June 9, 1936. J. J. SLOYAN 2,043,597

HEAT GENERATOR

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Fig. 1

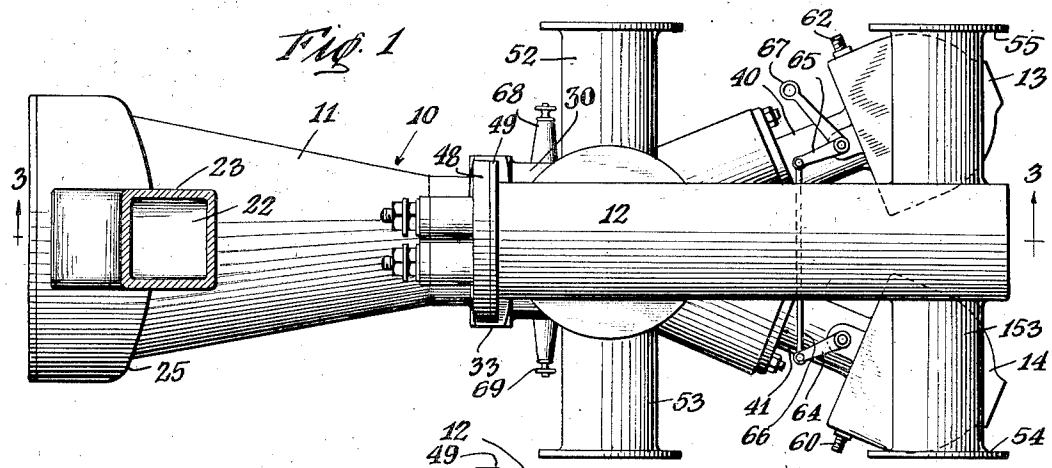



Fig. 2

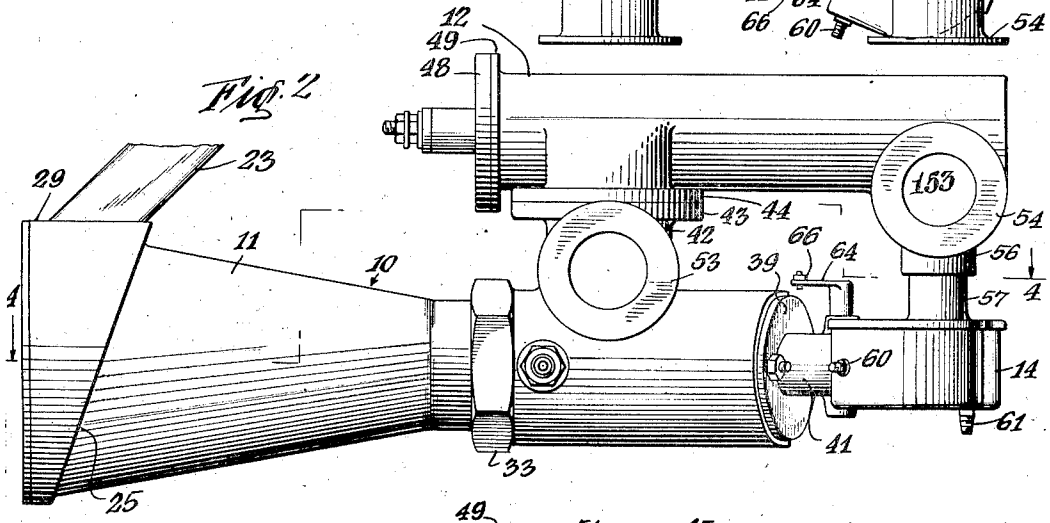
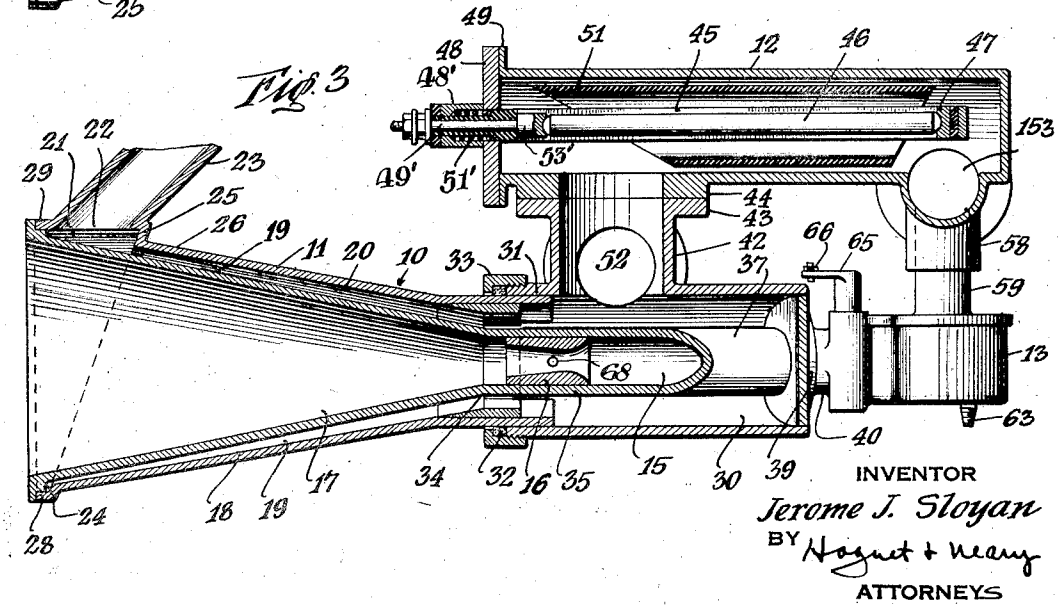



