Nov. 21, 1933. J. G. GILMORE ET AL 1,935,628

PROCESS AND APPARATUS FOR OIL BURNING

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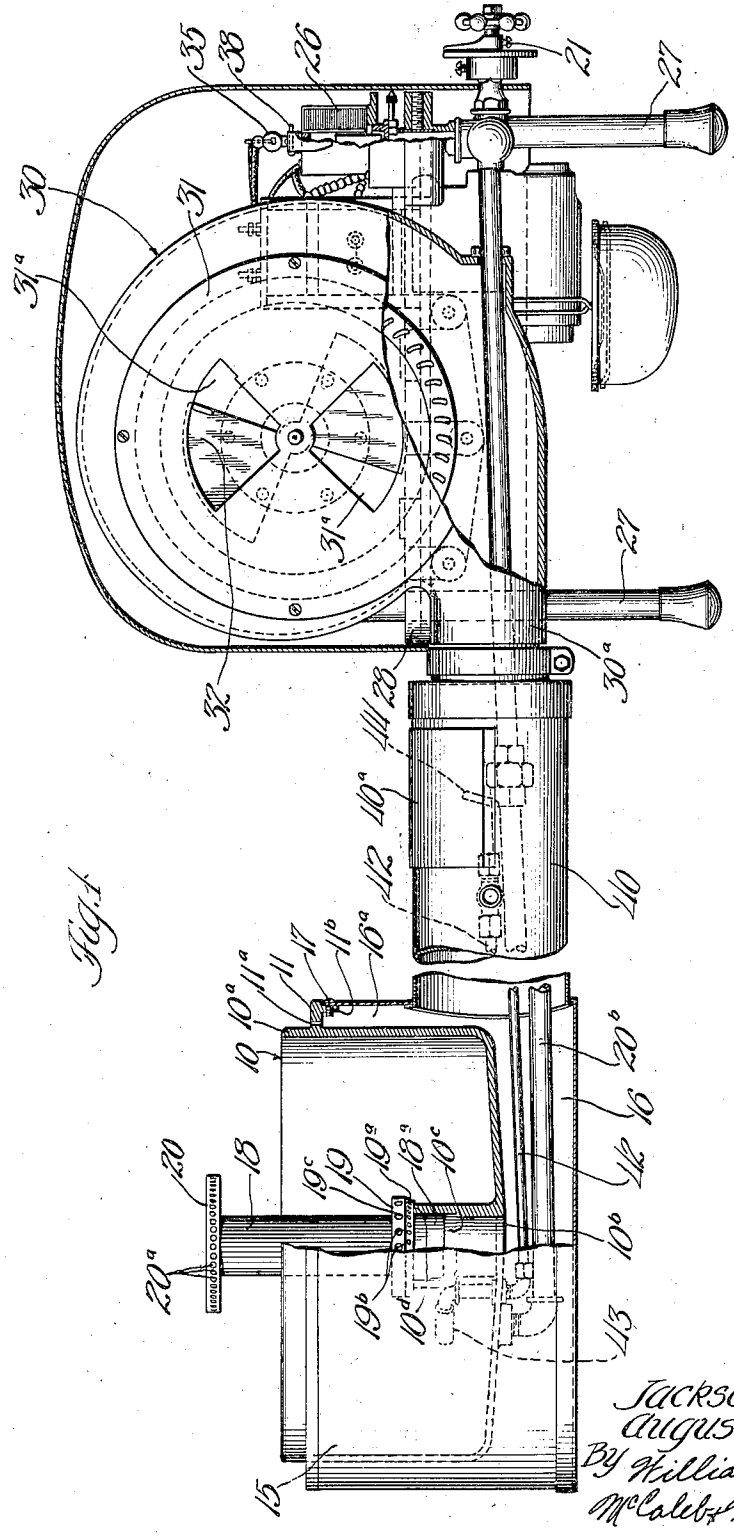


