April 16, 1946. I. LUBBOCK ET AL 2,398,654

COMBUSTION BURNER

Filed June 30, 1941

Fig. 1.

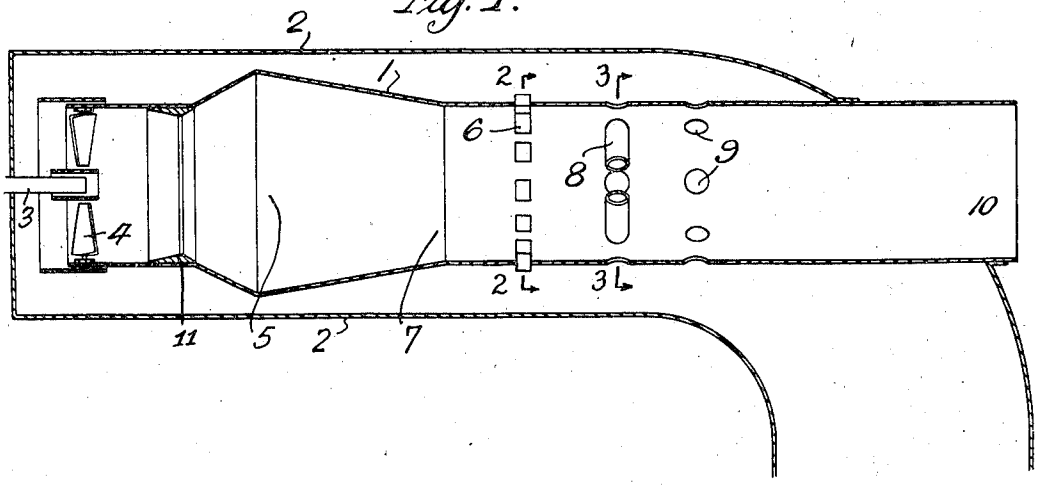


Fig. 2.

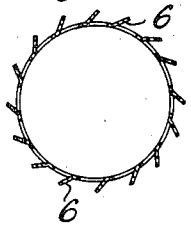
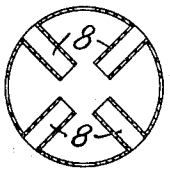


Fig. 3.



Inventors: Isaac Lubbock
Frederick James Battershill

By their Attorney: _____

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UNITED STATES PATENT OFFICE

REISSUED

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COMBUSTION BURNER

Isaac Lubbock and Frederick James Battershill, Great St. Helen's, London, England, assignors to The Anglo-Saxon Petroleum Company Limited, London, England, a company of Great Britain

Application June 30, 1941, Serial No. 400,548
In Great Britain January 24, 1940

3 Claims. (Cl. 60—44)

This invention relates to an improved process and apparatus for the continuous generation of gases by reaction between air and liquid or pulverulent combustible material. The object of the invention is to provide a more effective means whereby large quantities of the combustible material can be burnt in a zone of comparatively small volume under continuous conditions such as may be required for combustion turbines or for other gas utilising appliances. Thus the invention has in view rates of combustion which may exceed about one hundred pounds of, say, fuel oil per hour per cubic foot of combustion space.

In accordance with the invention the combustible material in liquid or pulverulent form, is sprayed into a chamber and in the course of passage therethrough to an offtake for the gaseous reaction products it is first caused to undergo preliminary thermal decomposition, which may be described as pre-oxidation, with a comparatively small quantity of air whereupon it is caused to encounter, or be enveloped in or drawn into a vortex of main primary air which, generally speaking, is moving backwards, i. e. in the opposite direction to the flow of the primary reaction products so that combustion is then substantially effected in a burning zone proper between where the primary air is admitted into the chamber and the place of spraying in the combustible material.

Preferably the secondary air with which the sprayed combustible material initially reacts is introduced at or near the spray nozzle or atomizer in a swirling state produced by any usual arrangement of inclined vanes or tangential admission ports. The chamber space may be somewhat enlarged at or about the zone where the primary reaction occurs.

