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Vits

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[54] **COMPACT BURNER FOR DRYERS**

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[51] **Int. Cl.²** **F23Q 9/00**

[58] **Field of Search** 431/284, 285, 353, 174, 431/187, 188; 239/424.5

[56] **References Cited**

UNITED STATES PATENTS

3,164,200 1/1965 Reed 431/284

3,545,903 12/1970 McCullough 431/353

FOREIGN PATENTS OR APPLICATIONS

1,278,661 12/1960 France

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[57] **ABSTRACT**

A compact burner which is particularly suitable for dryers is disclosed. The burner includes separate gas-burner and combustion-air chambers. At least two combustion-air outlets and at least one fuel gas outlet comprise an individual unit, the outlets being arranged so that the exiting fuel gas jet is mixed with the sequential air jets.

7 Claims, 4 Drawing Figures

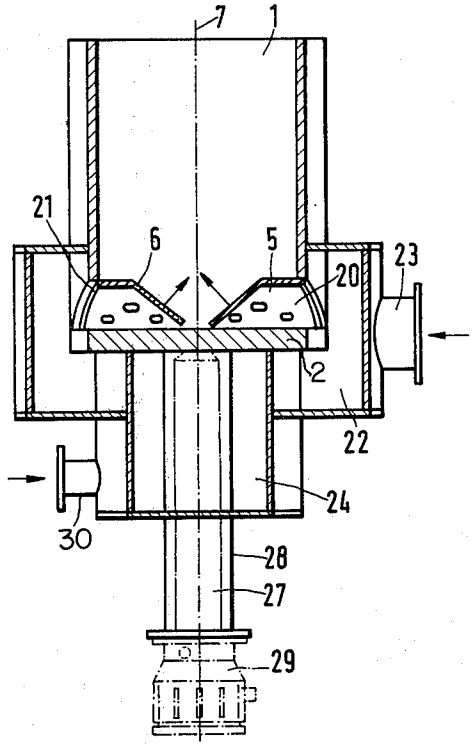


Fig.1

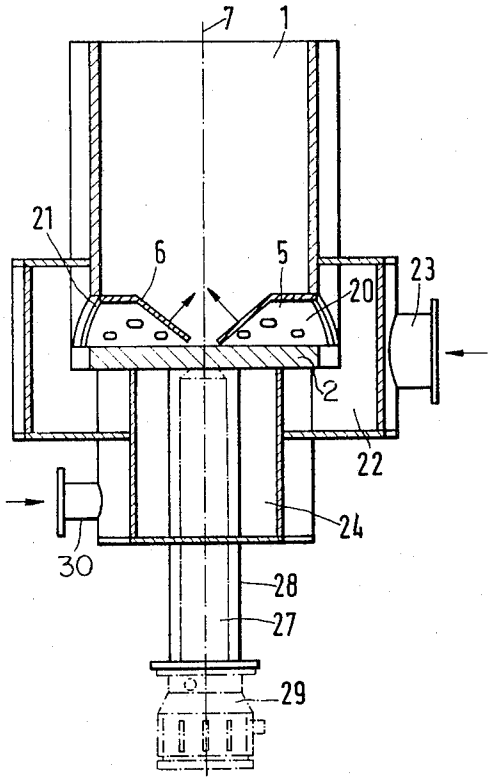


Fig.3

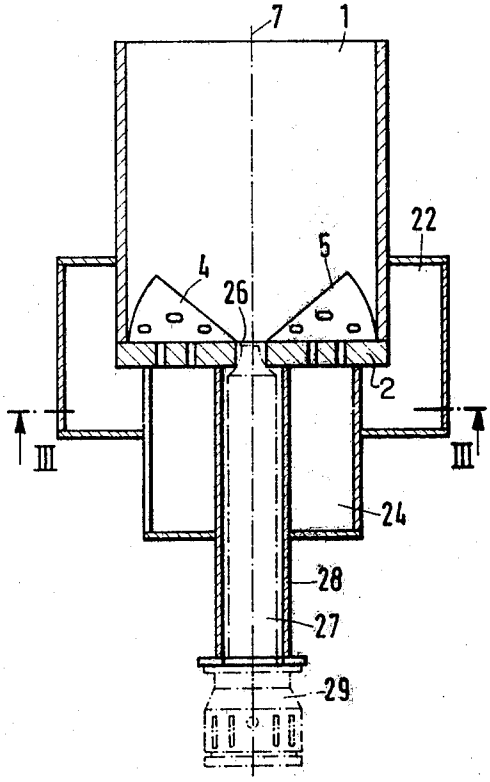


Fig.2

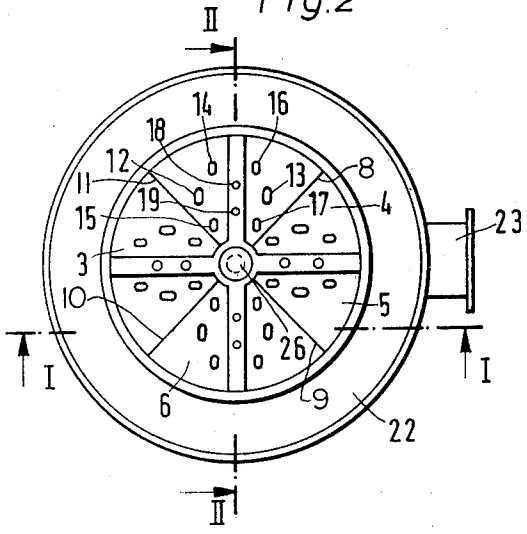
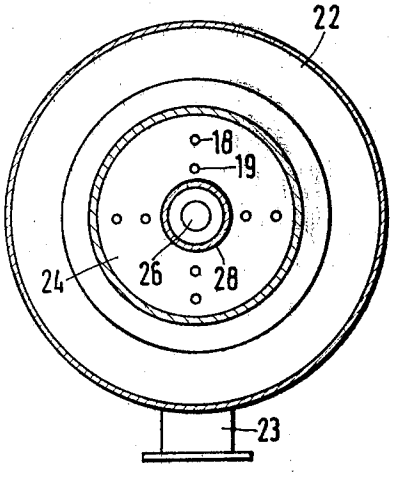


Fig.4



COMPACT BURNER FOR DRYERS

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention is concerned with a compact burner, especially for dryers, having separate gas-burner and combustion-air chambers, and a mixing area which is open in the direction of the burn-jet. A plurality of outlets are distributed around the central burner axis into which the fuel-gas and combustion-air channels terminate, this axis being provided with an opening for a pilot-burner.

Compact burners to be utilized in dryers for continuously conveyed material such as, for example, paper, are required to provide a high performance (several 100.000 kcal/h), to be quickly regulatable over a wide range, and to have a high ignition potential as well as a highly stable flame, so that optimal burning of the fuel-gas/combustion-air mixture can take place, without being affected by the turbulence which exists in the dryer.

