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F. J. M. RASKIN

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HYDROXYLATING FUEL BURNER

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2 Sheets-Sheet 2

Fig. 2.

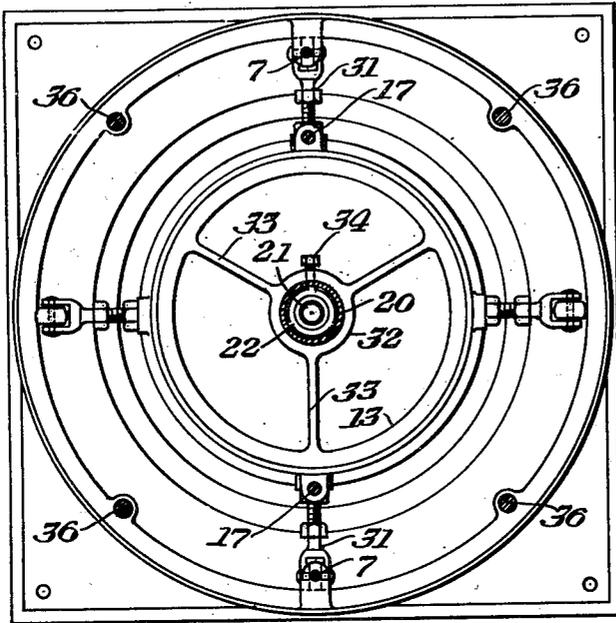
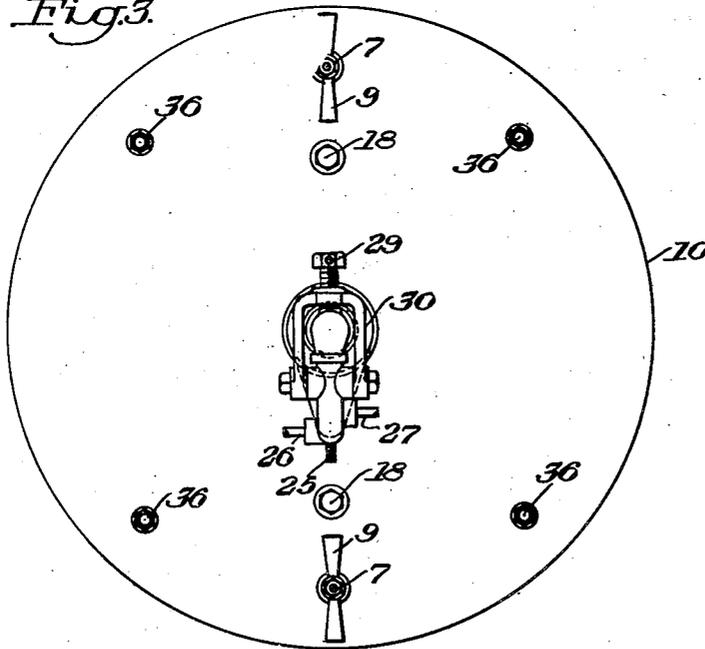


Fig. 3.



INVENTOR.
Franz J. M. Raskin.
BY
Richard E. Marine
His Attorney

UNITED STATES PATENT OFFICE

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HYDROXYLATING FUEL BURNER

Franz J. M. Raskin, Montreal, Quebec, Canada

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15 Claims. (Cl. 158—1.5)

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This invention relates to hydroxylating fuel burners for burning fluid fuels such as atomized oil, gas or pulverized coal. The purpose is to insure quick and intimate mixture of the air for combustion with the fluid fuel by means of an air register having (a) a minimum number of moving parts and operating adjustments, (b) air passages streamlined and proportioned to require minimum draft loss through the register at high capacities, and (c) subdivision of the air for combustion to provide most efficient application to the fuel stream to facilitate hydroxylation as hereafter set forth.

With these and other objects in view, the invention consists of novel details of construction and combination of parts more fully disclosed in the specification and drawings and pointed out in the claims.

Referring to the accompanying drawings forming a part of the specification, in which like numerals designate like parts in all the views, and which show, for purpose of exemplification but without limiting the scope of my invention or claims thereto, certain preferred embodiments of my invention:

Fig. 1 is a central longitudinal section through one form of burner adapted for burning oil; Fig. 2 is a section taken along the line 2—2 of Fig. 1; Fig. 3 is a face view of the burner; Fig. 4 shows a modification for burning pulverized coal; and Fig. 5 a modification for burning either gas or oil.

