FORCED AIR CIRCULATION COMBUSTION TYPE SPACE HEATER

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This invention relates to a space heater of the type in which a combustion chamber is positioned within a surrounding cabinet. In the description to follow, the heating unit is exemplified by an oil burner which is disposed within the lower end of an upright combustion chamber in the form of a cylindrical drum which is disposed within the cabinet in spaced relation to its walls and top. A space heater of this general description is well suited for small homes, stores, shops and the like.

Among its objects my invention here is concerned with optional conversion of a space heater of the natural circulation type to one of the forced circulator type by application thereto of a blower unit; with the construction of the heater cabinet which facilitates the attachment thereto of the blower unit on the cabinet rear wall over an opening therein provided by displacement of a knock-out closure section; with the discharge nozzle forming part of the blower unit which forces a thin stream of air over a primary heating surface to be reheated preliminary to its delivery from the cabinet; with the means provided for forced discharge of highly heated air in a thin stream in a downwardly inclined direction from the cabinet; with the arrangement of passages provided within the cabinet front at a point close to its top for movement of air to and through the blower unit; and with the blower unit itself and the protection afforded to its operating motor; and with various other features of construction which will be specifically referred to hereinafter. A space heater having these various features of construction is greatly improved in its performance, and the heated air discharged therefrom will continue its movement to a distant point in the room where it is most effective and comfortable for heating purposes.

Objects and purposes such as these, and also others which will be hereinafter noted, may be realized from a construction such as is illustrated in the accompanying drawings wherein:

Figure 1 is a plan view of a space heater which embodies the features of my invention;

Fig. 2 is a view in vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is a side elevation of the blower unit with a portion of its housing broken away to exhibit the construction of the rotor therewithin;

Fig. 4 is an enlarged elevational view showing certain details of the attaching means for the blower unit, the view being confined to the area within the circle marked Z in Fig. 3;

Fig. 5 is a view in front elevation of the blower unit;

Fig. 6 is a fragmentary view in elevation of the rear wall of the heater cabinet, showing the knock-out panel provided therein adjacent the flue thimble which extends outwardly from the wall; and

Fig. 7 is a horizontal section taken on the offset line 7—7 of Fig. 2:

The space heater of this invention comprises a cabinet C having a front wall 10 rising from a bottom 11 and joining with side walls 12 which are interconnected by a rear wall 15. A top wall 16 is carried by and supported by those vertical walls. The cabinet top is provided with a grille which may comprise a plurality of forwardly inclined depending louvers 17 which define between them narrow vertical slits. If desired, the cabinet may be supported slightly off the floor as by means of a plurality of feet (not shown).

Within a cabinet of this general description is a platform raised slightly from the bottom for support of an upright construction chamber in the form of a drum D. The top 20 of the drum is slightly upwardly convex in contour and spaced from the cabinet top wall 15 a substantial distance to provide therebetween a horizontal passageway 19 having at its front a forwardly inclined depending baffle shield 21. This baffle shield provides, in effect, a diverter to deflect downwardly the air passing out through an elongated delivery opening o therebelow formed in the front of the cabinet and defined in part by a head plate 22 also extending downwardly and forwardly from a point adjacent the drum top 20 at its front toward an outstanding panel 23 which may constitute a door for the cabinet front wall 10. If desired, this head plate 22 may beapered at 24 in the form of a grille, both for ornamentation and to provide escape openings for air ascending through the passageway 19 between the drum and the cabinet front panel 23. This panel extends for the major portion of the width of the cabinet (see Fig. 7) and down to a point relatively close to the bottom thereof. Closely below the panel is an elongated slot 25 extending crosswise of the cabinet to provide therefor an inlet opening for air which is to be circulated upwardly therewithin. Another inlet opening in the form of an elongated slot 26 may also be provided in the rear wall 15 at a point close to the cabinet bottom for the same purpose.

The heating drum D is positioned centrally within the cabinet so as to be spaced from all its walls, including the top 16 below which the horizontal top passageway 19 is provided. Within the drum in its bottom region is placed a burner P.
here shown as the pot type, to which fuel oil may be fed through a pipe 39 which leads from a control unit 31. A supply tank 32 supported at the rear of the cabinet plate 33 is connected by a pipe 34 with the control unit to assure a gravity feed of oil thereto for operation of the burner.