Fig. 1

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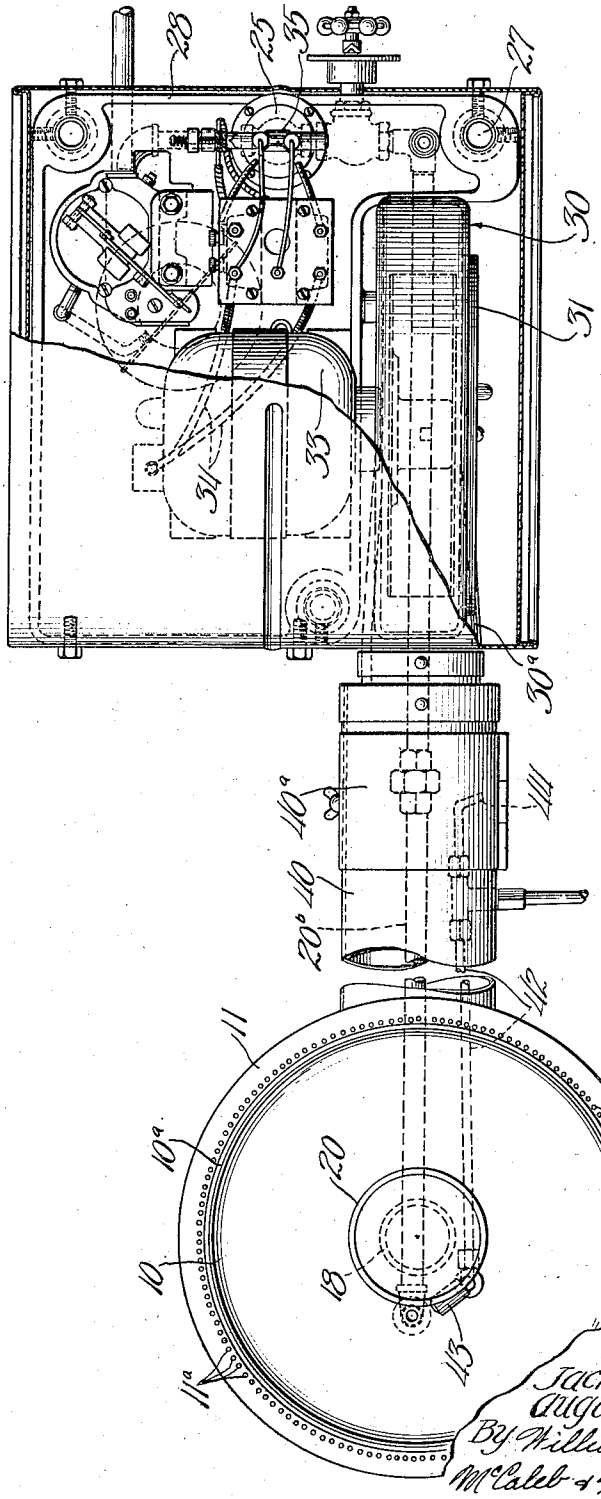


