April 6, 1948. W. G. CARTTER 2,439,038

OVERHEAD GAS-FIRED RADIATOR AND REFLECTOR

Filed Nov. 21, 1942 3 Sheets-Sheet 1

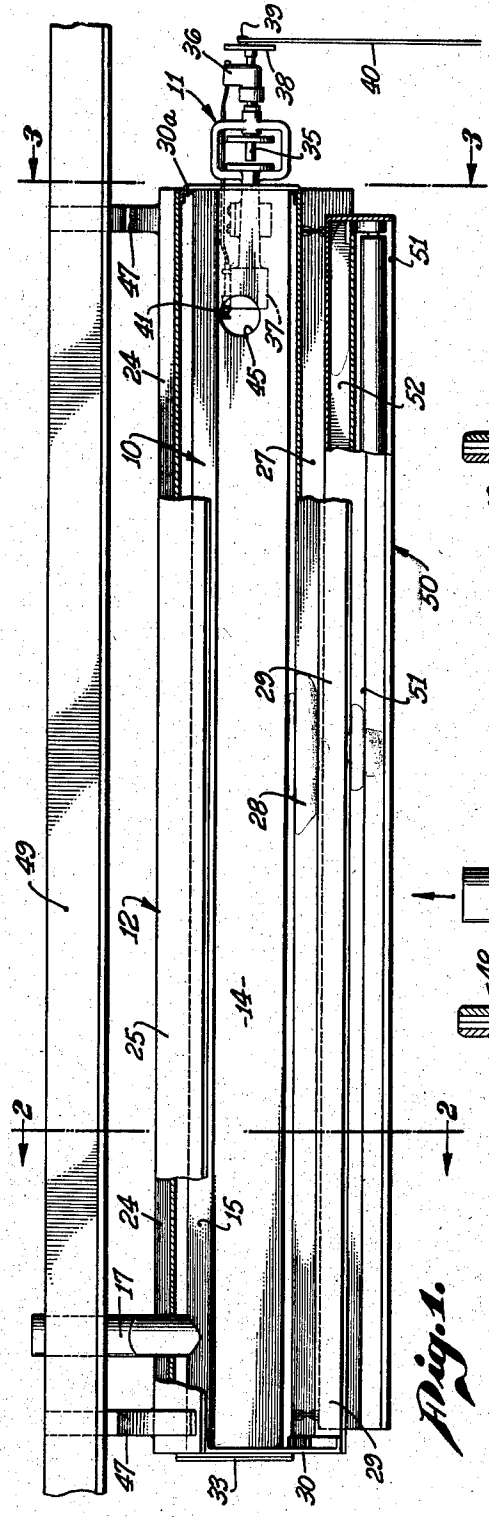


Fig. 1.

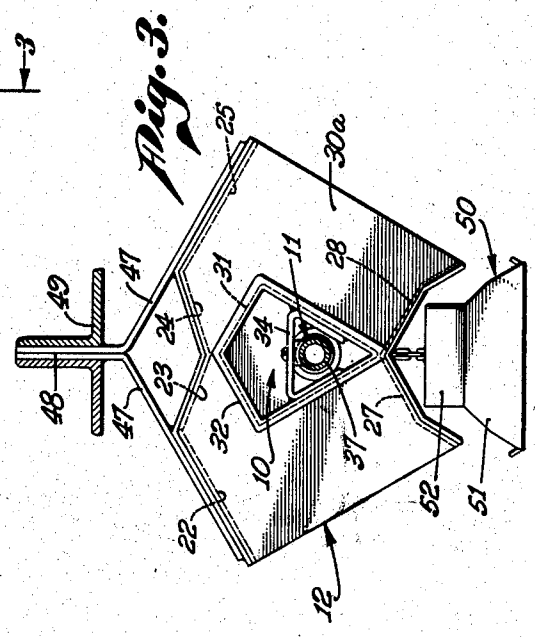


Fig. 3.