From an opening in the rear side of the drum D, in its upper region, is extended a flue thimble 36, passing through the rear wall 15 of the cabinet to connect with the elbow 37 of a flue pipe 38 for ejection of the products of combustion into a stack or chimney (not shown). So that this thimble may be of minimum length, it is located in the center of the back wall of the cabinet and relatively close to its top so as to connect with the heating drum at a high-up point.

The space heater thus far described is complete and operational as a radiant type of heater. The air entering through the base inlet openings 25 and 26 is free to ascend along the heating drum which is in the passageway b rearwardly thereof, and also within the somewhat wider passageways c upon opposite sides thereof. To a certain extent this is true also of the air ascending within the front passageway a which may be partially closed at the top by the head plate 22. As a result the air is raised to a high temperature by convection, and in this condition escapes through the grills in the cabinet top 16, and perhaps also through openings in the head plate 22, if provided therein, to enter the room into which additional heat is also transferred by radiation from the heated walls of the cabinet. A space heater of this type is effective to heat a room but only within a short radius; it cannot operate effectively as does a forced-circulator type of heater, to deliver the heat to a more distant point. To provide for a forced circulation and discharge of the heated air through the delivery opening c at the front of the cabinet near its top, and thereby convert the heater to one of the forced-circulator type, I have arranged blower means of peculiar character now to be described.

A blower unit B, complete in itself, is optionally attachable to the rear wall 15 of the cabinet to discharge therefrom the air which is heated therewithin. This blower unit fits over an opening k formed by displacement of a knock-out section K having its marginal spaced very slightly by a narrow slit 40 from the cabinet read wall 18 to which it may remain connected by tenons 41. Such a section may readily be displaced from the cabinet wall with which it is initially joined integrally by pressing its opposite ends inwardly and then bending the panel back and forth until it becomes loose and free. The opening k vacated by the knock-out section K is located in part over the thimble 33 (see Fig. 6). It also extends laterally to one side of the thimble and angularly in a downward direction with its low end formed substantially as a semi-circle.

The blower unit B comprises an elongated housing 45 which at one end is enlarged and rounded in the general form of a scroll s, the housing extending laterally therefrom to provide a duct d whose rear wall is curved forwardly in the form of an elbow (see Fig. 1). This duct extends in the form of a generally rectangular mouth opposite the wall opening k at a point above the flue thimble 36 (see Figs. 5 and 6) where it joins with a nozzle N from which the heated air issues in the form of a stream which is vertically thin and horizontally wide. This nozzle may be secured fixedly to the forward side of the blower housing so as to require no other support. As shown, this nozzle comprises a lower channel piece 47 facing an upper channel piece 48 to which fuel oil may be fed through a pipe along opposite edges, the shield at its forward end 51 executing a slight upwardly inclined, but the former more so than the latter so as to be in converging relation therewith. The upper channel piece continues on beyond the lower channel piece to provide a shield 50 having depending flanges along opposite edges, the shield at its forward end 51 executing a slight downward bend, as shown. A nozzle of this description will conduct the heated air coming from the blower to a point substantially at the top 16 of the cabinet (see Fig. 2), and in so doing will transform the stream of air moving out of the blower to one which is relatively wide (horizontally) and thin (vertically) at the point of its issuance from the nozzle into the top passageway t.

The blower unit B comprises also a rotor 55 (see Fig. 3) which may take the form of the conventional squirrel cage, the rotor being located eccentrically in the scroll 52 of the blower housing (see Fig. 5), where a large circular inlet opening thereinto is fitted with a collar 56. This rotor is carried by a shaft 57 which extends through one end of a housing M containing an electrical motor so as to be directly driven thereby.