Fig. 3




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Fig. 4

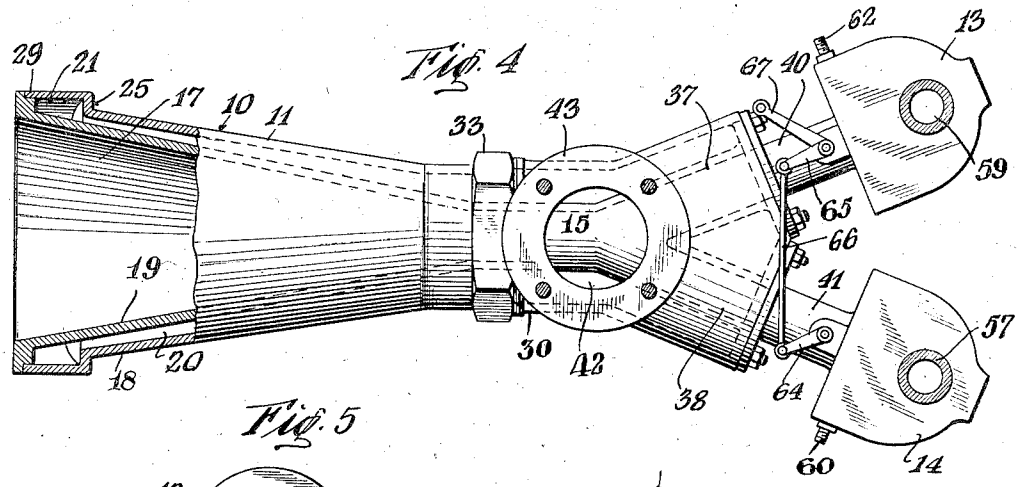



Fig. 5

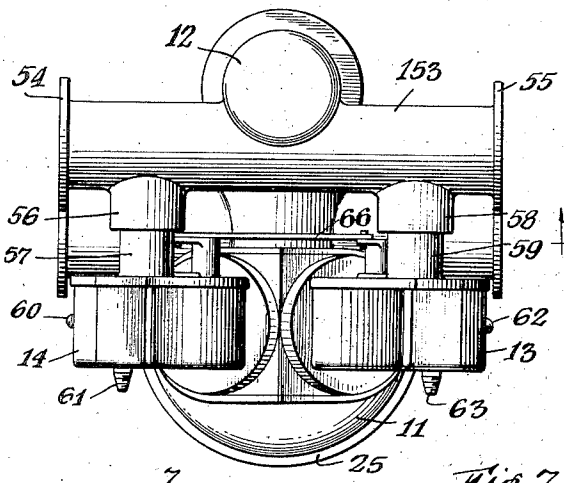



Fig. 8

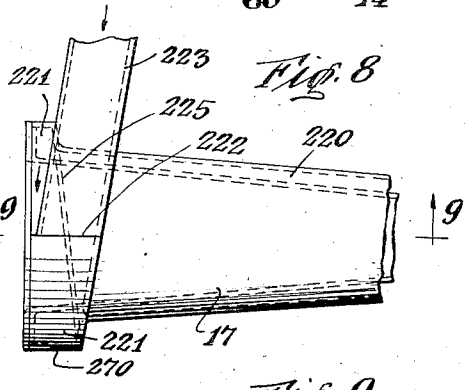



Fig. 9

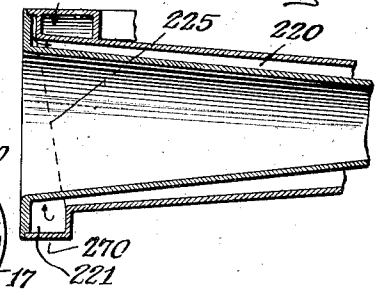



Fig. 6

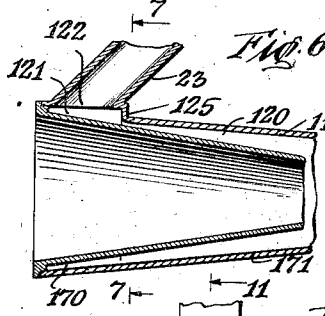



Fig. 7

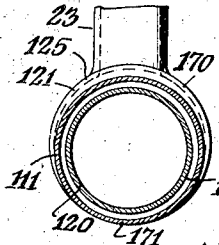



Fig. 10

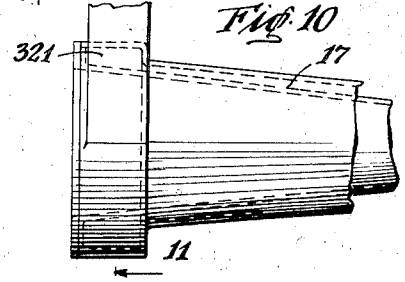
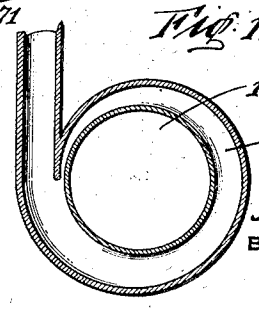



Fig. 11




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2,043,597

## HEAT GENERATOR

Jerome J. Sloyan, Red Bank, N. J.

Application July 2, 1932, Serial No. 620,592

4 Claims. (Cl. 158—28)

This invention pertains generally to the class of heat generators, and particularly to the class of heat generators in which the air employed for obtaining a combustible mixture is preheated.

In a certain type of heat generator as shown and described in my copending applications, Serial Nos. 492,132 and 502,055 filed October 29, 1930 and December 13, 1930 respectively, air is passed about a certain portion of the combustion chamber for preheating purposes, the combustion chamber at this point being comprised of a material, for instance, metal, which is capable of rapid heat transfer. As a general rule, the materials employed are not of a refractory character and are susceptible to destruction or rapid deterioration if the temperature at any point or points becomes excessively high.

Furthermore, even though this portion of the combustion chamber is formed of a material which cannot be destroyed by heat, safety requirements often demand that no part of it shall acquire a temperature sufficiently high to cause ignition of any stray gases which might find their way into the air passage, for instance, from the surrounding atmosphere and through the blower.