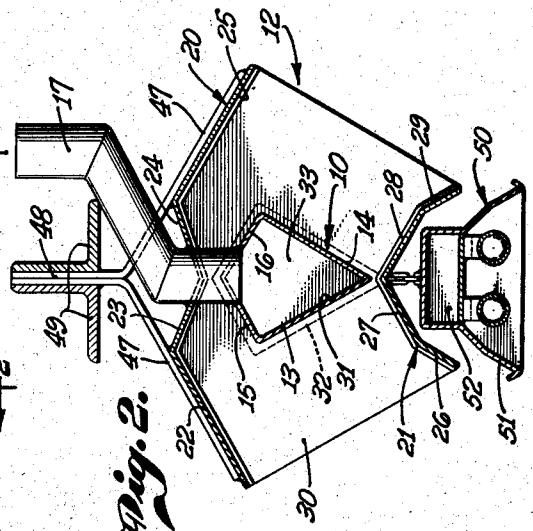


Fig. 2.

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Filed Nov. 21, 1942 3 Sheets-Sheet 2

Fig. 6.

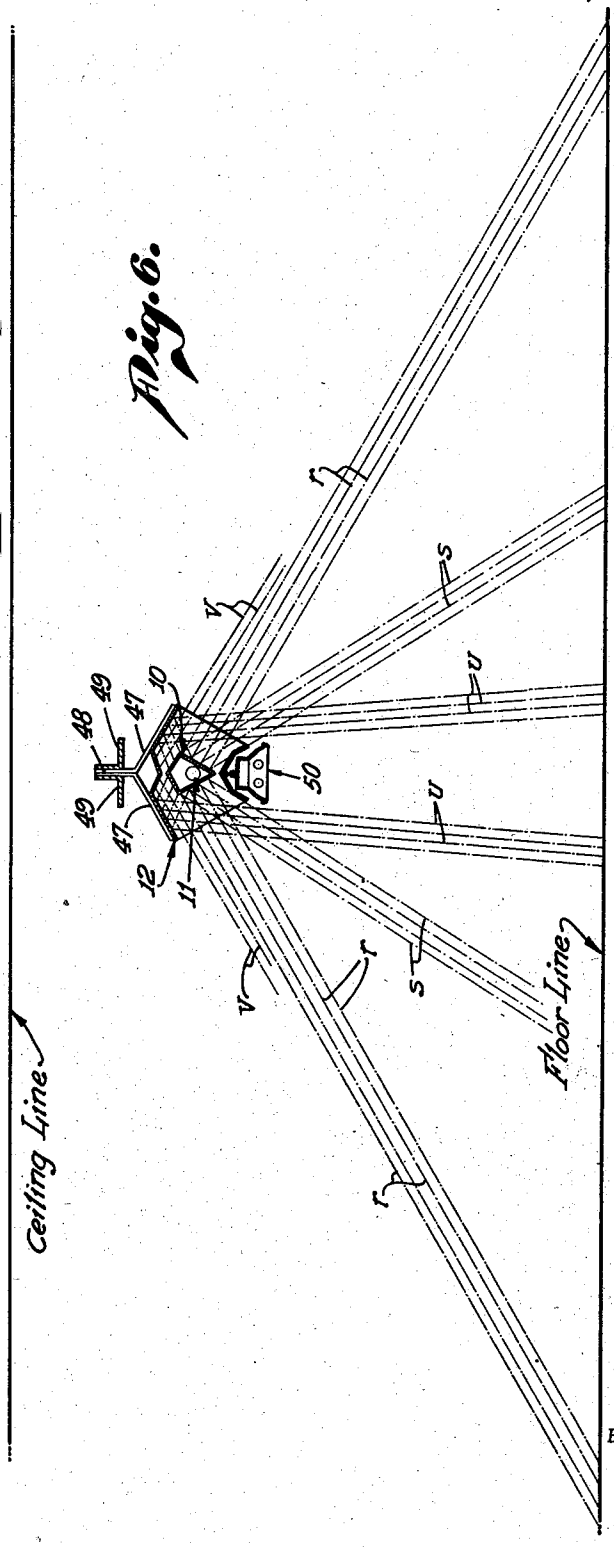


Fig. 5.

