Dec. 4, 1934. P. L. MIKESKA 1,983,386

COMBUSTION ARRANGEMENT FOR OIL BURNERS

Original Filed Jan. 2, 1931

Fig. 1

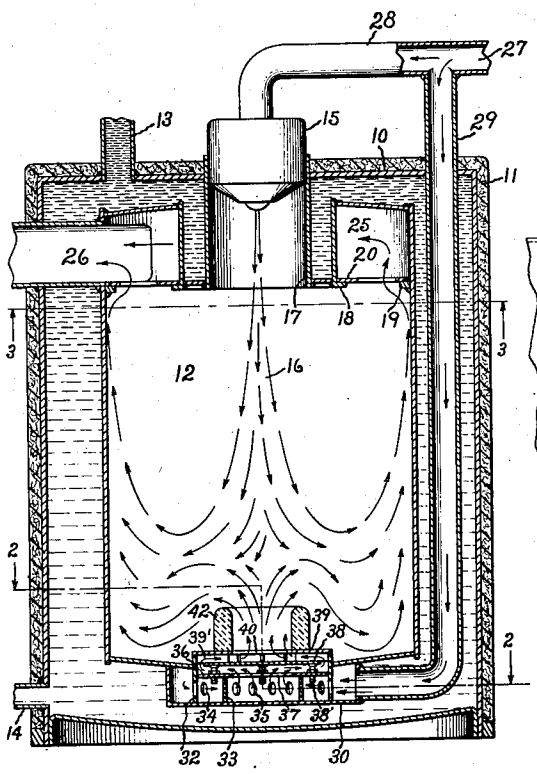


Fig. 3

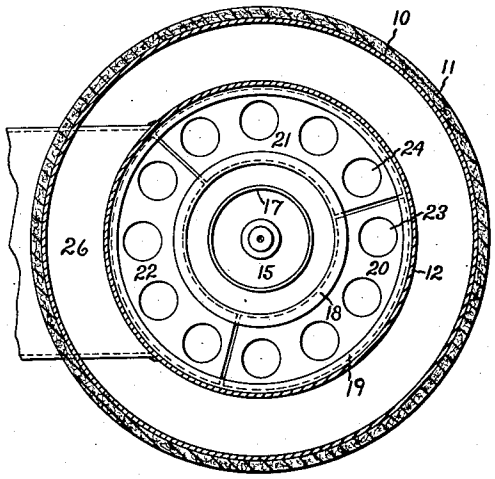


Fig. 4

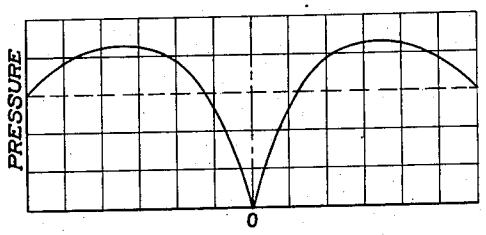
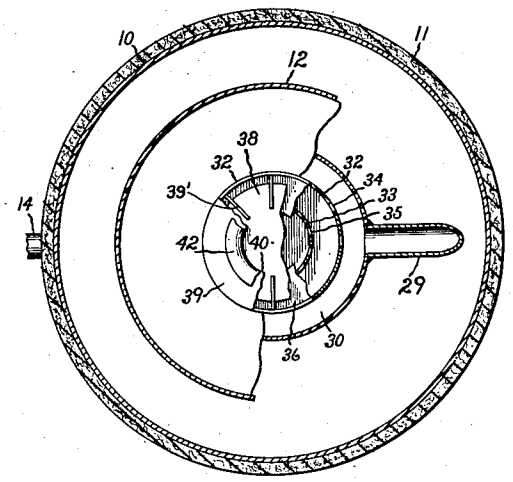


Fig. 2



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His Attorney.

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UNITED STATES PATENT OFFICE

1,983,386

COMBUSTION ARRANGEMENT FOR OIL BURNERS

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Application January 2, 1931, Serial No. 506,001
Renewed May 12, 1934

19 Claims. (Cl. 158—4)

My invention relates to liquid fuel burners, more particularly to improved methods of combustion in liquid fuel burners making use of a downwardly directed flame, and is an improvement over the device set forth and claimed in a co-pending application of A. Macchi, application 505,867, filed December 31, 1930 and assigned to the same assignee as the present invention.

In the device disclosed in the Macchi application referred to above, a downwardly directed stream of oil and air is supplied for furnishing a flame within an oil burner furnace. This is met by an upwardly directed stream of air which spreads the flame laterally in all directions and returns the flame back up the sides of the combustion chamber.