Fig. 2

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Fig. 3

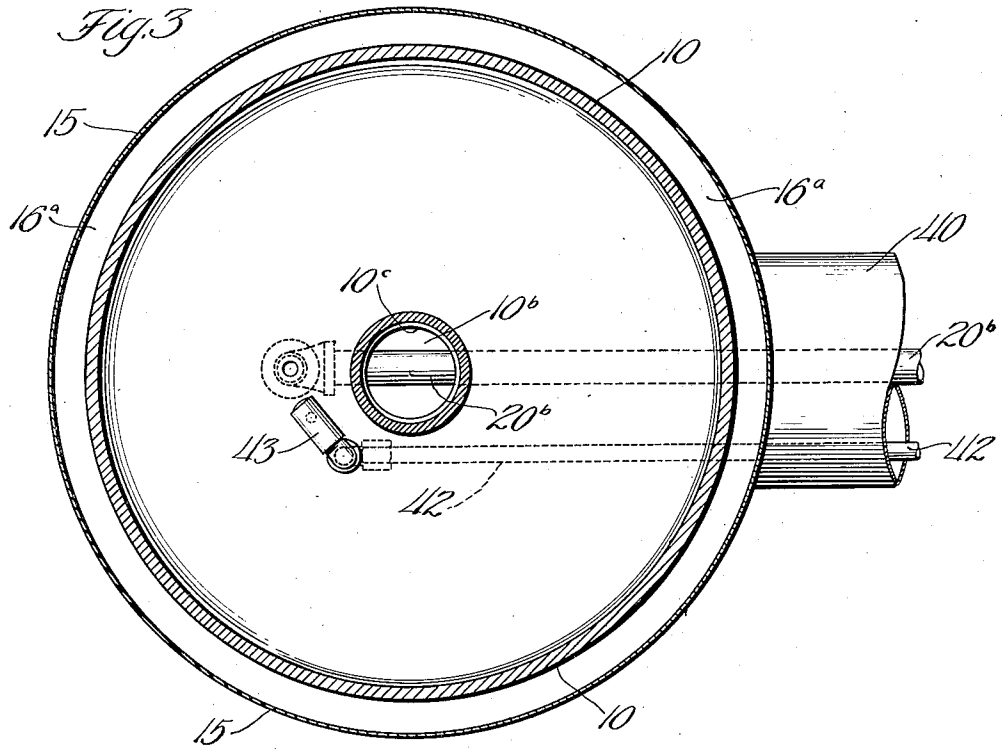
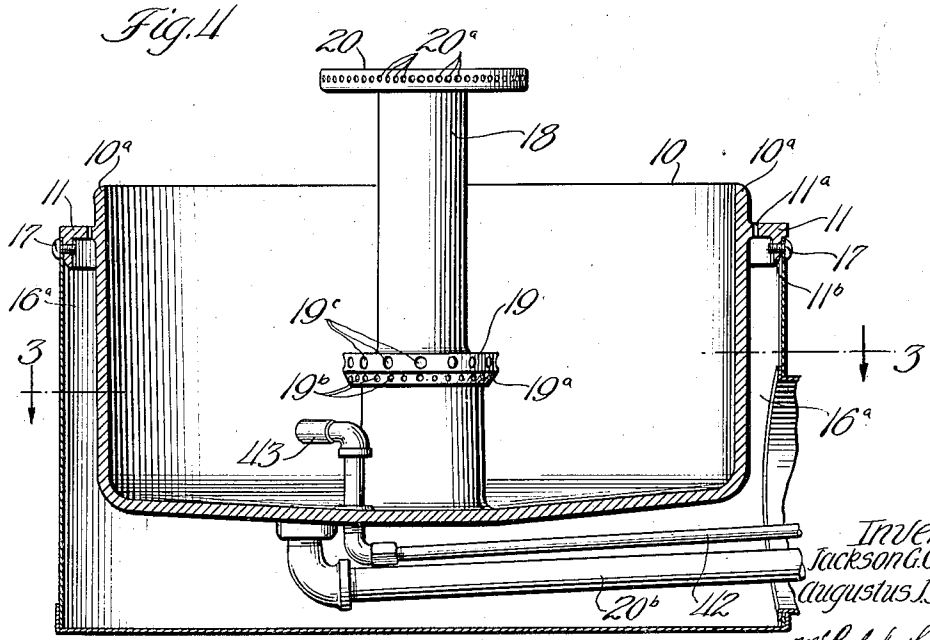


Fig. 4



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UNITED STATES PATENT OFFICE

1,935,628

PROCESS AND APPARATUS FOR OIL BURNING

Jackson G. Gilmore and Augustus J. Frame, Columbus, Ohio, assignors to Franklin Oil Heating, Inc., Columbus, Ohio, a corporation of Ohio

Application August 22, 1929. Serial No. 387,631

18 Claims. (Cl. 158—92)

This invention relates to process and apparatus for oil burning and has for an object to provide an apparatus comprising a bowl or mixing chamber surrounded by a spaced casing which forms with the bowl an air chamber to which air is supplied under pressure from a motor-driven fan. Oil is supplied to the bowl at the bottom thereof and a substantially constant level of oil is maintained in said bowl. In the center of the bottom of the bowl is provided an air inlet from which extends upwardly an air distributing member having two distributor heads, a lower one adjacent the normal fuel level and an upper one located substantially above the upper plane of the bowl. This air distributor is in communication with the chamber and a closing flange extends from the bowl to the top of the casing forming a closure for the chamber. This flange or closure is provided with vertical apertures.

In our previously issued Patent No. 1,670,033, patented May 15, 1928, we disclosed a somewhat similar apparatus in which, however, the air was supplied to the chamber under natural draft and to the air distributing member under forced draft while a deflector overlay the apertures in the closure flange which were of greater area than those of the present application. Also, in our patent the upper distributor head was located substantially in the plane of the deflector and upper end of the bowl.

While the structure of that patent functioned satisfactorily under limited capacity and favorable conditions, our present structure is a distinct improvement thereover, providing a greater capacity and a flattened or saucer-shaped flame which is positioned a substantial distance above the bowl or mixing chamber. The upward direction of the secondary air flowing through the closure flange is also an advantage over the inwardly deflected secondary air of our patent, as will be pointed out hereinafter.