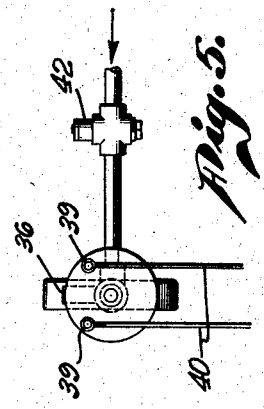
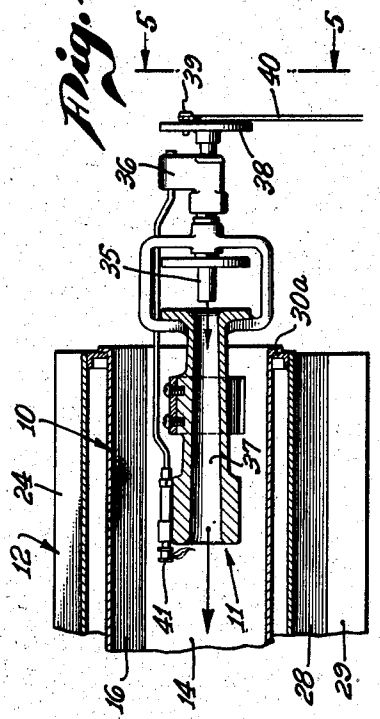


Fig. 4.



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April 6, 1948. W. G. CARTTER 2,439,038

OVERHEAD GAS-FIRED RADIATOR AND REFLECTOR

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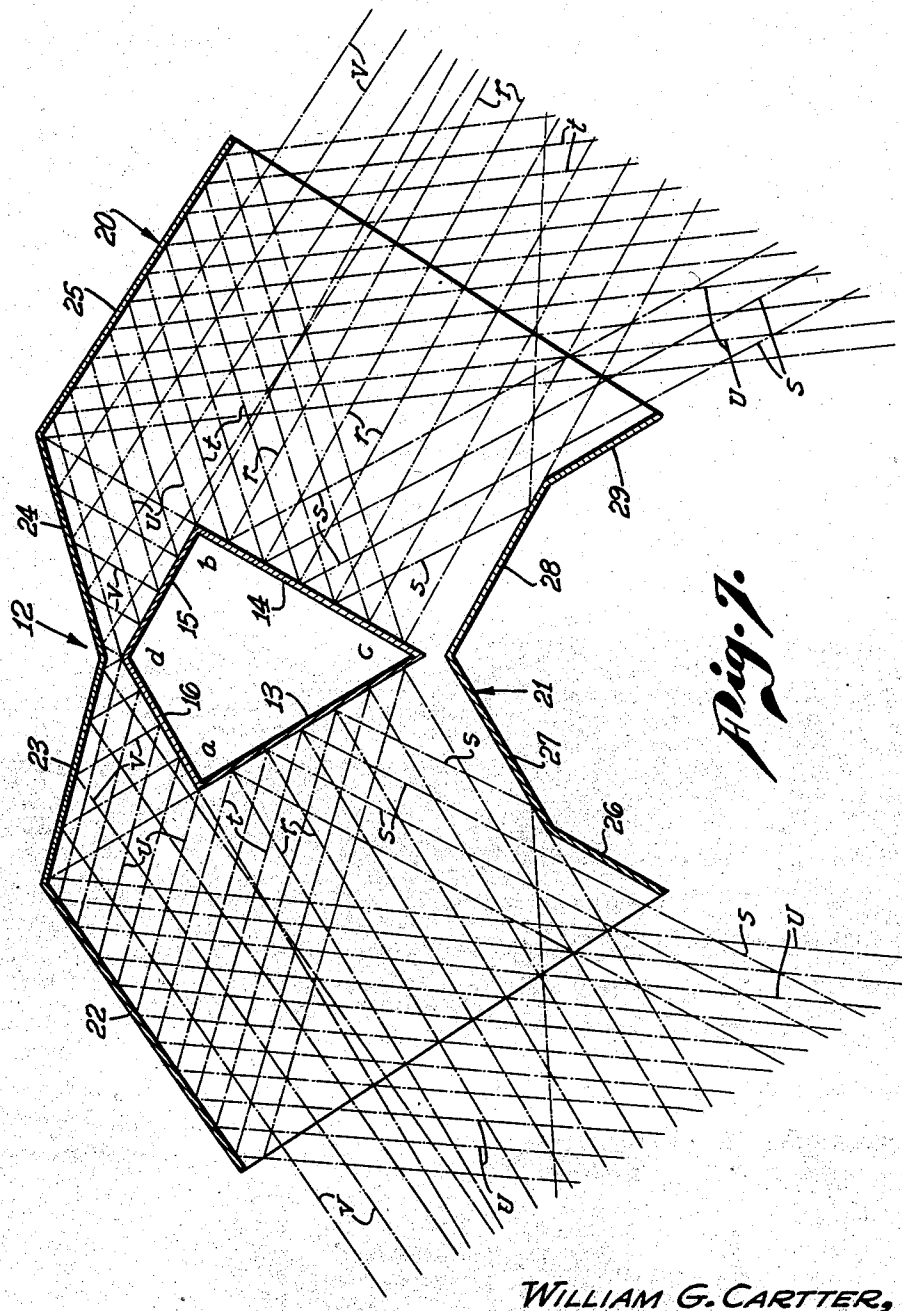


Fig. 1.