It is the principal object of my invention to provide improved combustion and a more stable flame in an oil burner making use of opposed oil and air jets.

It is another object of my invention to produce an even distribution of combustion air with reference to the axis of the combustion chamber which will eliminate the formation of air pockets within the combustion chamber.

It is another object of my invention to decrease the temperature to which the air box or scroll is in present devices of like character exposed.

It is a further object of my invention to eliminate the necessity for the refractory bricks upon the air box with the further advantage of being able to shorten the combustion chamber which in turn results in a shorter boiler.

It is a further object of my invention to produce an air box or air distribution chamber in which the air box or bustle may be removed.

Another object of my invention is to provide exit conditions for the products of combustion having a symmetrical form with respect to the axis of combustion, thereby preventing cross currents and resulting in a more stable flame.

It is another object of my invention to provide a more even temperature of the refractory and to prevent hot gases from carrying small particles of refractory and driving the same into the wet oil on the nozzle.

These and other objects will appear hereinafter.

Briefly, my invention consists of an oil burner having a combustion chamber into which oil and air are directed downwardly along the axis of the combustion chamber by means of a nozzle. The nozzle is surrounded by a water-backed shield, although the water backing can be eliminated under certain conditions, which extends within the combustion chamber for a short space past the nozzle. This shield and the sides of the combustion chamber support bustle plates which permit the products of combustion to rise up evenly on all sides of the combustion chamber and pass out through a flue without having the flame cross itself after returning from the lower part of the combustion chamber. The downwardly directed flame is met by an upwardly directed stream of air which spreads the flame laterally in all directions, the products of combustion then passing up the sides of the combustion chamber through the bustle and out to the flue. Air under pressure is introduced to an air box at the bottom of the chamber, the air box having a plurality of circular members or bustles for evening up the air as it passes through the air box. The air passes upwardly through the air box after passing through the bustles and out through a refractory nozzle. There is no swirl to the air although a swirl can be produced by changing the angle of guide vanes or fins in the bustle. The air merely passes upwardly with a free flow to meet the downwardly directed flame. This even free flow of air meets the downwardly directed flame to spread the flame as pointed out above. The bustle arrangement has no critical pressure at which it must be operated.

Referring to the drawing, Fig. 1 shows a cross section of an oil burner furnace employing my invention; Fig. 2 is a cross section taken on the line 2—2 of Fig. 1 showing the lower bustle arrangement; Fig. 3 is a cross section taken along the line 3—3 of Fig. 1 looking upwardly, showing the details of the upper bustle supported by the shield and the sides of the combustion chamber, and Fig. 4 is a pressure curve taken across the exit aperture of the air box. The curve (Fig. 4) shows the even distribution of the air pressure within the combustion chamber. It is of course understood that the shape of curve can be varied by changing the exit aperture of the air box or by changing the refractory nozzle on the air box or by changing the angle at which the vanes are placed on the bottom side of the air box cover 39 shown in Fig. 1.

Referring to the drawing, the oil burner furnace 10 is covered with an insulating material 11. Within the furnace 10 is mounted the combustion chamber 12 surrounded by water as indicated. Of course, it is understood that the combustion chamber 12 is suitably supported within the furnace 10. The system shown is a