The motor housing M is affixed at one end to a vertical base plate 50 (see Fig. 4) formed with a plurality of offset feet 51 through each of which is extended a bolt 52 which passes also through a bracket plate 65 and on through a spacer sleeve 56. Continuing, this bolt also passes through a shield 57 spaced from the bracket plate 65 and from the proximate rear wall of the housing 45 through which the bolt is extended to present its head 58 against the inner face thereof. A lock nut 59, also threaded onto the bolt, may engage with the outer face thereof. By some such means as this each bolt is carried rigidly by the blower housing rear wall from which it extends outwardly to secure the various parts just described. Threaded onto each bolt upon opposite sides of the feet 51 of the base plate are grummetts 70 to the outer side of which are arranged washers, a nut 72 being threaded onto the bolt to exert a clamping pressure on all the parts carried thereby. Such an assembly is desirably provided for each foot of the base plate to secure the motor immovably upon the exterior of the rear wall of the blower housing.

The bracket plate 65 which stands in spaced relation to both the motor and the cabinet rear wall is extended beyond the motor both vertically and horizontally to shield it from the heat which radiates from the blower housing. The shield 67 also intervenes between the bracket plate and the cabinet, being spaced from each
by an air gap which is open on all sides so as to further prevent the transmission of heat outwardly toward the motor. Since the motor is spaced laterally from the floor pipe 38 by only a short distance (see Fig. 1), I have arranged at the end of the bracket plate 65 a lateral extension 75 which serves as a shield to protect the motor against excessive temperature at that point.

The collar 56 surrounding the inlet opening into the blower housing is formed to provide frictional bearings 78 for a rod 80 one end of which is turned to provide a crank 81. Affixed to this rod and concentric with the circular collar 56 is a damper 62 which, in the position of Fig. 5, substantially closes the inlet opening into the blower housing. The operating crank 81 may be turned to adjust this damper to any selected rotative position whereby to control the amount of heated air entering into the blower housing.

Electrical energy for operating the motor is conducted through insulated wires contained in an extension cord 66 which is encased for a substantial distance by a conduit pipe 85 having brackets 87 and 88 to facilitate its fixed attachment to the rear wall of the cabinet. By the provision of such a conduit pipe extending from a point adjacent the motor down toward the lower end of the cabinet, ample protection is afforded to the extension cord against excessive heat which otherwise might prove dangerous to the electrical connections.

The air circulating space heater of this invention is advantageous in numerous particulars. Perhaps a feature of primary importance is the arrangement whereby air heated to a maximum temperature within the cabinet is drawn into the blower at a high-up point, and then discharged therefrom, in the form of a vertically-thin, horizontally-wide stream, close to the primary heating surface at the top of the heating drum where it is subjected to reheating; the air at this point of maximum temperature is then delivered outwardly and downwardly from the front of the cabinet at a point close to its top to proceed directly over the drum, the floor of the room at a low down level. This stream of air which is driven outwardly from the cabinet in no wise impairs the heating by radiation in the lateral area close to the cabinet or the heating by convection in the area thereabout. The air forced out to the front and downwardly is intended rather to reach a more distant part of the room, perhaps even passing through an open doorway into another room thereafter.

When distribution of heat takes place by natural convection the result is a high temperature in the upper portion of the room and in an area close to the heater cabinet, but adjacent the floor and at some distance from the heater the temperature is relatively low. As a result there is less comfort to the occupants of the room, and the expenditure of more fuel and heat is required to attain a desired comfort level. By the heater herein disclosed, I am able to force a substantial portion of the heated air out to a greater distance from the cabinet, in a comparatively narrow stream that issues from a point near the top of the heater cabinet in a direction angularly downwardly toward the floor. Inasmuch as heating to rise is desirable, in order to obtain mechanical advantage for the distance to be reached, that the heated air should be discharged angularly downwardly and at some distance from the floor to attain lateral distance. While it is possible by using sufficient force to attain lateral distance when the air is discharged at lower levels, comfort is noticeably lacking in such circumstances and the faster moving air stream may be noisy and may also pick up dust and dirt which will be dispersed throughout the heated area.