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UNITED STATES PATENT OFFICE

2,439,038

OVERHEAD GAS-FIRED RADIATOR AND REFLECTOR

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Application November 21, 1942, Serial No. 466,409

12 Claims. (Cl. 126—91)

1

This invention relates to the art of space heating, and more particularly to the structure of a gas heater embodying a horizontally elongated combustion chamber by which radiant heat is dispersed from an overhead position evently through a given area and by which hot spots or cold spots are substantially eliminated.

Conventional over-head gas heaters have several deficiencies. Those depending upon radiant heat lack efficient heat dispersion and invariably have a hot spot directly below the heater. Heaters incorporating blowers to distribute heat by circulation cause undesirable drafts and diminishing efficiency at points progressively outward from the heater.

It is a primary object of my invention to provide an over-head heater utilizing a horizontal walled combustion chamber discharging radiant heat and so controlled by the functional design of the heater that neither hot spots nor cold spots are present in the area adapted to be serviced by the heater, and by which a substantially even and efficient distribution of heat reaches the outside boundaries of the area to be serviced, as well as all intermediate areas.

A further and more specific object of my invention, is to provide a heater of the character described, in which the combustion chamber is a substantially closed horizontally elongated box, affording a safety factor, and which box is formed with plane heat radiating walls bearing a determined functional relationship to plane surfaces of a heat reflector.

By the term radiant heat I refer to heat rays which travel in straight lines, sometimes referred to as "black light." It is not limited to incandescent or visible sources. No light is visible on the surface of my combustion unit, but the heat rays emanating therefrom may be photographed by film sensitized for infra-red. Such rays are projected from all heated surfaces, and may be reflected and controlled as light rays. The relationship of the area, shape and position of the heated surfaces and the reflector elements to the area to be serviced is highly important, and it is my purpose to establish these relationships to a high degree of efficiency.

Another object is to provide a radiant heater of the character described, which effects general increased efficiency and consequent economy of operation. This arises from several factors, first in a room with a high ceiling such as a factory or store, I am able to control heat dispersion so that heat is directed only to the lower portion of the room, as for example throughout a

2

strata extending from the floor to a height of say ten feet. Second, radiant heat finds response in the human body, the latter of which functions as a radiator, and the circulating air in the room may be relatively cold, without adversely affecting the comfort of the workmen; and, third, the novel design and functional relationship of my horizontal combustion chamber and reflector elements are particularly efficient in obtaining maximum delivered heat from any given fuel consumption.

These and other objects and advantages arising from my invention will become more apparent from a further consideration of the disclosure.

In the drawings:

Figure 1 is a front elevation, with parts in section, of my heater as it may be installed.

Figure 2 is a cross-sectional view of the same taken on the line 2—2 of Figure 1.

Figure 3 is an end view of the same taken on the line 3—3 of Figure 1.

Figure 4 is an enlarged fragmentary vertical sectional view, illustrating one end of the heater and the burner construction.

Figure 5 is a fragmentary end view of a valve control device utilized in the heater taken in the direction of the arrows 5 in Figure 4.

Figure 6 is a schematic view with the heater in section, and illustrating the relationship of the heater to a room area.

Figure 7 is a schematic view illustrating in greater detail the path of heat radiation from the combustion chamber to the reflecting surfaces and their outward dispersion.

The primary elements of my heater are the combustion chamber 10, burner 11, and reflector element 12. The combustion chamber 10 is a horizontally elongated box with impervious plane walls 13, 14, 15 and 16, arranged with a cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal, or a kite, as illustrated in the several figures. The walls 13 and 14 are wider than the walls 15 and 16, and a vertical line bisects the angle of intersection of the two pairs of walls. Referring to Figure 7, the angles a and b are approximately 90° each, the angle c approximately 60°, and the angle d approximately 120°, in the particular form chosen to illustrate the invention. The burner 11 is installed in one end, and a flue pipe 17 at the opposite end carries off the products of combustion. The flue pipe 17 is preferably formed with elbows as illustrated in Figure 2 to circumvent the supporting beam hereinafter de-

scribed. It is within the scope of my invention to use a burner at each end, and a flue pipe in the center; or to use a central burner directing flame both ways, and use flue pipes at both ends.