In addition to the foregoing, it is important in burner operation that the mixture of air and fuel be homogeneously constant over a wide range of combustion rates, that is, between minimum and maximum operation points. This homogeneity of mixtures should obtain even though rapid changes in the combustion rate are made.

One of the features of this invention is a structure for preheating the air in which provision is made for maintaining the material dividing the air passage from the sphere of combustion at a safe temperature throughout without the existence of hot spots which might cause destruction of the dividing material.

Another feature of this invention is a construction whereby the combustible mixture is maintained substantially homogeneously constant over a wide range of combustion rates irrespective of the rate of change of the combustion rate.

Referring to the drawings in which like reference characters are appended to like parts in the various figures,

Fig. 1 is a top plan view of an oil burner illustrating my invention;

Fig. 2 is an elevation thereof;

Fig. 3 is a sectional elevation taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional plan view taken on line 4—4 of Fig. 2;

Fig. 5 is an end view;

Fig. 6 is a sectional elevation of a modified form of air passage;

Fig. 7 is a section on line 7—7 of Fig. 6;

Fig. 8 is a top plan view of another form of air passage;

Fig. 9 is a section on line 9—9 of Fig. 8;

Fig. 10 is a top plan view of a still further form of air passage;

Fig. 11 is a section on line 11—11 of Fig. 10.