Referring to the accompanying drawings, 1 is a furnace; 2 is a refractory ring through which the flame enters the furnace; 3 is the wall of the furnace in which the burner is mounted; 4 is the main air burner body; 5 is a wind box attached to the furnace wall, through which all the air for combustion both primary and secondary enters the burner; and 6 is a sliding cylindrical air gate to admit air or close off its entrance to the burner, which is shown in open position. The air gate 6 is moved over main air burner body 4 by rods 7 sliding through bearings in the register front 10 and held in different positions by set screws 8 and having hand grips 9 at the outer ends. 11 is the opening or throat through which the burning gases enter the furnace 1; 12 is an auxiliary throat extending through the truncated cone-shaped portion of the combustion member 13 in which ignition of fresh fuel by heat from the burning fuel which precedes it, initial combustion and hydroxylation take place. The combustion member 13 forms a division between the air passing through the auxiliary throat 12 and the secondary air passing through the annular space 14; 15 is an inclined circular guide surface to direct the secondary air into the flame; 16 is a cylindrical gate controlling admission of air to throat 12 and sliding on member 13 and operated by screw adjustment 17, 18 which moves member 16 longitudinally. In the center of plate 10 is a cylindrical housing 19 in which is mounted

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a tube 20 in which the oil gun 21 is centered by spider 22, if oil is the fuel in use as in this particular application. Tube 20 is also used to move combustion member 13 longitudinally to regulate opening 14. The gun 21 has at its furnace end an atomizer 23 which may be for steam, air, mechanical or other means of atomization as desired. It is supported by a rod 24 mounted for in and out movement on tube 20 and secured by clamp screw 25. Oil is supplied through port 26 and atomizing steam, if used, by port 27. The gun may be conveniently dismounted for cleaning by breaking the pressure joint 28 after unclamping screw 29 and swinging yoke 30 outward and downward.

Member 13 is centrally spaced and slidably mounted in member 4 by supports 31. Central tube 20 is held in adjustable position in member 13 by collar 32, radial legs 33 and set screws 34. This member 20 is then used to move member 13 in main air burner body 4.

Bolts 36 are used to support plate 10 and hold it in fixed position relative to main air burner body 4.

Part 37 is a wall casting which can be either set in the furnace wall or attached to the boiler casing. On one side it carries the refractory throat 2 and on the other the main burner body 4 and serves to hold them in proper alignment. In some applications, part 2 may be omitted.

When the forced draft air supply is shut off by cylindrical air gate 6, plate 10 can be removed or pulled back to get access to the burner to make adjustment or repair.

If the furnace is equipped with more than one burner, the other burner or burners may be kept in operation while this operation is carried out.

While the foregoing description refers to air for combustion as supplied under pressure in wind box 5, the wind box may be omitted and the air drawn through the burner by chimney or induced draft. The oil atomizer and its attachments may be of any design throwing a finely atomized hollow cone of oil and the particular type shown is not an essential element in the invention.

Similarly, gas or pulverized coal may be introduced centrally by any standard device commonly used. For example, in the modification of Fig. 4, pulverized coal, fed into the pipe 38, is discharged at its ignition end 39. Similarly, in the modification of Fig. 5, natural or manufactured gas, fed in at 41, passes into the annular space 42 between the inner and outer walls of the pipe 40, and discharges through orifices 43. The inner space 44 is adapted to receive an oil atomizing gun 21, thus adapting the burner for operation on either oil or gas, or both.

The importance of the proper functioning of the air for combustion may be better realized by considering the oxygen therein as the principal fuel instead of the carbon in the oil, gas or coal since the air consumed weighs about sixteen

times as much, for instance, as the oil with which it unites. Moreover, while the oil supply, for example, is relatively fixed as a hollow cone spray discharges from a single central source, such as an orifice or circular group of orifices, the air may be supplied in an almost infinite number of velocities and directions relative to the oil spray and may be subdivided in various ways, some of the combinations being of necessity better than others. The present invention is directed to securing that arrangement of the air as to the number of passageways, their positions relative to each other and to the fuel supply, the effective direction of the air streams and their relative quantities as may be essential to securing the best operating results.

To effect these results, the following features are provided:

(1) The air for combustion on entering the burner through air gate 6 is divided between two air passages 12 and 14.

(2) This air enters the two passages 12 and 14 by continuous forward flow without reversal of direction.

(3) The primary air flowing to the auxiliary throat 12 is adjusted to obtain any desired percentage of the total air by longitudinal movement of air gate 16 backward or forward to enlarge or restrict the air passageway leading to auxiliary throat 12.

(4) This primary air is immediately brought in contact with and commences mixing with the oil spray 35 issuing from atomizer 23.