It is the purpose of the present invention to provide a compact burner of the above mentioned type which, while of a simple construction, fulfills these requirements. Such a burner is provided by the present invention, in which always at least two of the combustion-air outlets and always at least one of the fuel-gas outlets form one unit, with the further feature that the axes of the combustion-air outlets of each unit cross each other in the mixing area, while the axes of the fuel-gas outlet of the same unit are positioned in the mutual mirror plane of the axes of the two combustion-air outlets in such a way that the exciting fuel-gas jet mixes with the sequential combustion-air jets.

In the present compact burner, the combustion-air jets meet each other diagonally and mix turbulently in the area of the mutual mirror plane with the fuel-gas jet. This causes an intensive mixing of the fuel-gases with the combustion-air in the immediate proximity of the outlets of smaller as well as larger burner operations, without danger that the flame will lash back or become turbulent. A switch-over from the smallest burner operation to the maximum burner performance is possible within only fractions of a second, without the possibility that thereby unburned fuel gases will flow into the dryer and thereby form an explosive mixture. Since the combustion-air jets meet sequentially, their flow-current components discontinue in tangential direction, so that the fuel-gas/combustion-air mixture exits from the mixing area without drift components and burns with a larger, thinner flame.

In a preferred embodiment, one unit of combustion-air outlets has two fuel-gas outlets which are arranged at both sides of the plane spanned by the axes of the combustion-air outlets. In such an arrangement, the lateral fuel-gas jets communicate with the outer planes of the air-jets which are pointed towards each other.

A preferred arrangement of the combustion-air outlets and the fuel gas outlets, so far as construction is concerned, is that in which the combustion-air outlets are provided in the inclined sides of wedge-shaped hollow bodies, each hollow body having an apex which extends radially to the burner axis. For the purpose of the earliest possible ignition of the fuel-gas/combustion-air mixture by means of the pilot burner, the apexes of the hollow bodies are suitably inclined towards the burner axis and counter to the direction of the jet of the burner.

The hollow bodies may be arranged as attachment pieces on a plate, thus closing off the rear side of the mixing area. The fuel-gas outlets may be provided in the plate.