hot water system, although my invention is equally applicable to other systems, the outlet 13 being shown at the top of the furnace and the return 14 at the bottom. Axially mounted above the combustion chamber is the oil burner nozzle and its associated apparatus 15 which directs a downwardly directed stream of oil and air 16 to supply the flame within the combustion chamber 12. Surrounding the nozzle 15 and extending within the combustion chamber is the water backed shield 17 which carries at its outer circumference and at the bottom thereof a ledge 18. Another ledge 19 carried by the side of the combustion chamber 12 supports the bustle plates 20, 21 and 22 as shown in Fig. 3. These bustle plates are provided with suitable outlet openings therethrough such as 23 and 24. These bustle plates together with the sides of combustion chamber form an exhaust chamber around the water backed shield which opens into the flue 26 which carries off the products of combustion. Although the burner can be operated without the bustle plates, improved operation results when said bustle plates are in position. It is of course, understood that the products of combustion could be passed through a secondary heat absorbing chamber having suitable means therein for absorbing heat from the products of combustion. Such an arrangement, however, is not shown although it is understood that the system which I propose could be readily adapted to such type of furnace. Air for combustion purposes is introduced by means of the duct 27 which divides into the two ducts 28 and 29, the duct 28 leading air under suitable pressure to the nozzle 15 but in insufficient quantities to complete combustion of the atomized oil. Suitable means, not shown, but which are understood by those familiar with the art, can be used for igniting the oil spray. The air which is led through the duct 29 to the air box 30 at the bottom of the combustion chamber serves the double function of spreading the downwardly directed flame and of furnishing auxiliary air for complete combustion of the flame. The air on entering the air box 30 circles the first cylindrical bustle 32 and passes through the openings 34 in the bustle before reaching the second circular bustle 33 provided with the openings 35. The openings 34 and 35 of the bustles 32 and 33 are offset or staggered with respect to each other. The purpose of this bustle arrangement is to even up the flow of air which is introduced into the air box by means of the duct 29. The air after passing through the second bustle passes upwardly through the opening 37 in a cover member 36 supported by the inner bustle member. This cover in turn supports a baffle member 38 which is supported by means of adjustable screws 38'. The air passes around this baffle, as shown by the arrows, and then passes upwardly through the opening 40 in the cover 39 to which the guiding vanes or fins 39' are attached, the cover being supported by the outer bustle. A refractory nozzle 42 is supported on this upper cover. The air flows out evenly and upwardly to meet the downwardly directed flame 16 and in doing so the two opposed streams cause the flame to be spread outwardly and laterally in all directions within the combustion chamber, thus producing a very symmetrical flame with respect to the axis of the nozzle which sprays the oil into the chamber and the nozzle which directs the secondary combustion air against this downwardly directed stream which furnishes the flame. The whole unit comprising an outer and an inner bustle can be lifted and removed from the air box 30. It is, of course, understood that the bustles need not be limited to two as indicated on the drawing but that a plurality of said bustles could be used to produce a more even flow of air from the nozzle 42. By means of the upper and lower bustle arrangement a very symmetrical flame can be produced with respect to the axis of the combustion chamber and cross currents of hot gases are entirely eliminated since the products of combustion pass up through the upper bustle around the shield 17 thereof instead of across the flame 16.

The curve indicated in Fig. 4 is the result of pressure measurements taken with a Pitot tube. With the air being given a slight swirl, pressure measurements were taken at different points on a straight line across the middle of the exit aperture of the air box. The dotted line in Fig. 4 represents atmospheric pressure; the portion of the curve above the dotted line represents pressures above atmospheric pressure; and the portion of the curve below the dotted line represents pressures below atmospheric pressure. The pressure was atmospheric at the edges of the aperture and increased above atmospheric in moving from either edge up to a certain point toward the center, but decreased from this point to sub-atmospheric at the center of the aperture. The curve shows the almost perfect and even distribution of the secondary combustion air which is introduced into the combustion chamber by means of the air box at the bottom of the combustion chamber.

The operation of my device is as follows: A spray of oil and air under pressure is downwardly directed into the combustion chamber 12 by means of the nozzle 15 and is ignited by suitable means (not shown) but which are well known to those familiar with the art. Primary air is introduced around the nozzle 15 through the ducts 27 and 28 to assist in combustion of the downwardly directed spray of oil. Secondary air for completing combustion of the oil passes down through the duct 29 and is evened up in passing through the bustles 32 and 33 and around the baffle 38 through the nozzle 42. The downwardly directed flame meets the upwardly directed even flow of air and spreads the flame out laterally in all directions as described above. The flame 16 after meeting with this upwardly directed stream of air passes upwardly along the sides of the combustion chamber 12. Due to the fact that the upper bustle plates have a series of outlet or exhaust openings arranged around the circumference thereof the hot gases may pass upwardly into the exhaust chamber 25 and out through the flue 26 without interfering with the downwardly directed flame 16. This, of course, prevents the cross currents of hot gases which have hitherto been present in this type of burner.

By means of my unique construction, a more even distribution of air is produced with respect to the axis of the combustion chamber. Air pockets are avoided and because the air box is not surrounded by the downwardly directed flame the air box is not exposed to high temperatures as before which makes it unnecessary to provide refractory material around the air box except for the nozzle. This permits the combustion chamber as well as the boiler to be much shortened and hence reduces the expense

of making the oil burner furnace. The unit comprising the bustles and refractory nozzle can be easily removed which makes for flexibility in the unit. The upper bustle arrangement results in a very symmetrical flame with respect to the axis of the burner which results in a more uniform temperature of the refractory and since no cross currents of hot gases exist the flame becomes more stable. The prevention of the cross currents and hot gases also prevents small particles of refractory from being forced into the wet oil upon the nozzle with its attendant objections.