(5) By advancing or withdrawing the oil atomizer 23, the area of spray exposed to the incoming primary air stream before the resulting flame enters the auxiliary throat 12 may be increased or diminished. The distance of the nozzle from the outlet end of the primary air channel should preferably be approximately equal to the radius of a conical extension from the nozzle to approximately the outlet end of the inner channel, divided by the tangent of half the included angle of said extension, as clearly taught in Figs. 1, 4 and 5.

(6) The mixture of primary air and burning oil globules enter the auxiliary throat 12, which constitutes an initial combustion chamber in which hydroxylation of the oil takes place while the process is protected from the secondary air entering through passage 14.

(7) While the burning gases are passing through the auxiliary throat 12 there is a time element introduced to a predetermined extent and fixed by length of throat 12 which permits the chemical reaction to proceed to a desired stage. This desired stage is definitely reached by the time the burning mixture leaves the auxiliary throat 12, by the proper proportioning of the throat.

(8) The desired stage of gasification and initial combustion having been reached as the burning mixture leaves the auxiliary throat 12 the remaining quantity of air necessary to complete combustion is directed into the flame at exactly the proper angle by sloping element 15 to insure quick and intimate mixture of the supply of fresh air with the burning gases which have at this point reached the desired initial stage of combustion.

(9) Since various types of fuel such as gas, pulverized coal or oils atomized either by steam, by pressure only or by low or high pressure air will offer a varying amount of resistance to the air

penetration necessary to obtain the initial fuel and air mixture, the secondary air passage may be adjusted in order to overcome the resistance to air penetration by variation of the velocity of the air flow from passage 14 and thereby establish the desired distribution of the total air for combustion between the primary air through the auxiliary throat 12 and the secondary air through annular passage 14.

(10) The angle of impact of the secondary air from passage 14 on the flame 35 may be controlled by structural modification of the inclined entrance guide 15.

(11) The total air for combustion entering the burner may be varied by opening or closing sliding air gate 6 or by varying forced or induced draft fan speed or by changing furnace draft without altering ratio of primary and secondary air to each other.

(12) These changes in total air supply will not alter the direction in which either primary or secondary air are applied to the flame since there are no adjustable vanes used to give rotation to the air relative to the flame.

(13) Since the ignition and the partial combustion of the fuel are to an unusually large extent within the burner before leaving through the furnace throat 11, the resulting radiant heat is of great value in promoting combustion of the fuel and by preheating the air before it mixes with the fuel, and preparing the mixture of fuel and air for completion of combustion in the furnace without smoke and in the minimum time, both of great importance, particularly in marine and industrial boilers.

(14) Member 13 in which ignition and hydroxylation takes place is designed so that the secondary air flowing over its outside surface serves to prevent overheating of the member and also to control the temperature of the hydroxylating mixture so that it shall be held at that temperature which is best to obtain maximum stability of this reaction.

(15) Member 13 in which ignition and hydroxylation takes place gives off heat which is used to preheat the secondary air. This preheating of the secondary air is an important factor in obtaining best possible combustion of the fuels and also in decreasing the furnace volume required for completion of combustion.

(16) By changing the relative locations of the fuel sprayer, member 13 and member 4 the characteristics of the combustion can be varied so that either a long lazy flame, a short intense one or any intermediate one can be obtained to suit the particular heating requirements and furnace physical characteristics.

The term "fluid fuel" as used herein, is hereby defined as embracing any fuel having particles which easily move to change their relative position and which readily yield to pressure, such as atomized oil, gas or pulverized coal.

It will be understood that various changes may be made in the form, features, and arrangement of the several parts disclosed by way of exemplification without departing from the spirit and scope of my invention and that certain features may be used to advantage without a corresponding use of other features.

I therefore do not wish to be limited to the particular embodiments disclosed; but what I claim is:

1. In a fuel burner in combination: two longitudinally extending air supply channels, one

within the other; a longitudinally adjustable fluid fuel supply channel located within the innermost air supply channel, said innermost channel having at its inlet end an air controlling means for controlling solely the air supply to said inner channel and said fuel supply channel having at its discharge end a nozzle producing a cone-shaped fuel spray of a diameter within the inner supply channel less than and located in the rear of the discharge end of said channel, said nozzle located at a distance approximately equal to the radius of a conical extension from the nozzle to approximately the outlet end of the inner channel divided by the tangent of half the included angle of said extension to provide a hydroxylation chamber of sufficient length to allow time for the air from said innermost channel and the fuel from the fuel channel to mix and, when ignited, to cause hydroxylation of the fuel to take place within said chamber before the additional air from said outer air channel is applied to the previously ignited and hydroxylated fuel, to effect further combustion, and means at the outlet end of the innermost supply channel for controlling the velocity of the secondary air at the outlet end of said innermost channel.