The primary air may be definitely introduced through a ring of ports provided with swirling vanes to form a strong vortex within the chamber, the axis of this vortex being coincident with the axis of the chamber, and the ring of ports being disposed at a substantial distance from the end of the chamber where the conbustible material is sprayed in. The axial position of this ring of admission ports for the primary air requires fairly close determination, having regard to the various conditions obtaining, in order to secure the most satisfactory operation. It has been ascertained in an experiment that the distance of the ring of ports from the sprayer or atomizer should be somewhere about twice the greatest diameter of the chamber.

It will be understood that it is within this chamber space between the primary air admission ports and the sprayer that the intermediate and final stages of combustion take place. If the admission ports are too close to the sprayer the fuel particles will be splashed about onto hot surfaces and there will be an insufficient space available to effect the preliminary decomposition of the combustible material which reaches the burning zone proper which is further downstream.

In accordance with another feature of the invention additional air may be admitted to intermix with the reaction products after they have passed from the combustion zone. This additional air will be introduced in such manner that it will be entrained substantially into the centre core of the stream of reaction products where the temperature is usually highest. In order to secure this result it is preferred to admit this further air through tubes spaced around the circumference of the chamber and radially disposed with their outlets close to the centre of the chamber.

In the preferred arrangement, the air required for the primary and secondary supplies and for the subsequent dilution is admitted under pressure into a space between the combustion chamber and an outer co-axial cylinder. However, individual air boxes may be provided if desired in order to supply each section.

It has been ascertained that by the process of the invention, involving a progressive form of combustion through intermediate stages of pre-oxidation, the issuing gases are devoid of unburnt or partially burnt substances and that they have the characteristic sweet odour associated with hydroxylation.

The accompanying drawing shows diagrammatically the preferred embodiment of the invention, Figure 1 being a longitudinal sectional elevation of the apparatus, Figure 2 a section on the line 2—2 of Figure 1, and Figure 3 a section on the line 3—3 of Figure 1.

Referring to the drawing, 1 indicates the combustion chamber casing and 2 the cylindrical casing of an air supply duct in which the casing 1 is co-axially mounted. Combustible material in liquid or pulverulent form is introduced into the chamber through the atomiser 3. The secondary air, taken under pressure, from the air supply duct, is admitted into the chamber through a swirler 4.

The primary reaction (pre-combustion) between the combustible material and the secondary air occurs in the enlarged zone indicated at

5. A jet 11, is provided between the enlarged zone 5 and fuel atomizer 3 as shown.

Primary air from the air supply duct is admitted into the chamber through the swirler 6 whereby the air is formed into a vortex which, moving backwards, i. e. from right to left in the drawing, envelops the reaction products coming from the primary reaction zone 5 and brings about their combustion in the zone indicated at 7.

The stream of reaction products from the combustion zone passing forwards through the chamber, is diluted by entraining into its core additional air admitted through the radially disposed tubes 8. Further diluting air is admitted through the holes 9, after which the gases pass to the outlet 10.

What we claim is:

1. A fuel combustion apparatus comprising an elongated combustion chamber, said chamber comprising from one end to the other, a mixing zone, a jet, an enlarged pre-combustion zone, a combustion zone, a dilution zone and a discharge outlet; an air supply means surrounding said chamber; a fuel nozzle and secondary air supply means at the end of said chamber adjacent said mixing zone; a primary air supply swirler around said combustion zone for introducing primary air into said combustion zone; and dilution air ducts projecting radially into said dilution zone and terminating adjacent its center.

2. The apparatus of claim 1 wherein the distance between said fuel nozzle and said primary air swirler is equal approximately to twice the greatest diameter of said pre-combustion zone of said chamber.

3. A fuel combustion apparatus comprising an elongated combustion chamber, said chamber comprising from one end to the other, a mixing zone, a jet, an enlarged pre-combustion zone, a combustion zone, a dilution zone and a discharge outlet; an air supply means surrounding said chamber; means to supply air to said chamber under pressure; a fuel nozzle and secondary air supply means at the end of said chamber adjacent said mixing zone; a primary air supply swirler around said combustion zone for introducing primary air into said combustion zone; and dilution air ducts projecting radially into said dilution zone and terminating adjacent its center.

ISAAC LUBBOCK.
FREDERICK JAMES BATTERSHILL.