

[54] COMBUSTION HEADS FOR BURNERS

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[58] Field of Search 431/116, 351, 352, 354

[56] References Cited

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[57] ABSTRACT

This invention provides a combustion head for burners of the kind in which primary air is supplied to a combustion zone through a supply pipe which coaxially surrounds a fuel supply pipe, the latter terminating in a spray nozzle surrounded by a cup. An ejector device of the annular or deflected jet type is associated with the primary air supply pipe and is energised by the primary air to cause a low pressure externally of the cup so as to draw into the head a portion of the burnt gases from the burner so that these burnt gases are recirculated in a zone adjacent the reaction zone to dilute the reagents and promote complete combustion.

1 Claim, 2 Drawing Figures

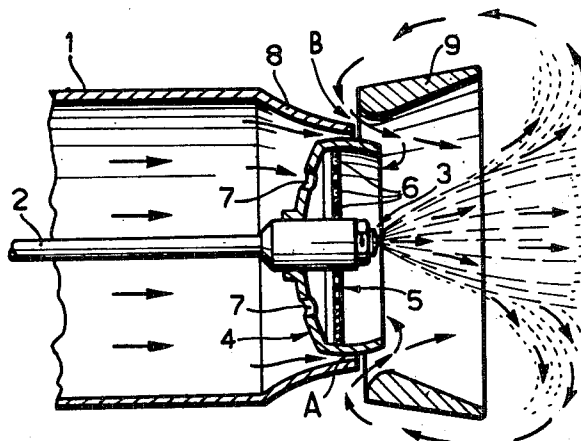


Fig. 1

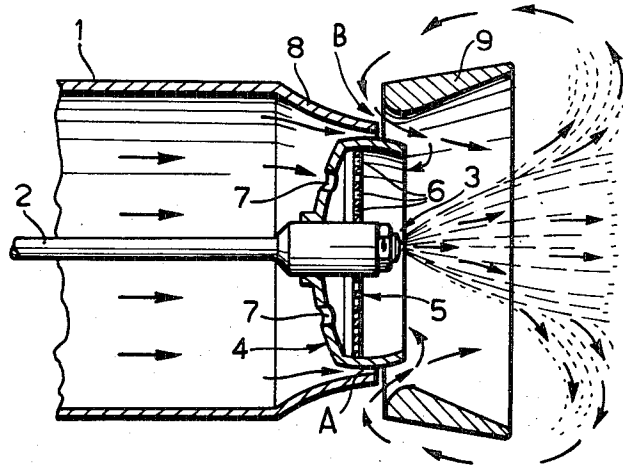
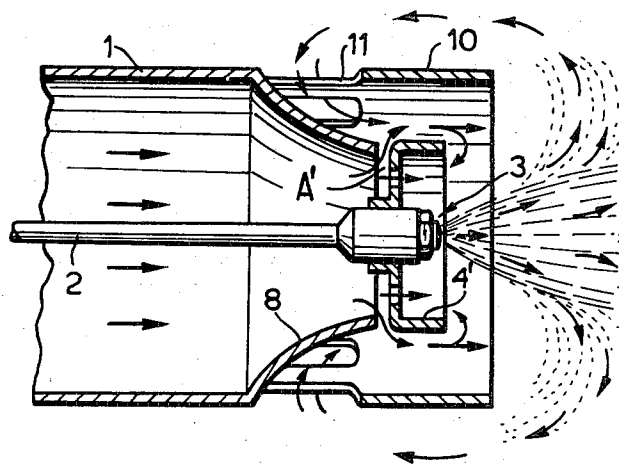


Fig. 2



COMBUSTION HEADS FOR BURNERS

BACKGROUND AND OBJECTS OF THE INVENTION

This invention concerns combustion heads for burners, especially burners for fluid fuels.

As is known, flame luminosity in combustion is produced by soot or micro-soot, made up of molecular groups of carbon or agglomerates of such groups. Micro-soot is formed mostly by cracking of the particles of fuel when these are subjected to very rapid heating in the flame. In order to avoid the formation of soot or micro-soot and to provide a smokeless flame rapid heating of the fuel particles must therefore be avoided.

One possible means of achieving smokeless combustion consists of diluting the reagents so as to slow down the combustion process. In fact the degree of smoke of a flame can be reduced or eliminated by suitably increasing the ratio of air to fuel; however, if this is overdone, the combustion yield is reduced.

Another technique, to which this invention especially refers, consists of recirculating some of the products of combustion, achieved by returning a portion of the combustion products to the reaction zone. Burners which have in the past used this technique have relied upon gasification of the fuel: this has necessitated the use of special fuel chambers with spill pipes or channels, gasification pre-combustion chambers, shaped baffles placed in front of the flame, specially made turbulence-producing burner nozzles, and other devices of complex and expensive construction, which in practice all have their respective limitations, either in length of effective life, or in the flexibility of use of the burner.

An object of this invention is to avoid the aforesaid disadvantages by providing a combustion head for burners which will allow re-circulation of a portion of the products of combustion to the vicinity of the flame so as to obtain a smokeless flame of high efficiency by means which are simple, and easy to adjust.