2. The combination defined in claim 1 in which both air channels are parallel, coaxial and concentric and are directed to feed air parallel to their axes continuously toward their outlet orifices.

3. The combination defined in claim 2 in which the inner and outer air supply channels are longitudinally adjustable with respect to each other and in which guides are provided between the outlet ends of said channels to insure the coaxial and concentric relationship of said ends under all conditions of operation.

4. The combination defined in claim 1, in which means are provided for relative adjustment of the respective effective cross-sectional areas of said air channels to give the desired ratio of quantities and velocities of air supplied by said respective channels.

5. The combination defined in claim 1 in which means are provided for altering the total quantity of air entering the burner without changing materially the ratio of said two air supplies with respect to each other as to relative quantities and velocities.

6. The combination defined in claim 1, in which means are provided for altering the quantity of air entering the inner air supply channel independently of the quantity of air entering the outer air supply channel.

7. The combination defined in claim 1, in which means are provided for regulating the total quantity of air admitted to both air supply channels and means for regulating the ratio of the quantity of air admitted to said respective air supply channels.

8. The combination defined in claim 1, in which the fluid fuel supply channel is adjustable with respect to the inner air supply channel to protect the initial flame, during ignition and hydroxylation, from air issuing from the outer air supply channel under different conditions of operation.

9. The combination defined in claim 1, in which the outer air supply channel is located in heat-exchange relationship to the inner air supply channel, whereby a portion of the heat generated in the initial combustion reaction will be transferred to the air in said outer air supply channel, thereby preheating the same, and, at the same time, preventing overheating of the internal parts

directly exposed to the generated heat, and at the same time tempering the heat of the hydroxylating mixture.

10. The combination defined in claim 1, in which means are provided for longitudinally adjusting said fluid fuel supply channel with respect to the inner air supply channel, and for independently longitudinally adjusting both said channels, as a unit, with respect to the outer air supply channel.

11. The combination defined in claim 1, in which the inner coaxial air supply channel terminates in a flared out portion to permit spreading of the flame and the outer coaxial air supply channel is provided at its discharge end with a radially inwardly inclined deflecting portion having an outlet spaced in front of said flared out portion to direct the secondary air into the flame.

12. The combination defined in claim 1, in which an air duct is provided, into a side of which the open intake ends of the two coaxial air supply channels extend; and axially slidable air gates, one surrounding both of said channels and the other surrounding one of said channels, to admit regulatable quantities of air uniformly about their respective intake ends.

13. The combination defined by claim 1 in which the fluid fuel supply channel is an oil atomizer.

14. The combination defined by claim 1 in which the fluid fuel supply channel is provided with a discharge orifice for a combustible gas.

15. The combination defined by claim 1 in which the fluid fuel supply channel comprises a pipe having an open ended nozzle for the discharge of pulverized coal.

FRANZ J. M. RASKIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
45 641,368	Brunler	Jan. 16, 1900
1,129,791	Coen	Feb. 23, 1915
1,412,023	Erickson	Apr. 4, 1922
1,490,281	Leach	Apr. 15, 1924
1,495,859	McKean et al.	May 27, 1924
50 1,532,041	Couch	Mar. 31, 1925
1,566,177	Whitaker	Dec. 15, 1925
1,643,788	Seaver et al.	Sept. 27, 1927
1,721,879	Hazelhurst et al.	July 23, 1929
1,795,454	Van Brunt	Mar. 10, 1931
55 1,801,431	Irish	Apr. 21, 1931
1,910,893	Frisch	May 23, 1933
1,938,335	Hubbard et al.	Dec. 5, 1933
1,938,625	Engels	Dec. 12, 1933
2,047,570	Wiltshire	July 14, 1936
60 2,086,572	O'Brien	July 13, 1937
2,111,908	Andrews	Mar. 22, 1938
2,117,270	Bloom	May 17, 1938
2,167,183	Naab et al.	July 25, 1939
2,206,553	Nagel	July 2, 1940
65 2,269,333	Bloom	Jan. 6, 1942
2,320,575	Dunn	June 1, 1943
2,325,444	Vroom et al.	July 27, 1943

FOREIGN PATENTS

Number	Country	Date
70 291,908	Great Britain	June 14, 1928
655,055	Germany	Oct. 12, 1938
698,697	France	Nov. 28, 1930