The embodiment of the invention illustrated and described herein has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet the different conditions encountered in its use, and I, therefore, aim to cover by the appended claims all of the modifications within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An oil burner furnace provided with a combustion chamber and having an oil and air mixing nozzle for projecting a flame into said combustion chamber, and a bustle surrounding the nozzle for exhausting the products of combustion symmetrically around said nozzle, said bustle comprising a shield around said nozzle and extending into the combustion chamber below said nozzle and bustle plates supported by the end of said shield extending into said combustion chamber and by the walls of said combustion chamber, said plates being provided with apertures for the products of combustion.

2. An oil burner furnace provided with a combustion chamber and having a downwardly directed flame including means for projecting said flame downwardly into said combustion chamber and to spread said flame laterally and outwardly, and an exit bustle for leading off the products of combustion symmetrically with respect to said flame and around said first means to prevent cross drafts of hot gases from affecting the stability of said flame, said exit bustle comprising means extending into said combustion chamber around said flame projecting means, and plates provided with exhaust apertures for the products of combustion, said plates being supported by the means surrounding said nozzle and the walls of said combustion chamber.

3. An oil burner having a combustion chamber, means for directing a flame downwardly within said chamber, said flame being spread laterally and outwardly in all directions, a bustle concentric of said means having a plurality of exit passages around its circumference for leading off the products of combustion upwardly and around said first means to prevent cross drafts of hot exhaust gases from affecting the stability of said downwardly directed flame.

4. In an oil burner having a combustion chamber, means for directing an oil flame downwardly within said chamber, a shield extending partially within the combustion chamber around said directing means, bustle means surrounding the lower end of said shield and contacting with the sides of said combustion chamber, said bustle means including removable sections having exit openings therein for leading the exhaust gases upwardly and symmetrically around the outside of said shield thereby insuring an even, stable flame of symmetrical form with respect to the axis of said directing means.

5. An oil burner having a combustion chamber, means for directing a flame downwardly within said chamber, a bustle for exhausting the products of combustion comprising water backed means surrounding said first means and extending within said combustion chamber, exit means surrounding said water backed means and partially supported thereby for leading the products of combustion upwardly and symmetrically around the outside of said flame directing means and said water backed means, whereby said water backed means may absorb the maximum amount of heat from said products of combustion, and said flame may maintain a stable symmetrical form.

6. An oil burner having opposed air and oil streams for combustion, said oil stream furnishing a downwardly directed flame, and an air inlet device for providing an even flow of air free from turbulence in an upwardly direction for spreading the flame laterally in all directions, said device including a baffle means provided with staggered apertures for causing an even flow of air from said inlet device.

7. An oil burner having a flame directed therein and an opposed air inlet device including a plurality of concentric circular members of different diameters, a plurality of non-registering apertures in each of said members for causing an even flow of air from the interior of the innermost member and a cover member provided with a central aperture for permitting an even flow of air from said air inlet device.

8. An oil burner having a downwardly directed flame, a bustle for directing a stream of air upwardly for evenly spreading said flame laterally and outwardly in all directions, the products of combustion returning upwardly around said downwardly directed flame, said bustle including a cylindrical member provided with a plurality of inlet openings around its circumference, a second cylindrical member within said first cylindrical member and provided with inlet openings around its circumference staggered with respect to the inlet openings in said first cylindrical member, a cover for said cylindrical members provided with a centrally disposed opening therein for directing a stream of air upwardly, and means for leading air under pressure to the outside of said first cylindrical member, said air after passing through said bustle flowing freely and upwardly through said cover.

9. In an oil burner having a downwardly directed flame, a bustle for directing a stream of air upwardly against said flame to spread said flame laterally and outwardly in all directions, said bustle being removable and comprising concentric cylindrical members provided with inlet openings around the circumferences thereof, the openings in one of said members being staggered with respect to the openings in the other, spaced apart covers for said members provided with openings axially disposed for directing a stream of air upwardly, one of said covers being supported by one of said cylindrical members and another cover by another cylindrical member, one of said covers supporting a baffle plate intermediate the axial openings in said covers, air under pressure supplied to the outside of said cylindrical members leaving said bustle in an even flow from the axis of said bustle upwardly and outwardly in all directions.

10. An oil burner having a downwardly di-

rected flame, a bustle for directing an even concentrated flow of air upwardly to meet and spread the flame laterally and outwardly in all directions, returning said flame upwardly and symmetrically with respect to its axis, and bustle means arranged opposite and above said first bustle for exhausting the products of combustion in a symmetrical manner around said downwardly directed flame to thereby prevent cross drafts of hot gases from affecting the stability of the flame.