By my invention the high temperature air is discharged from the heater at a point adjacent its top at moderately high velocities. Its movement proceeds angularly downwardly toward the floor and then in a generally horizontal direction close to the floor. When it has first advanced a short distance from the heater, the air temperature begins to reduce due to its diffusion with cooler air. By the time the air has reached the floor its temperature is reduced below the danger point so that overheating or scorching of finishes or coverings will be avoided. By diffusing the high temperature in the manner explained a large quantity of heat is delivered to the greatest possible distance from the heater at a comfortable temperature; at the more distant points its velocity is reduced somewhat so that the heated air will rise and diffuse in its entirety within the remaining cooler air of the room.

Another feature of importance inherent in this invention is the heater unit itself which is attachable to an existing heater cabinet, or may be affixed thereto at the time of its manufacture or sale. For convenience in shipping, and otherwise, it may be preferred to install the heater unit on the cabinet at or about the time that the space heater is to be delivered for use. This heater unit is designed for attachment to the cabinet rear wall at the point where it will be most efficient in operation, i.e., directly over the flue duct which extends laterally from the heating drum at a point relatively close to its top. At this high-up level the air ascending through the passages a, b, c, and d will have attained its highest degree of temperature. It is at this point that the air is drawn into the blower through its inlet opening and then circulated therethrough and out again through the forwardly extending nozzle directly over the overhead heating drum. Here a reheating of the air takes place preliminary to its discharge from the cabinet at the front. By this arrangement the blower distributes and discharges heated air which has reached a point of maximum temperature, and just prior to its emergency from the cabinet reheats the air so that at the moment of its delivery into the room its temperature is at the highest point.

By the various other minor features hereinbefore described I safeguard the motor from the surrounding temperatures which may be considerable. On the two sides which are proximate to the cabinet and to the flue the motor is protected by shields with intervening air spaces which will promote ventilation. The resilient grommets employed in connection with the bolts which secure the motor base to the cabinet wall serve also to eliminate vibration and noise. The motor although positioned in a zone of relatively high heat may be depended upon to operate over a long period without danger due to the protection afforded by the means described.

I claim:

1. An air circulating space heater in which is combined a cabinet having base inlet openings and in its upper region outlet openings for escape of heated air and at its front close to the top a horizontally extending, downwardly inclined.
louver for delivery of air in a direction toward the floor and forwardly of the heater, said cabinet being also provided with a blower unit opening located at the back of the cabinet in the upper region thereof, a combustion chamber within the cabinet in spaced relation to its walls and top, and a blower unit having a housing attachable to the cabinet rear wall in covering relation to the blower unit opening therein and formed with spaced inlet and outlet apertures, opposite the cabinet opening, a nozzle extended from the outlet aperture of the housing inwardly of the cabinet with a horizontally wide and vertically thin discharge opening close to the cabinet top at a point above the combustion chamber and inclined downwardly toward the top of the combustion chamber and toward the delivery louver therebey through the front wall of the cabinet, a motor carried by the housing exteriorly thereof, and a blower in driven relation with the motor mounted within the blower housing opposite the inlet aperture adapted to draw in highly heated air from the space surrounding the combustion chamber and discharge it through the nozzle back across the top of the combustion chamber to be reheated thereby immediately preceding its forced delivery through the front louver of the cabinet for circulation downwardly and forwardly thereof.

2. An air circulating space heater according to claim 1 in which there is provided a thimble flue extending from a high-up point of the combustion chamber through the cabinet rear wall, the blower unit having its inlet aperture disposed laterally of the thimble flue and its outlet aperture directly thereabove.

3. An air circulating space heater according to claim 1 in which the motor and blower are rigidly connected and the former is rigidly secured to the cabinet and provides the entire support for the blower to leave clear the inlet aperture into the blower housing.

4. An air circulating space heater according to claim 1 in which there is provided a thimble flue extending from the combustion chamber through the cabinet rear wall in proximity to the motor, said a mounting for the motor upon the blower housing comprising connections whereby the motor is maintained in spaced relation to the housing, and an insulating shield intervening between the motor and the housing and between the motor and thimble flue.

