said cabinet.

14. A unit room heater comprising an upright, floor supported casing having an open top and lower openings, an upright, direct fired heating unit spaced therein to provide an upwardly extending air heating passageway communicating with said openings so that air will enter the lower openings and rise and discharge through the open top by normal, convection circulation, a high temperature air heating duct extending downwardly in said casing and contiguous to and heated by said unit, said duct having a blower for forcing air downwardly therethrough, an intake opening at its upper end, and a horizontally-directed discharge opening at its lower end, and a grille forming horizontally-directing openings in the lower portion of the wall of the upright casing at the level of said horizontally-directed opening, said horizontally-directed opening being directed toward but spaced from said grille so that it will discharge its horizontal stream of high temperature air therethrough into the room when the blower is running and so that, when the blower is not running, additional air can enter said grille for the upward convection circulation.

15. A unit space heater comprising an upright, floor supported casing having an open top and lower openings, a direct fired, upright expansion drum spaced within said casing to form an upright air heating passageway communicating with said openings so that air will enter the lower openings and rise and discharge through said open top by normal convection circulation, only one separate, smaller air heating duct having a substantially straight intermediate portion extending downwardly in the essential portion of said drum and its upper portion bent and extending laterally through the upper side wall of the drum and having an upper air intake and a lower lateral opening at the lower end of the duct for discharging air out through a corresponding lateral opening in the lower portion of the upright casing, and a blower in the upper end of said duct.

16. A unit space heater comprising an upright, floor supported cabinet casing, a burner, a stack, an upright air heating unit enclosing said burner and connected to said stack, said upright air heating unit being spaced inwardly from the walls of said casing to provide an air heating passageway, said casing having upper and lower openings communicating with said passageway for upward air circulation therethrough, a relatively short, air heating duct extending downwardly through said unit in heat exchange relation with said burner, a blower to circulate air down through said duct, an upper air intake for said duct, and the lower portion of said duct extending laterally through the side wall of said unit above said burner and having a lower lateral discharge for the high temperature air from said duct opening through said casing.

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