Referring more particularly to the drawings, at 10 is shown an oil burner including generally an air preheating portion 11, a preliminary air preheating portion 12, separate mixing and metering portions 13 and 14, a combustible mixture homogenizing chamber 15 and a safety Venturi device 16.

The air preheating portion 11 comprises a portion of the combustion chamber wall 17, hereinafter referred to as the ante-combustion chamber and a sheath 18 about the ante-combustion chamber 17. The ante-combustion chamber 17 is shown as conical in shape; that is, with surfaces resulting from the revolution of a straight line. However, it is to be understood that the ante-combustion chamber 17 might have any other shape, for instance, that of a morning glory or of a tulip; that is, with surfaces of revolution resulting from the revolving of a curved line.

As described in my above mentioned copending application, Serial No. 502,055, the device shown at 16 illustrated as a venturi prevents the propagation of flame back into the portion 15 and into the mixing and metering devices 13 and 14.

From what has been previously said it will become apparent that in order to be assured that the wall of ante-combustion chamber 17 will be below a dangerous temperature, it is preferable to have a substantial flow of air over each portion of the outer surface of such chamber. To effect such a flow of air, air passage 19 between sheath 18 and ante-combustion chamber 17 is formed in two portions, to wit, a longitudinal portion 20, preferably with substantially uniform cross-sectional area throughout its length which is substantially obtained by having the walls of sheath 18 gradually depart from the walls of ante-combustion chamber 17 toward the narrower end thereof as clearly shown in Fig. 3, and a portion 21 for supplying air to the portion 20 and connected to the blower, not shown, through an opening 22 and conduit 23.

As illustrated in Figs. 1 to 5 inclusive, the conduit 23 and opening 22 are positioned radially with respect to the portion 21 so that the air will

divide substantially equally about the two sides of the ante-combustion chamber 17 within the portion 21 at the same time entering the portion 20. It can be seen that if the portion 21 were of uniform cross-sectional area about the ante-combustion chamber 17, in view of the air being progressively distributed through the portion 20 as it passes about ante-combustion chamber 17, the velocity of the air in the portion 21 would rapidly decrease toward a point opposite the opening 22. In other words, with such a construction there might be a possibility of a hot spot existing on ante-combustion chamber 17 at and/or adjacent to a point opposite the opening 22, particularly during very heavy duty, because there might be an insufficient air flow over this spot to keep it cool.

In order to prevent the possibility of a hot spot occurring in this manner I gradually decrease the cross-sectional area of the portion 21 between the opening 22 and the point 24 substantially opposite the center of the opening 22 so that by reason of the decrease in cross-sectional area a substantial velocity is maintained through all parts of the portion 21 and, consequently, over the entire surface of the ante-combustion chamber 17 within the portion 21. At the same time the air is delivered substantially uniformly over the entire cross-sectional area of the portion 20.

In order to effect the gradual decrease in cross-sectional area of the portion 21 in the form shown in Figs. 1 to 5 inclusive, I provide the portion 21 with a slanting side wall 25.

It is, of course, obvious that the side wall 25 may be of any shape, that is, straight or curved, and may be so formed as to provide substantially uniform velocity of air throughout the portion 21 if desired.

Inasmuch as the air from conduit 23 divides to flow about two sides of the ante-combustion chamber 17 at the opening 22, if a substantial variation in the velocity of the air is to be avoided, the cross-sectional area of portion 21 at this point should be substantially one-half that of the cross-sectional area of the portion 20. The invention, however, is not limited to such an arrangement.

The sheath 11 may be formed in any desired manner, either as a unit or in sections as desired. If the sheath 11 is unitary as shown, a convenient way of mounting its end upon ante-combustion chamber 17 is to provide that chamber with a shoulder 28 and to mount the end 29 of sheath 11 on shoulder 28 and then seal the joint in any desired manner such as by electric welding or with cement or otherwise.

The other end of sheath 11 enters a chamber 30 through an opening 31 conforming to the shape of the sheath 11. Packing 32 and a packing nut 33 may be provided for effecting a tight joint.