Another object consists in the inclusion in the combination with our burner head of means to provide for overrun of the motor and fan a sufficient period of time to support combustion of the oil remaining in the bowl after shut-off of the oil supply.

Another object consists in the process of burning oil which may be successfully carried out or practiced by the apparatus disclosed in this application, and it comprises briefly the supply and maintenance of a substantially uniform body of oil which is subjected to heat from the combustion as the radiant heat, to generate a vapor into which is introduced primary air through the lower distributor head in insufficient volume to support combustion under normal running conditions and thereafter supplying secondary air across the gases rising from the bowl or mixing chamber to effect combustion, additional secondary air being supplied in an upwardly directed cylinder around the rising gases, the secondary air from the distributor head being provided in sufficient volume and amount to overcome and deflect the rising gases and the secondary air flowing through the closure flange so that efficient combustion is obtained and the desirable flattened or saucer-shaped flame.

Other objects reside in the details and mechanisms of our invention as will more particularly appear in the following specification and as illustrated in the accompanying drawings, in which

Fig. 1 is a side elevation of apparatus embodying our invention, portions of the bowl, casing, air duct and fan casing being broken away for clearness;

Fig. 2 is a plan view of the apparatus, a portion of the casing which encloses the motor fan and control mechanism being broken away for clearness;

Fig. 3 is a horizontal section along the line 3—3 of Fig. 4, through the bowl and casing, drawn to enlarged scale.

Fig. 4 is a vertical section through the bowl and casing, the air distributor being illustrated in elevation.

Like numerals refer to like elements throughout the drawings, in which 10 indicates a bowl or mixing chamber open at its upper end and provided with an outwardly extending peripheral flange 11 provided with vertical or upwardly directed apertures 11—*a*. This flange is located sufficiently below the top of the bowl 10 to provide a vertical collar or flange 10—*a* as illustrated in Fig. 1, for example.

Surrounding the bowl 10 is the casing 15 which is spaced from the bowl to provide a chamber 16 having the upwardly extending annular portion 16—*a* closed by the flange 11. In the form illustrated, flange 11 is provided with an angular extension 11—*b* fitting closely inside the upper end of the casing 15 and secured thereto by screws 17 or any other suitable means.

The bowl 10 is provided with an air inlet 10—*b* in the center of the bottom thereof and from this air inlet extends upwardly the tubular portion 10—*c*. The bore of this tubular portion 10—*c*

is slightly enlarged at the upper end as indicated by numeral 10—*d* to accommodate the air distributing member.

Detachably mounted in the enlarged portion of the bore of the tubular member 10—*c* is an air distributing member 18 having an enlarged primary air distributing head 19 and at its upper end an enlarged secondary air distributing head 20. The air distributor member 18 is provided with the portion 18—*a* extending downwardly below the primary air distributor head 19 to fit in the bore of tubular portion 10—*c*, the air distributor being open at its lower end and forming with the tubular portion 10—*c* a vertical tubular air conveying member. The primary air distributing head 19 is provided with a chamfered lower portion 19—*a* in which are provided apertures 19—*b* and apertures 19—*c* are provided in the upper portion of this lower head as illustrated, for example, in Figs. 1 and 4. This lower distributor head 19 is located adjacent the normal fuel level in the bowl, being spaced therefrom a distance sufficient to insure thorough admixture of the air with the vapors or gases rising from the oil in the bowl. The upper end of the air distributor 18 lies a substantial distance above the upper plane of the bowl 10 and is provided with the apertures 20—*a* arranged to direct air outwardly in a substantially horizontal direction.

While the size and number of the various air supply apertures will be varied for different conditions and different capacities, we have constructed satisfactorily operating burners with the following arrangement and size of apertures: 60 $\frac{1}{8}$'' apertures 20—*a*, 150 $\frac{1}{16}$'' apertures 11—*a*, and in one size, 16 $\frac{3}{16}$'' apertures 19—*c*, 32 $\frac{3}{32}$'' apertures 19—*b*, and 9 $\frac{1}{16}$'' apertures (not shown) on the underside of distributor head 19.

We have varied these apertures on the lower head in four different combinations but that arrangement recited above has proved satisfactory in one size of burner.