The combustion chamber 10 is supported within the reflector element 12, in a manner hereinafter described and in the particular relationship illustrated.

The reflector element 12 comprises an upper section 20 and a lower section 21. The upper section has four plane faces or panels 22, 23, 24 and 25, angularly arranged in cross section as illustrated. Opposite sides are the same. The panel 23 is disposed at an angle of approximately 45° to the wall or face 15 of the combustion chamber, and the panel 22 is angularly depressed from the panel 23, approximately but not exactly paralleling the wall 15, and being at an angle of approximately 90° to the wall 13. The angle of intersection between the panels 22 and 23 may be located on a projection of the line representing the wall 13, as illustrated in Figure 7, but is not necessarily so.

While the heater illustrated is adapted to disperse heat in both directions, the principle of my invention may be employed for dispersing heat in one direction only by utilizing either half of the structure illustrated.

The lower reflector section 21 is formed with four plane faces or panels 26, 27, 28 and 29, angularly arranged in cross section as illustrated, the panel 27 being approximately parallel to the upper panel 22.

The upper and lower reflector sections are closed at one end by an end plate 30, and at the other end by an end plate 30*a*.

The combustion chamber 10 is supported on these end plates in any suitable manner. As shown in the drawings, the end plates are formed with openings 31 through which the combustion chamber extends, and flanges 32 turned out from the latter are attached to the outer sides of the end plates. At the flue end of the combustion chamber, the latter is closed by a cover 33. The burner end of combustion chamber is open as illustrated, for example in Figure 3, to provide for the burner 11. This burner may be mounted by means of a bracket 34 welded or otherwise attached to the lower walls 13 and 14 of the combustion chamber.

The burner comprises a gas tube 35 controlled by a valve 36 and positioned to feed into a mixing chamber 37. The control valve is provided with a disc or wheel 38, having pins 39 to which may be attached chains or cords 40 by which the valve may be operated from below. A pilot light 41 is provided, and supplied with a standard pilot safety 42, which will shut off the gas if the pilot goes out.

An auxiliary air inlet 45 is formed in the combustion chamber adjacent the pilot 41 to facilitate access to the pilot. This inlet will be normally closed when the heater is in operation.

Mounting brackets 47 are welded or otherwise attached to the upper surfaces of the reflector element 12 and are joined as indicated at 48 for suitable attachment to horizontal beams 49, the latter of which are normally suspended from the ceiling or across the room in a factory. Any other convenient or suitable means for suspending the heater may be employed.

A novel auxiliary feature of my heater is the suspension of a fluorescent lighting fixture 50 below the lower reflector panel 21, as illustrated. This lighting fixture includes angularly arranged walls 51 following a cross sectional pattern somewhat similar to the walls 26, 27, 28 and 29 of the section 21, and occupying substantially the same or greater horizontal cross sectional area than the latter, mounted below a spacing box 52, thus providing a convenient over-head fluorescent lighting without the lighting fixture usurping additional space; and the box and reflector element of this lighting fixture 50 serves as a shield to partially absorb or deflect any heat radiated downwardly through the heat reflector section 21, thus diminishing any tendency for the creation of a hot spot directly below the heater.

In the use of my invention the valve 36 is opened by pulling on one of the chains or cords 40 and as the gas issues through the tube 35 it is ignited by the pilot 41, and the gas burns in the combustion chamber. The products of combustion travel through the combustion chamber 10 and are exhausted through the flue 17. In doing so the walls 13, 14, 15 and 16 of the combustion chamber are heated and the heat therefrom radiates outwardly. There is no flame visible and the products of combustion may be carried outside of the building by any suitable and conventional means. The heat distributed is radiant heat projected from the four walls of the combustion chamber, some passing directly into the area being serviced and some being reflected. It is to be noted that the combustion chamber is spaced from the reflector elements 12 and 21 even at the closest point on the vertical center so that with the exception of a negligible amount of heat conducted from one element to the other at the end supports, the reflector elements receive only radiant heat which they in turn reflect outwardly and downwardly. The general result is illustrated schematically in Figure 6. Where an exceptionally large room is to be heated a battery of my heaters may be employed and spaced so that there is a slight over-lapping at the extremes of the heat radiation.