The ante-combustion chamber 17 at its end 34 is provided with an extension 35 in which is positioned the venturi 16. The extension 35 is connected to or formed integral with the combustible mixture homogenizing chamber 15 which is connected to each of the mixing and metering devices 13 and 14, the homogenizing chamber 15 as shown being Y-shaped for this purpose. The branches 37 and 38 of the Y may either pass through the wall 39 of chamber 30 or may be connected to such wall as by flanges or by welding or otherwise in order to form a construction whereby branch 37 may be connected to the outlet 40 of mixing and metering device 13 and branch 38 connected to the outlet 41 of mixing and metering device 14.

Mixing and metering devices 13 and 14 are shown as carburetors but any other device may be substituted therefor.

Chamber 30 is provided with an outlet 42 which is attached as by flange 43 to a similar flange 44 on preliminary heating chamber 12 so as to open into the inner portion of said preliminary heating chamber 12.

Preliminary heating chamber 12 is shown provided with a heating element 46 which may be of any suitable construction. The heating elements illustrated are supported at one end in spaced relation by contact block 47 mounted inside of and insulated from the preliminary heating chamber 12 at the closed end thereof by means of a frame 45 secured to the flange 48. Flange 48 is secured to a flange 49 on the open end of preliminary heating chamber 12.

Flange 48 is provided with a hollow boss 48' through which is fitted insulated plunger conductor 53'. The end of the plunger conductor is held tightly against the end of its respective heating element by a compression spring 51' located around the plunger insulator 52' but within the boss. Consequently, the heating element is held tightly against contact block 47. Current supply lines are attached to that portion of the plunger which extends outside of flange 48.

Any other construction may be substituted.

In order to make the heating elements most effective, a tube 51 slightly smaller in outside diameter than the inside diameter of the preliminary heating chamber 12 is provided about the elements. Some of the air passes between the tube 51 and the chamber wall to maintain the chamber wall cool and thus reduce heat loss.

The outlet conduit 42 is shown provided at opposite sides with extended openings 52 and 53. The openings 52 and 53 are merely for the purpose of inserting a thermostat into the conduit 42.

The preliminary heating chamber 12 opens into a transverse conduit 153 having open ends 54 and 55 for the purpose of selectively placing a thermostat in the conduit 153 from either side. Conduit 153 has an opening 56 connected to the air inlet 57 of carburetor 14 and an opening 58 connected to the air inlet 59 of carburetor 13.

Carburetor 14 is provided with a fuel inlet 61 and an overflow 60 and carburetor 13 is provided with a fuel inlet 63 and an overflow 62. However, any other type of carburetor may be used.

The arm 64 attached to the butterfly valve, not shown, of carburetor 14 and arm 65 attached to the butterfly valve, not shown, of carburetor 13 are connected together by rod 66 and controlled by arm 67.

The preliminary heating means, the provision for positioning thermostats in the air stream and the carburetor fuel inlets and overflows form no part of the present invention and merely adapt the device to automatic starting and operating means more particularly described in the above-mentioned copending applications.

In operation, air is supplied through the conduit 23 by any means, not shown, the air passing about ante-combustion chamber 17 through the portion 21 at a substantial velocity, the air at the same time feeding into the portion 20. As set forth above, there will be a substantial flow of air over the entire outer surface of the ante-combustion chamber 17. After the burner is in operation, heat will be transferred to the air while flowing about the ante-combustion chamber 17.

The air is eventually delivered to the carburetors 13 and 14 wherein it is mixed with fuel,

metered by said carburetor and the combustible mixtures thus formed are delivered through the branches 37 and 38 into the homogenizing chamber 15 from which the homogenized mixture is delivered through venturi 16 into ante-combustion chamber 17 for combustion. Homogenizing chamber 15 absorbs heat from the air passing through chamber 30 which heat assists in homogenizing operations.

Ignition is effected by means of electrodes 68 and 69, the operation of which, together with the venturi 16, is more particularly described in the above-mentioned copending applications.

It is found that the use of two or more carburetors, the outputs of which are delivered into a common conduit such as the homogenizing chamber 15, maintains an unusually high degree of homogeneity of the combustible mixtures for all rates of burning from maximum to minimum and vice versa and for practical purposes regardless of the rate of change of combustion. This homogeneity is far superior to that which can be obtained with a single mixing and metering device of equivalent capacity. The heat supplied by chamber 30 compensates for loss in temperature due to latent heat of vaporization.