Another object of preferred embodiments of the invention is to provide a combustion head of the aforesaid type, by which it is possible to have a stable flame of low luminosity and low noise level.

SUMMARY OF THE INVENTION

According to the invention there is provided a combustion head for burners comprising in combination a supply pipe for primary air coaxially surrounding a fuel supply pipe which terminates in a spray nozzle, a cup surrounding the spray nozzle, an ejector device coaxial with the spray nozzle and adapted to be energised by primary air from said primary air supply pipe to induce a low pressure externally of the cup to induce recirculation of a portion of the burnt gases from the burner to a zone adjacent the combustion reaction zone, causing dilution of the reagents and promoting complete combustion.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristic features and advantages of the invention will emerge in the course of the following detailed description, given by way of non-limiting example, with reference to the attached drawings, in which:

FIG. 1 is a diagrammatic axial section of a combustion head for burners according to one embodiment of the invention, and

FIG. 2 is a diagrammatic axial section of a combustion head according to another embodiment of the invention.

Corresponding component parts in the two embodiments of FIGS. 1 and 2 are denoted by the same reference numerals.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring to FIG. 1, reference numeral 1 indicates a supply pipe for primary air, coaxially surrounding a fuel supply pipe 2 which terminates in a spray nozzle 3 surrounded by a cup 4.

The bottom wall of the cup 4 within the pipe 1 has a number of holes 7 adapted to allow the passage of a portion of the primary combustion air from the pipe 1 into the cup 4 and through a number of perforations 6 in a disc 5 placed transversely in the cup 4.

The air supply pipe 1 has a tapered end portion 8, the end of which coaxially surrounds the cup 4 to define therewith an annular opening A through which part of the primary combustion air passes. Downstream of the opening A there is placed an annular shroud element 9 with an inner rounded annular edge spaced from the end of the tapered portion 8 of the pipe 1. The shroud element 9 forms with the other parts of the combustion head an ejector device of the annular type adapted to be energised by the primary air escaping through the aperture A, so as to induce aspiration of air through an annular aperture B defined between the shroud element 9 and the tapered end portion 8 of the pipe 1. The low pressure which results in the region of the aperture B externally of the shroud element 9 causes some of the burnt gases to be drawn through the aperture 9 and into the vicinity of the reaction zone, so that a re-circulatory flow of a portion of the burnt gases is induced, as shown by the arrows in FIG. 1.

Some of the aspirated air mixed with burnt gases impinges on the edge of the cup 4 and is deflected into the cup 4, as shown, stabilising the flame which is formed, as in conventional burners. This negative flow of air and burnt fuel, that is, flow directed upstream, could contain some of the particles of atomised or pulverised fuel from the nozzle 3 and cause them to impinge on the disc 5, incrusting it. The provision of the perforations 6 in the disc 5, and the holes 7 in the bottom wall of the cup 4 counteracts this tendency by ensuring a positive air flow through the cup 4.

The resulting flame is for practical purposes smokeless even when the amount of air supplied is practically stoichiometric, the flame being cup-shaped, and blue in colour, with possibly a few yellow flashes at its base. The flame is reasonably silent.

A further improvement in the recirculation of the burnt gases can be achieved by exploiting the Coanda effect to achieve deflection of the gas streams. A suitable combustion head for this purpose is shown in FIG. 2, in which the ejector device is formed by the addition of a tubular extension 10 to the air supply pipe 1. The tubular extension 10 forms, with the tapered end portion 8 of the said pipe 1, an annular duct which communicates with the surrounding air by way of a set of circumferentially spaced apart apertures 11 through which a portion of the burnt gases flow, with air, as in-

indicated by the arrows. In place of the apertures 11 a single annular aperture may be provided. The tapered portion 8 of the air supply pipe 1 terminates near to the cup 4', forming with the latter an annular aperture A' through which there passes a regulated portion of the primary air to form a deflected jet ejector device. In this case the gaseous stream which flows over the outer surface of the cup 4' has a tendency to adhere to this surface by virtue of the Coanda effect, causing some of this gaseous stream to be deflected in an upstream direction at the edge of the cup 4', as shown, to increase the stability of the flame.

It will be appreciated that practical details of embodiments of the invention can be widely varied from the embodiments which have been described and illustrated. For example, the construction of the combustion head could readily be adapted for obtaining flames of different shape and colour.

What is claimed is:

1. A burner comprising a primary air supply pipe, a fuel supply pipe extending coaxially within said air supply pipe, a spray nozzle secured to the end of said fuel supply pipe, a cup secured to and surrounding said spray nozzle, said cup having a plurality of apertures in the bottom thereof for the regulated flow of air from said air supply pipe to said spray nozzle, said air supply pipe terminating in spaced-apart adjacent relation to said cup to provide an annular passage for the regulated flow of air over the outer surface of said cup, and an ejector ring device spaced from the external surface of said air supply pipe and said cup, said ejector ring means defining with said air supply pipe an annular aperture through which recirculating burnt gases are drawn by the passage of primary air through said annular passage between said air supply pipe and said cup.

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