With the use of the small apertures 11—*a* in the flange or closure 11 and the use of the relatively large apertures 20—*a* the air issuing from the latter exceeds in volume and is of sufficient velocity to deflect or divert the gases rising from the bowl 10 and the air rising from the apertures 11—*a*, at the same time both supplies of secondary air will admix with and effect combustion of such gases, thus producing a substantially saucer-shaped flame of a desirable character.

Oil for combustion is supplied through the pipe 20—*b* to the bottom of the bowl, a regulating valve generally indicated by 21 being included in the line. An automatic valve is also provided in the line, being generally indicated by numeral 25 (see Fig. 2). This valve is opened by a solenoid 26 which is in circuit or in parallel circuit with the motor described later.

Suitably supported upon the legs 27 carrying a table 28 is the fan, generally indicated by numeral 30, comprising the casing 31 having the sector-shaped inlets 31—*a*, the size of whose opening may be varied by adjustment of the pivoted damper 32. This fan is driven by an electric motor generally indicated by numeral 33, the leads 34 for supplying current to such motor being in circuit with a tiltable mercury switch generally indicated by numeral 35 (see Fig. 2) and overlying the stem of the automatic valve 25. This switch is carried upon the pivoted plate 38.

An air duct 40 leads from the outlet 30—*a* of the fan to which it is coupled to the chamber 16—*a* as illustrated in Figs. 1 and 2, this duct being provided with a pivoted door 40—*a* as illustrated.

The oil supply pipe 20—*b* is located in the duct 40 for convenience, as is a gas supply pipe 42 leading from any suitable source to a gas pilot member 43 located to project a gas jet downwardly upon the underlying fuel to start ignition of the burner. An adjusting valve is provided in the gas line 42, the handle thereto being accessible after opening of the door 40—*a* and being generally indicated by numeral 44.

In the operation of the apparatus described and illustrated and in the practice of our process, when the fan 30 is in operation and the fuel line 20*b* open after lift of the valve 25 air will be forced through the duct 40 into the chamber 16—*a* from whence it will flow outwardly through the apertures 11—*a* in the closure flange and those in the lower and upper distributor heads 19 and 20. The apertures 19—*b* will direct air jets downwardly toward the surface of the fuel to effect a more uniform admixture of the air and vapor in the bowl.

Regulation of the air supply to meet the conditions and to obtain proper combustion is effected by regulation of the damper 32 but to increase or decrease the capacity of the apparatus distributor members 18 may be substituted with differently sized ports or with a different number of ports, this permitting a change in the supply of primary and secondary air effected by the distributing member 18.

The gas pilot 43 (or an oil pilot if gas is not available) will effect ignition of the gas or vapors from the oil as it first flows into the bowl 10. At the outset combustion takes place in the bowl but as the heat rises it is found that this combustion in the bowl is discontinued, presumably because the effect of the heat upon the fuel in the bowl increases the generation of vapor or gas to such an amount that insufficient air for combustion is supplied through primary air apertures in the lower distributor head 19. We believe that an initial reaction takes place between this primary air and the gas or vapor from the oil which is hydroxylation, resulting in a combustible gas or gaseous mixture. The gaseous mixture will then rise and flow upwardly out of the bowl where it encounters the transverse jets of secondary air flowing through the upper distributor head 20 and where it is enveloped by the air rising through the apertures 11—*a*. A projection of the air from the upper distributor head 20 across the gases serves to commingle the secondary air therewith and to support combustion. The preponderance of the air issuing from the upper distributor head 20 deflects the gases and the secondary air delivered through the apertures 11—*a*, which also contributes to support of combustion, and a saucer-shaped flame located above the upper plane of the bowl 18 is obtained. The effect is as if gas were being delivered from the bowl 10, admixed with the secondary air for the production of the flame described.

The resultant flame when the proper adjustment is made is clean and of high heating power and is eminently desirable for heating purposes.

When we speak of combustion in the pot or retort, we are using the term in the popular sense, i. e., as accompanied by visible flame. It has been found that such combustion occurring in the pot in any substantial quantity results in the formation and deposit of carbon in the pot or retort, with highly detrimental results in the continued operation of the apparatus.

It will be apparent that our invention is susceptible of modification from the form illustrated in the drawings and described in the specification and we do not wish to be restricted to such form except within the proper scope of the appended claims.

