

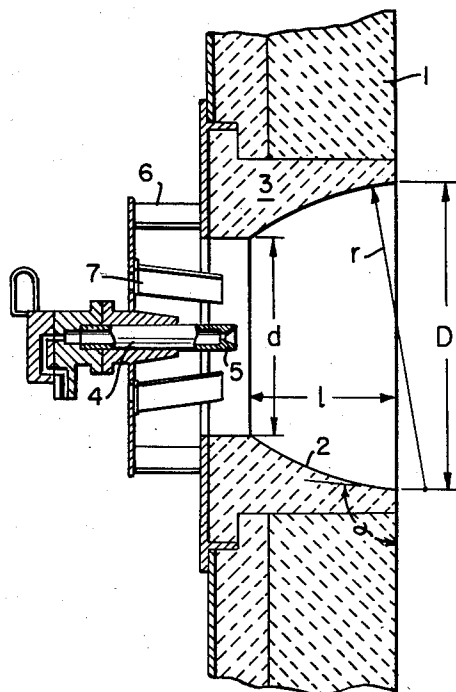
Dec. 1, 1964

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3,159,200

LIQUID FUEL BURNER

Filed Jan. 30, 1962



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3,159,200

LIQUID FUEL BURNER

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Filed Jan. 30, 1962, Ser. No. 169,787

Claims priority, application Belgium, Feb. 13, 1961,

477,481, Patent 600,137

1 Claim. (Cl. 158—1)

The invention relates to a combustor for liquid and/or gaseous fuels to be applied, for example, in a boiler or in an industrial furnace to heat liquids like petroleum or petroleum fractions.

In accordance with a widely used construction such combustors consist of a burner placed centrally in an opening in the wall of the combustion space, so that concentrically around the burner an annular space is provided for admission of the combustion air.

The opening in the wall of the combustion space is in its simplest form cylindrical, delimited by the two sides of the furnace front and a cylindrical cavity in the brick wall. In this case, the burner is placed in the axis of the cylinder. A cone-shaped cavity in the brick wall is another possibility. Such constructions have been described, for example, in British Patent 447,624 and in French Patent 961,605.

It has now appeared that shape and dimensions of the cavity in question are of fundamental importance for the combustion pattern and especially for the shape and the stability of the flame. In the constructions as applied up to now, at certain loads a strong spreading of the flame invariably occurred, which caused this flame to touch the furnace front and also the tubes built in the front. This had an adverse effect on the life of the furnace wall, while also local overheating of the tubes situated near the furnace front sometimes caused serious difficulties.

It was now found that these problems do not occur when the burner is placed in a bowl-shaped recess of special dimensions. The invention therefore relates to a combustion device for liquid and/or gaseous fuels, consisting of a burner placed centrally in a bowl-shaped recess in the wall of a combustion space, an annular opening for the combustion air being provided coaxially between the burner and the edge of the recess, the shape of the recess being such that the following conditions are satisfied:

(a) The ratio between the smallest diameter and the largest diameter of the recess (d/D) is between 0.58 and 0.72.

(b) The ratio of the length to the largest diameter of the recess (l/D) is between 0.45 and 0.55.

(c) The angle (α) formed by the wall of the bowl-shaped recess and the surrounding wall of the combustion space where it enters the combustion space is between 95 and 100°.

By applying this construction the shape of the flame can be completely controlled and, particularly, the flame can be prevented from spreading. The flame obtained with this construction is slender and compact, so that contact between the flame and the furnace front and front tubes is prevented, and longer life of the materials is obtained.

The recess should be bowl-shaped, the concave side be-

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ing turned towards the combustion space. The generating line of the recess is preferably in the form of an arc of a circle, the ratio between the radius of this arc and the largest diameter of the recess (r/D) being between 0.70 and 1.50. The generating line can also have another shape, for example, that of a parabola.

If the burner is used for burning liquid fuel like residual fuel oil, it is provided with an atomizer for the fuel. Conventional pressure jet burners are particularly suitable, but steam jet burners may also be employed.

Burners suitable for burning both liquid and gaseous fuels can also be used. A suitable construction for this type of burner is described in British Patent 755,389.

The air necessary for combustion enters the combustion space via an annulus between the burner and the wall of the recess. To control the amount of combustion air, an air register fitted on the outside against the furnace front is generally used. A very suitable construction for an air register to be used for the construction according to the invention is described in U.S. Patent 2,515,843. In this construction part of the combustion air is caused to rotate by means of a plurality of annularly placed blades and led into the combustion space via the circumference of the recess, while another part of the air, caused to rotate in the opposite direction by another set of blades, is directed into the combustion space immediately around the burner.

The construction according to the invention will now be described in more detail with reference to the accompanying drawing.

In this drawing, 1 represents the wall of the combustion space, such as the furnace of a steam boiler or of an industrial furnace, for heating for example petroleum or petroleum fractions. This wall has a bowl-shaped recess 2 which, because of the excessive thermal load, is preferably made of a heat-resistant material 3 like sillimanite.

In the bowl-shaped recess, a burner 4 for liquid or gaseous fuel is fitted concentrically. If the combustor is used for burning liquid fuels, like residual oils or bitumen, this burner is provided with an atomizer 5, for example, a pressure jet atomizer of known construction.

The air necessary for the combustion is fed via air register 6, also of known construction. The air entering at 6 is preferably brought to rotation by means of a plurality of blades, which promotes the mixing of the air and the fuel and thereby also the stability of the flame formed in the recess. Usually part of the combustion air is fed to the combustion space via the inlets 7 which are annularly placed around burner 4, rotating in a direction opposite to that of the air entering at 6.

The shape of the recess is determined by the largest diameter D at the entrance into the combustion space, the smallest diameter d , the length l and the angle α formed by the wall of the recess at the entrance into the combustion space and the surrounding wall of this combustion space.

For the construction given in the figure:

- (a) The ratio $d/D=0.65$
- (b) The ratio $l/D=0.48$
- (c) The angle $\alpha=97^\circ$
- (d) The ratio $r/D=1.00$

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We claim as our invention:

A combustion device for liquid and/or gaseous fuels, comprising a burner placed centrally and rearwardly in a recess in the wall of a combustion space, an annular opening for the combustion air being provided in the wall of the combustion space coaxially between the burner and the edge of the recess, characterized in that the recess is bowl-shaped and that the largest diameter thereof opens into the combustion space and the smallest diameter thereof is remote from said space, the following conditions being satisfied:

- (a) the ratio between the smallest diameter and the largest diameter of the recess (d/D) is between 0.58 and 0.72;
- (b) the ratio of the length between the two said diameters to the largest diameter of the recess (l/D) is between 0.45 and 0.55;

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- (c) the angle (α) formed by the wall of the bowl-shaped recess and the surrounding wall of the combustion space at the entrance to the combustion space is between 95° and 100° ; and
- (d) the generating line of the bowl-shaped recess is the arc of a circle, the ratio of the radius of this arc to the largest diameter of the recess (r/D) being between 0.70 and 1.50.

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