5. In an air circulating space heater, the combination of a cabinet having vertically spaced inlet and outlet apertures therethrough, a combustion chamber fixedly positioned within the cabinet spaced from the walls and top thereof, a flue thimble extending from the combustion chamber through the cabinet rear wall and therebetween, said cabinet with the thimble flue, and a blower unit affixed to the cabinet rear wall exteriorly thereof in covering relation to the elongated opening therebetween, the blower unit comprising a support with spaced inlet and outlet apertures opposite the rear wall opening in communication with the cabinet interior, a rotatable blower within the housing opposite the inlet opening, a nozzle carried by the housing in surrounding relation to the outlet aperture and extending therefrom into the space between its top and the top of the combustion chamber, a motor affixed to the housing exteriorly thereof and coaxially of the blower, and a shaft operatively interconnecting the motor and blower and serving to support the latter within the housing.

6. In an air circulating space heater, the combination of a cabinet provided with a base inlet opening and an upper outlet opening for escape of heated air at and at its front adjacent the top with a horizontally extended, downwardly inclined louver for forced delivery of air in a direction towards the floor and forwardly thereof, a combustion chamber located within the cabinet and spaced from the walls and top thereof, there being an elongated opening in the rear wall of the cabinet, and a blower unit comprising an elongated housing fixedly secured to the rear wall of the cabinet upon the exterior face thereof and fitted over the elongated opening in said rear wall of the cabinet, a discharge nozzle mounted upon the blower housing and extending through the opening in said rear wall into the cabinet within the space between its top and the combustion chamber therebelow and pointed towards the louver through the cabinet front wall, whereby heated air issuing from the nozzle will pass over the top of the combustion chamber to be reheated thereby immediately preceding its forced delivery through the louver, a blower mounted within the housing for operation therein, and a motor connected with the blower for operation thereof and mounted upon the housing exteriorly thereof, there being in the housing wall covering the elongated opening in the cabinet rear wall an inlet aperture opposite the blower housing.

7. In an air circulating space heater, the combination of a cabinet provided with base inlet openings and upper outlet openings for escape of heated air, and at its front adjacent the top with a horizontally extended, downwardly inclined louver for delivery of air in a direction towards the floor and forwardly of the heater, there being an elongated opening in the rear wall of the cabinet to provide communication with the interior thereof, a combustion chamber located within the cabinet and spaced from the walls and top thereof, and a blower unit comprising an elongated housing secured to the rear wall of the cabinet exteriorly thereof and covering the elongated opening of said rear wall, said housing being provided with spaced inlet and outlet apertures opposite the elongated opening in the rear wall of the cabinet to provide communication with the interior thereof, a motor driven blower mounted for operation within the housing opposite the inlet aperture thereof and extending laterally therefrom through the elongated opening in the rear wall of the cabinet into the space interiorly thereof between the top of the cabinet and the combustion chamber therebelow and pointed towards the louver through the cabinet front wall whereby heated air discharged from the nozzle is required to pass over the top of the combustion chamber immediately preceding its forced delivery through the louver in a downwardly and forwardly direction.

8. In an air circulating space heater, the combination of a cabinet having low inlet and high outlet openings therethrough and a downwardly inclined louver at the cabinet front extending horizontally in proximity to its top, a drum arranged within the cabinet space between the walls and top of the cabinet and forming a combustion chamber, air circulating means provided with an inlet communicating with the space between the combustion chamber forming drum and the cabinet below the top of the drum, said air circulating
9. In an air circulating space heater, the combination of a cabinet having low inlet and high outlet openings therethrough and a downwardly inclined louver at the cabinet front extending horizontally in proximity to its top, a drum within the cabinet spaced from the walls and top of the cabinet and forming a combustion chamber, and an air circulating blower unit mounted on the rear wall of the cabinet exteriorly thereof and provided with an inlet communicating with the space between the combustion chamber forming drum and the cabinet below the top of the drum, said air circulating blower unit having an outlet and provided with a fixedly extending nozzle connected to said outlet and projecting through an opening in the rear wall of the cabinet and extending into the space between the top of the cabinet and the top of the drum, the nozzle having a discharge opening horizontally wide and vertically thin facing toward the louver at the cabinet front with a shield projecting from the top of the nozzle and inclined downwardly toward the top of the drum to direct air issuing from the nozzle toward the top of the drum and cause the current of air issuing from the nozzle to impinge against the top of the drum for reheating immediately preceding its forced discharge through the louver at the front of the cabinet.

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