What we claim is:

1. Oil burning apparatus comprising a bowl, means to supply oil thereto, a casing surrounding said bowl and spaced therefrom to form a chamber, an air supply means including a fan and a duct leading therefrom to said chamber, means to supply oil to said bowl, said bowl being provided with an air inlet communicating with said chamber, an air distributing member projecting upwardly in said bowl from said inlet and provided with primary air supply means in said bowl proportioned to deliver air for admixture with the vapor from said oil in insufficient quantity to support combustion in said bowl during normal operation of said apparatus and a secondary air supply means located above the upper end of said bowl, said primary and secondary air supply means being directed to project air horizontally therefrom, and means to direct air upwardly from said casing in a substantially vertical plane around the upper edge of said bowl.

2. Oil burning apparatus comprising a bowl, means to supply oil thereto, a casing surrounding said bowl and spaced therefrom to form a chamber, means to supply air to the interior of said bowl in insufficient quantity to support combustion of fuel therein under normal running conditions, means to supply air in a substantially vertical direction around the gases rising from said bowl and means to supply air transversely of said gases above said bowl to effect with said surrounding air combustion of said gases.

3. Oil burning apparatus comprising a bowl means to supply oil thereto, a casing surrounding said bowl and spaced therefrom to form a chamber, means to supply air to the interior of said bowl in insufficient quantity to support combustion of fuel therein under normal running conditions, means to supply air in a substantially vertical direction around the gases rising from said bowl and means to supply air transversely of said gases above said bowl to effect with said surrounding air combustion of said gases, said last-named air supply means being directed and dimensioned to supply air in sufficient volume and at such velocity as to overcome and deflect the gases rising from said bowl and the air surrounding the same.

4. Oil burning apparatus comprising a bowl, means to supply oil thereto, a casing surrounding and spaced from said bowl to form a chamber, a closure extending between said casing and said bowl adjacent the top thereof and provided with apertures arranged to direct air therethrough in a substantially vertical direction, an air distributing member extending upwardly in and from the bottom of said bowl and means to supply air under pressure to said chamber and to said air distributiug member, said member being provided with a primary air distributing means adjacent the oil level in said bowl proportioned to deliver air for admixture with the vapor from said oil in insufficient quantity to support combustion in said bowl during normal operation of said apparatus, and secondary air supply means located above the upper plane of said bowl, said secondary air supply means being directed to deliver air in a substantially horizontal direction outwardly of said distributing member above said bowl in such volume and at such velocity as to overcome and deflect the air flowing upwardly through the apertures in said closure.

5. That improvement in the art of oil burning which consists in providing an air supply and an oil supply, gasifying said oil, mixing said air and said oil-gas within a mixing chamber without fire, causing said mixture to burn outside of said mixing chamber and adding a final air supply to the outer tip portions of the burning mixture to intermingle with and complete the combustion of the same, said final air supply being delivered in an upward and non-inward direction around the periphery of said mixing chamber.

6. That improvement in the art of oil burning which consists in providing an air supply and an oil supply, gasifying said oil, mixing said oil-gas and said air within a mixing chamber without fire, adding a final air supply outside of said mixing chamber to complete combustion of said mixture, causing said mixture to burn outside of said mixing chamber, the said final air supply including an upwardly and non-inwardly directed air supply around the periphery of said mixing chamber to intermingle with the outer edge portions of the burning mixture and to complete combustion of same.

7. That improvement in the art of oil burning which consists in providing a mixing chamber, feeding oil thereto, feeding air thereto, said air being delivered within the lower portion of said chamber, gasifying said oil, mixing said oil-gas and air without fire, causing said mixture to burn outside of said mixing chamber, and providing a final air supply delivered in a non-inward direction around the periphery of said mixing chamber, intermingling same with the outer tip portions of the burning mixture to complete the combustion of same.

8. The improved process of oil burning which consists in providing a mixing chamber, feeding oil thereto, feeding air thereto, gasifying said oil, mixing said air and oil-gas in proper proportions within the mixing chamber to permit hydroxylation of such mixture, causing said mixture to burn outside the mixing chamber, and directing a final air supply upwardly and non-inwardly around the periphery of said mixing chamber, intermingling said final air supply with the outer tip portions of said burning mixture to complete combustion of same.

9. The improved process of oil burning which consists in providing a mixing chamber, feeding oil thereto, feeding air thereto, gasifying said oil, mixing said air and oil-gas in proper proportions within the mixing chamber to permit hydroxylation of such mixture, causing said mixture to burn outside said mixing chamber, directing final air supplies both at the central portion of said mixture and around the periphery of the said mixing chamber in an upward and non-inward direction, said final air supplies intermingling with the burning mixture to complete combustion of same.