A manner in which the rate of combustion may be controlled forms a part of the above-mentioned co-pending applications.

Another form of air passage is shown in Figs. 6 and 7 wherein the sheath 111 is formed so that the wall 125 is substantially non-slanting, the reduction in area of portion 121 being effected by gradually decreasing the spacing between wall 170 surrounding air passage portion 121 and ante-combustion chamber 17, the spacing between wall 171 surrounding air passage portion 120 and ante-combustion chamber 17 being substantially unchanged from the previous form as clearly illustrated in Figs. 6 and 7.

In the above descriptions the air inlet has been disposed radially. It is, of course, possible to have the air inlet disposed in any manner such as tangentially as illustrated in Figs. 8 and 9 and Figs. 10 and 11.

In the form shown in Figs. 8 and 9, the inlet 222 is tangential with respect to the air passage portion 221. The spacing between wall 270 surrounding portion 221 and ante-combustion chamber 17 being uniform, the area of the portion 221 is gradually decreased by means of a helical wall 225.

In order not to effect a substantial difference in velocity between portion 221 and portion 220, the cross-sectional area of the portion 221 at the opening 222 should be substantially equal to that of the portion 220. The invention, however, is not limited thereto.

In Figs. 10 and 11 I have shown another tangential form of air inlet in which the air passage portion 321 is of substantially uniform width as shown in Figure 10 but of varying depth about the ante-combustion chamber 17 as clearly illustrated in Fig. 11.

While I have described the invention in connection with a blower delivering air to the air preheating portion 11 the invention is in no way limited thereto.

While the parts as described are more particularly adapted to the combustion of liquid fuels, the invention applies equally to gaseous fuels and solid fuels such as comminuted coal, etc. It is, of course, not necessary to simultaneously operate each of the mixing and metering devices. Any one or more mixing and metering devices may be accordingly operated to deliver a combustible mixture or combustible mixtures to the homogenizing chamber. To cut out any one mixing and metering device it is merely necessary to disconnect its butterfly valve arm from a common control and secure the butterfly valve in closed position. It is, of course, obvious that any other means may be used for cutting out any one or more mixing and metering devices.

I claim:

1. In a burner, a casing forming a combustion chamber, an air conduit arranged circumferentially about said casing, said air conduit having an air passage comprising a longitudinal portion extending substantially the length of said combustion chamber and a relatively short circumferential portion annularly disposed with relation to one end portion of said combustion chamber, said circumferential portion opening at one of its sides into one end of said longitudinal portion, said circumferential portion having an opening for the entry of air and positioned to permit air to flow in opposite directions through said circumferential portion, said circumferential portion progressively decreasing in cross-sectional area in opposite directions from said opening toward a point opposite said opening.

2. In a burner, a casing forming a combustion chamber, an air conduit arranged circumferentially about said casing, said air conduit having an air passage comprising a longitudinal portion extending substantially the length of said combustion chamber and a relatively short circumferential portion annularly disposed with relation to one end portion of said combustion chamber, said circumferential portion opening at one of its sides into one end of said longitudinal portion, said circumferential portion having an opening for the entry of air arranged tangentially with respect to said circumferential portion, said circumferential portion progressively decreasing in cross-sectional area throughout the length thereof.

3. In a burner, a casing forming a combustion chamber, an air conduit arranged circumferentially about said casing, said air conduit having an air passage comprising a longitudinal portion extending substantially the length of said combustion chamber and a circumferential portion annularly disposed with relation to one end of said combustion chamber, said circumferential portion having an air opening for the entry of air thereinto, said circumferential portion being provided substantially throughout its length with a communicating opening into said longitudinal portion, said circumferential portion being of progressively reduced cross sectional area throughout from the air inlet thereinto.

4. In a burner, a substantially frustro conical casing forming a combustion chamber, a sheath arranged about said casing in predetermined spaced relationship therewith to provide therebetween a longitudinally extending air passage in heat exchange relationship with said combustion chamber, said sheath also being arranged about one end portion of said casing to provide an air passage extending circumferentially of said casing and emptying into said first air passage circumferentially throughout and having progressively smaller dimensions throughout from the point of air inlet into said first air passage for insuring air flow at a substantially constant velocity throughout said circumferential passage.

JEROME J. SLOYAN.