11. An oil burner furnace having a combustion chamber, means for projecting a stream of oil and air downwardly into said combustion chamber to produce a flame, means for directing an even concentrated flow of air upwardly to meet and spread said flame laterally and outwardly in all directions and for returning the products of combustion upwardly around said downwardly directed flame, said last means including a plurality of apertured concentric cylindrical members and having an outlet means for delivering an even concentrated flow of air against said flame.

12. An oil burner furnace having a combustion chamber, means for projecting a stream of oil and air into said combustion chamber for supplying a flame therein, means for directing an even concentrated stream of air against said flame and coaxially thereof to spread said flame laterally and outwardly in all directions and to assist in the complete combustion of said oil, said air directing means including concentric cylindrical members with openings therein, the air being introduced into said air directing means on the outside of the outer cylindrical member, and an outlet means for said air directing means for directing an even concentrated flow of air against said flame.

13. An oil burner having a combustion chamber, means axially disposed of said chamber for directing an oil flame therein, means for directing a stream of air in axial alignment with and against said flame for assisting combustion thereof and to spread the flame laterally and outwardly in all directions and exit means surrounding said first means for leading off the products of combustion symmetrically with respect to the axis of said flame whereby said flame is maintained substantially symmetrical with respect to its axis.

14. An oil burner having a combustion chamber, spray means for projecting a stream of oil and air into said chamber to produce a flame, a bustle comprising concentric cylindrical devices with openings therein and an outlet means for directing an even concentrated flow of air against said flame to meet and spread said flame laterally and outwardly in all directions, a bustle mounted adjacent said projecting means for exhausting the gases symmetrically with respect to said flame thereby preventing drafts of hot gases across said flame to affect the stability thereof.

15. An oil burner having a combustion chamber, means for directing a stream of oil and air for supplying a downwardly directed flame within said combustion chamber, a water backed shield surrounding said means and extending within said combustion chamber, a bustle at the bottom of said chamber, said bustle comprising a series of concentric cylindrical members having inlet openings in the circumference thereof and a cover means for said cylindrical members having an axial opening therein for directing a stream of air upwardly therefrom, means for directing air to the outside of said concentric cylindrical members, said air after passing through said bustle flowing evenly and upwardly to spread said downwardly directed flame laterally and outwardly in all directions, the products of combustion passing upwardly and evenly against the sides of said combustion chamber, and an exhaust bustle arranged around said water backed shield for leading the products of combustion upwardly and symmetrically around said shield thereby insuring an even stable flame in said combustion chamber.

16. An oil burner furnace having a combustion chamber, a nozzle for spraying oil and air downwardly into said combustion chamber for producing a flame therein, a bustle mounted in the bottom of said combustion chamber including concentric cylindrical members with openings therein, and having an outlet means placed axially of said cylindrical members whereby air introduced into said bustle at the outside of said cylindrical members will leave said outlet means in an even concentrated flow of air against said flame and spread said flame laterally and outwardly in all directions, and means at the top of said combustion chamber for exhausting the products of combustion from said combustion chamber.

17. A burner having a combustion chamber, a device for directing fuel into said combustion chamber centrally thereof for providing a flame therein, means for directing a flow of air oppositely and coaxially with respect to said flame for spreading the flame laterally in all directions, said air directing means including a baffle means provided with staggered apertures for causing an even flow of air from said air directing means.

18. A liquid fuel burner having a combustion chamber, a nozzle for spraying fuel downwardly into said combustion chamber, a device for supplying air around said downwardly directed spray in insufficient quantities to support complete combustion, an air box for directing a flow of air upwardly to meet said downwardly directed spray to mix therewith whereby complete combustion thereof is obtained, said air box including a baffle means provided with staggered apertures for causing an even flow of air from said air box.

19. A burner having a symmetrical combustion chamber, a fuel nozzle mounted on the top of said burner for providing a downwardly directed flame centrally of said combustion chamber, an air box supported in the bottom of said combustion chamber for directing a flow of air upwardly and coaxially with respect to said downwardly directed flame, and conduits for supplying air to said box and downwardly with the fuel from said nozzle to support incomplete combustion of the downwardly directed flame adjacent said nozzle, said upward flow of air being sufficient for complete combustion and for spreading said downwardly directed flame to the sides outwardly and in all directions, said air box including a baffle means provided with staggered openings for causing an even flow of air from said air box.

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