10. The improved process of oil burning which consists in providing a mixing chamber, feeding oil thereto, feeding air thereto, gasifying said oil, said air being injected into said mixing chamber in a plurality of streams, mixing said air and said oil-gas without fire, causing said mixture to burn outside said mixing chamber, and adding a further air supply around the periphery of said mixing chamber in an upward and non-inward direction to intermingle with the burning mixture as it emerges from said mixing chamber and

to complete the combustion of said burning mixture.

11. The improved process in the art of oil burning which consists in providing a mixing chamber, feeding oil thereto, feeding air thereto, gasifying said oil, mixing said air and oil-gas in proportions to effect mixing without fire, causing said mixture to burn outside of said mixing chamber and directing a final air supply around the periphery of said mixing chamber in an upward and non-inward direction to intermingle with the outer tip portions of the burning mixture and to complete combustion of said tip portions.

12. The improved process of oil burning which consists in providing a mixing chamber, feeding oil thereto, feeding air thereto, gasifying said oil, said air being introduced outwardly from a central vertically extending stack in proper proportions to mix with said oil-gas without fire within said chamber, thereby forcing said mixture upward and out of said chamber, causing said mixture to burn outside of said chamber, delivering a final air supply in an upward and noninward direction around the periphery of the said mixing chamber, intermingling said final air supply with the outer tip portions of the burning mixture to complete its combustion.

13. The improved process of oil burning which consists in providing a mixing chamber, feeding oil thereto, gasifying said oil, introducing outwardly from a vertically extended stack a proper supply of air to mix with said oil-gas without fire within said chamber, thereby forcing said mixture upward and out of said chamber, delivering an air supply from said upwardly extending stack outwardly to said mixture as it emerges from said chamber, causing said mixture to burn outside of said chamber, and adding a final air supply non-inwardly around the periphery of said mixing chamber to intermingle with the outer tip portions of said burning mixture and thereby completing its combustion.

14. Apparatus of the kind described, comprising a mixing chamber, means to supply oil thereto, means to supply air to gasify said oil and to mix with the resulting oil-gas without fire within said chamber, whereby said mixture is forced up and out of said mixing chamber, and means to provide a final air delivery to said mixture as it emerges from the mixing chamber, said final air delivery being directed in a non-inward direction around the periphery of said mixing chamber and into the outer tip portions of the mixture.

15. Apparatus of the kind described, comprising a mixing chamber, a central air delivery stack in said chamber, means to supply oil to said chamber, means to supply a plurality of air streams from said central stack into said mixing chamber in a horizontal and downward direction, whereby oil-gas is formed in said chamber, said combined means being so proportioned as to effect a mixture without fire within the mixing chamber, and to force same upwardly and out of said chamber, and means to deliver a further air supply in an outward direction from said stack and in a non-inward direction around the periphery of said chamber, to said mixture as it emerges from said chamber.

16. Apparatus of the kind described comprising a mixing chamber, means to supply oil thereto, said mixing chamber being constructed and arranged with an encircling air conduit and a central vertically extending hollow stack having a plurality of openings therethrough into said mixing chamber, means to supply air outwardly from the openings in said air stack to gasify said oil and to mix with the resulting oil-gas in said chamber, and means to deliver a final air supply non-inwardly from the outer air conduit surrounding the mixing apparatus into the periphery of the resultant flame.

17. That improvement in the art of oil burning which consists in intermingling air and oil-gas within a mixing chamber without fire and subsequently producing fire and flame at the mouth of, or outside of, the mixing chamber; by providing a mixing chamber, an oil supply and an air supply, gasifying said oil, intermingling the oil-gas and air in the mixing chamber without fire and adding a final air supply delivered upwardly and non-inwardly around the periphery of the mixing chamber to intermingle with and complete the combustion of the mixture and of the outer tip portions of the resultant flame.

18. Oil burning apparatus comprising a bowl, a casing surrounding said bowl and spaced therefrom to form a chamber, means to supply oil to said bowl, an air distributing member projecting upwardly in said bowl, said distributing member being provided with upper outwardly directed air discharge apertures and with lower primary air discharge apertures, said last named apertures being directed downwardly and outwardly, and means to discharge additional air substantially vertically around the upper periphery of said bowl.

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