Figure 7 indicates in more detail some of the lines of heat radiation and reflection. In a drawing of this character the total effect cannot be illustrated, but representative lines are shown.

Thus the heat rays *r* may radiate outwardly from the wall 14 directly into the area to be heated. Likewise heat rays *s* also radiate directly outwardly, as well as intermediate rays and some rays on both sides of the angle *r*—*s*. Heat rays *t* radiating from the wall 14 strike the reflector 25 and are reflected downwardly as illustrated, the angle of reflection being equal to the angle of incidence. Some of the rays such as *u* from the combustion chamber wall 15 strike the reflector 25 and are directed downwardly. Other rays *v* from the wall 15 strike the reflector 24 and are reflected downwardly but outwardly at a wider angle than the rays *u*. It will be obvious that there are innumerable combinations of radiation and reflection arising in the operation of this heater, all controlled by the principles illustrated.

Inasmuch as the reflector section 21 receives radiated heat only with a negligible exception at the ends where the parts are supported, which radiated heat the reflector 21 disperses outwardly and downwardly, substantially no heat is lost by radiation upwardly from the reflector 21. For the same reason substantially little heat is lost downwardly through the lower reflector section 21.

There is an important critical relationship between the cross sectional form of the combus-

tion chamber and the reflector element, as well as the relative sizes and proportions of the same, as illustrated.

I have found by actual demonstration and tests that from a point directly under the heater to a distance of 20 or 30 feet outwardly therefrom depending upon the size and position of the heater and therefore its effective heating area, the temperature in the strata below the heater varies but a few degrees at the most in different locations within that space, and that the variation is hardly perceptible to persons occupying various positions in that space. This is true irrespective of the room temperature outside the heating area of the heater, and as heretofore mentioned the temperature outside of this area may be disregarded. Inasmuch as the radiated heat warms the human body upon contact therewith in a manner similar to that of the sun's rays, such heat being infra-red rays, even cold drafts of air passing through the heated area are not highly objectionable.

The use of a combustion chamber with plane heat radiating walls is an important feature of the invention. A conventional burner or open gas flame not only presents a fire hazard but the heat thereof is not controllable for correct dispersion as provided for by my chamber of novel configuration. This chamber confines the flame and the products of combustion, and the walls thereof, being flat, radiate the heat in known directions and therefore make it possible to control not only the heat radiated directly into the room from the chamber, but also enable the provision of correct plane reflecting surfaces for advantageously utilizing 100% of the area of the chamber and accomplishing a wider and more effective dispersion of the heat therefrom.

My invention embraces not only the structure shown, and equivalents, but a novel method or art of heating from overhead. To my knowledge, I am the first to utilize overhead heat conducting plane walls heated from one side and discharging radiant heat from the opposite side into a room area. This is enhanced by the reflection from plane surfaces of upwardly travelling heat rays downwardly and outwardly into the space to be heated, the total result being an even dispersion of radiant heat throughout a horizontal strata below and to one side of the heater.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures and methods.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An overhead gas heater comprising the combination of: a substantially closed combustion chamber formed of horizontally elongated plane walls, means adapted to direct flame into said chamber and means to carry off products of combustion from said chamber, whereby the walls are caused to project radiant heat, upper reflecting surfaces over said combustion chamber adapted to reflect downwardly and outwardly the principal heat rays which initially pass upwardly from said chamber, and lower reflecting surfaces under said combustion chamber adapted to intercept and reflect outwardly the principal heat rays which pass vertically downward from said chamber.

2. An overhead gas heater comprising the combination of: a substantially closed combustion chamber formed of horizontally elongated plane walls, means adapted to direct flame into said chamber at one end and means to carry off products of combustion from said chamber, whereby the walls are caused to project radiant heat, upper reflecting surfaces over said combustion chamber adapted to reflect downwardly and outwardly the principal heat rays which initially pass upwardly from said chamber, and lower plane reflecting surfaces under said combustion chamber adapted to intercept and reflect outwardly the principal heat rays which pass vertically downward from said chamber.

3. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal, burner means adapted to direct a flame into said chamber for heating the same, and a plane faced reflector co-extensive in length with the combustion chamber and spaced above the latter to reflect approximately all of the heat rays downwardly and outwardly which are initially projected from said combustion chamber at an angle substantially above horizontal.

4. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal and its diagonals disposed vertically and horizontally respectively, burner means adapted to direct a flame into said chamber for heating the same, and a plane faced reflector co-extensive in length with the combustion chamber and spaced above the latter, said reflector having on one side a face disposed at an acute angle to the upper complementary wall of the combustion chamber, and a similar face on the opposite side.

5. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal and its diagonals disposed vertically and horizontally respectively, burner means adapted to direct a flame into said chamber for heating the same, and a plane faced reflector co-extensive in length with the combustion chamber and spaced above the latter, said reflector having on one side a face disposed at an acute angle to the upper complementary wall of the combustion chamber, and a second face joined to the first at an obtuse angle, the said reflector being similar on the opposite side.

6. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal and its diagonals disposed vertically and horizontally respectively, burner means adapted to direct a flame into said chamber for heating the same, and a plane faced reflector co-extensive in length with the combustion chamber and spaced above the latter, said reflector having on one side a face disposed at an acute angle to an upper wall of the combustion chamber and the outer edge of said face ending at the intersection of said side and

the projection of a line representing the adjacent lower wall of the combustion chamber.

7. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls and having a lateral cross section one side of which includes two walls the first of which is inclined downwardly and outwardly and the second of which is inclined upwardly and outwardly to intersect the first, burner means adapted to direct flame into the combustion chamber and a reflector panel structure having one panel extending upwardly and outwardly substantially above the first wall, and a second panel extending downwardly and outwardly substantially laterally of both walls.

8. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a lateral cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal and the angle of intersection of adjoining upper and lower walls is approximately 90°, means adapted to direct a flame into said combustion chamber at one end and means adapted to conduct away the products of combustion from said chamber whereby the walls of said chamber are heated, and a plane faced reflector co-extensive in length with said combustion chamber and spaced above the latter to reflect heat rays downwardly and outwardly which initially radiate upwardly toward said reflector.

9. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a lateral cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal and the angle of intersection of adjoining upper and lower walls is approximately 90°, means adapted to direct a flame into said combustion chamber at one end and means adapted to conduct away the products of combustion from said chamber whereby the walls of said chamber are heated, and a plane faced reflector co-extensive in length with said combustion chamber and spaced above the latter to reflect heat rays downwardly and outwardly which initially radiate upwardly toward said reflector, said reflector having on each side two plane surfaces, the first extending upwardly at an angle acute to the upper wall of the combustion chamber, and the other extending downwardly at an obtuse angle from the first.

10. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a lateral cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal and the angle of intersection of adjoining upper and lower walls is approximately 90°, means adapted to direct a flame into said combustion chamber at one end and means adapted to conduct away the products of combustion from the other end whereby the walls of said chamber are heated, and a plane faced reflector co-extensive in length with said combustion chamber and spaced above the latter to reflect heat rays downwardly and outwardly which initially radiate upwardly toward said reflector, said reflector having on each

side two plane surfaces, the first extending upwardly at an angle acute to the upper wall of the combustion chamber and terminating at a point where the projection of a line representing the lower wall of said chamber intersects said first plane surface, and the other said surface extending downwardly at an obtuse angle from the first and of a width sufficient to intercept heat radiated from the combustion chamber in lines substantially above horizontal.

11. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a lateral cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal and the angle of intersection of adjoining upper and lower walls is approximately 90°, means adapted to direct a flame into said combustion chamber at one end and means adapted to conduct away the products of combustion from said chamber whereby the walls of said chamber are heated, a plane faced reflector co-extensive in length with said combustion chamber and spaced above the latter to reflect heat rays downwardly and outwardly which initially radiate upwardly toward said reflector, and a second reflector spaced below said combustion chamber having plane faces adapted to reflect heat rays from the combustion chamber and the upper reflector outwardly.

12. An overhead gas heater comprising the combination of: a horizontally elongated combustion chamber formed of plane walls having a cross section in the form of a quadrilateral of which two pairs of adjacent sides are equal, burner means adapted to direct a flame into said chamber for heating the same, a plane faced reflector co-extensive in length with the combustion chamber and spaced above the latter to reflect heat rays which are initially projected from said combustion chamber at an angle substantially above horizontal, downwardly and outwardly, and a second reflector spaced below said combustion chamber having plane faces adapted to reflect heat rays from the combustion chamber and the upper reflector outwardly.

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