In using hollow bodies, the combustion-air supply can be obtained in a simple manner whereby the areas of the hollow bodies are in communication with a combustion-air chamber which surrounds the mixing area by means of openings in the wall of the mixing area. A simple fuel-gas supply to the fuel-gas outlets can be realized in that a fuel-gas chamber is provided below the plate, whereby the fuel-gas outlets are in communication with the fuel-gas chamber.

In order to be able to ignite units of the fuel-gas and combustion-air outlets simultaneously, there is preferably provided a bore hole in the center of the plate serving as an opening for the pilot burner.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is more fully explained in the detailed description which follows, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 shows a longitudinal cross-sectional view of the compact burner of the present invention, taken along line I—I of FIG. 2;

FIG. 2 shows an elevational view of the compact burner according to FIG. 1;

FIG. 3 shows an axial cross-sectional view of the compact burner of FIG. 1, taken along Line II—II of FIG. 2; and

FIG. 4 shows a cross-sectional view of the compact burner of FIG. 1, taken along Line III—III of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS. 1 through 4, the compact burner of the present invention is, in general, of symmetrical construction of heat-resistant material, provided with a cylindrical mixing space 1 which is closed off at one end by means of a plate 2. Four wedge-shaped hollow bodies 3, 4, 5, 6 are arranged so as to surround the central axis of the compact burner on the side of the plate 2 which faces the mixing space 1. The apexes 8, 9, 10, 11 of said wedge-shaped hollow bodies are arranged cross-wise and inclined to the central axis 7 of the compact burner and to the plate 2. At the sides of each hollow body 3, 4, 5, 6, there are provided one each of the larger combustion-air outlets 12, 13 and two smaller combustion-air outlets 14, 15, 16, 17 laterally adjacent the larger outlet 12 and somewhat lower than the larger outlet 12. Two radially positioned fuel-gas outlets 18, 19 are provided in the plate 2 between each two adjacent hollow bodies 3, 4, 5, 6. The combustion-air outlets 12, 13, 14, 15, 16, 17 which are provided in the sides facing each other, of two adjacent hollow bodies, for example, 3, 4, together with the intermediary fuel-gas outlets 18, 19, form one unit.

The oppositely positioned combustion air outlets 12, 13, 14, 15, 16, 17 of each adjacent hollow bodies 3, 4, 5, 6 are arranged so as to be mirror-symmetrical to an axial plane, always located between the adjacent hollow bodies 3, 4, 5, 6 and passing through the central axis 7. The axes of each of the opposite combustion air outlets 12, 13, 14, 15, 16, 17 cross in the mixing space of the mirror-plane. The axes of the fuel-gas outlets 18,

19 are located in the mirror-plane and between the planes which are determined by the axes of the oppositely positioned combustion-air outlets **12, 13, 14, 15,** 16, 17. Each space of the hollow bodies **3, 4, 5, 6** is connected with a combustion-air chamber **22** which surrounds the mixing space **1,** by means of an opening **20, 21** in the wall of the mixing space **1.** The combustion air chamber **22** is provided with an air-intake **23.**

A fuel-gas chamber **24** having a gas intake **30** is provided below the plate **2.** The fuel-gas chamber **24** is connected with the fuel-gas outlets **18, 19.** A bore hole **26** is provided in the center of the plate **2** for receiving a pilot burner **29,** indicated by a dotted line. A tube-shaped area **27,** for mixing the fuel-gases with the air, is surrounded by a pipe **28** which leads through the fuel-gas chamber, and is tightly connected to the outside of plate **2.**

Based on the special arrangement of the fuel-gas outlets and the combustion-air outlets, the burner of the present invention burns within a widely adjustable range with a very stable flame. Flash-backs of the flame are not possible since the mixing of air with the fuel-gas takes place in the mixing space.

An additional feature of the present invention is found in the fact that, under conditions of strong turbulence, the flame will remain stable because of the intensive mixing of the fuel-gas with the combustion-air having taken place already inside the mixing space. This intensive mixing also permits the sudden switching of the burner from a maximum performance to the lowest required performance and vice versa. The burner flame is comparatively thin and long since the mixing of the fuel-gas with the combustion-air is made without producing a drift component. Since the burner is made entirely of metal, the danger that particles with splinter off and damage the surface of the cylinders, as is the case with burners which are constructed partially of ceramic materials, is eliminated.

It is claimed:

1. A compact burner for dryers having divided fuel-gas and combustion-air channels, a flame-jet and a mixing space which is open in the direction of the flame-jet, the fuel-gas and combustion-air channels communicating with the mixing space by means of a plurality of outlets which are arranged around the central axis of the burner, and an opening in the burner for a pilot-burner, at least two of the combustion-air outlets and at least one of the fuel-gas outlets comprising one unit, the axes of the combustion-air outlets of each unit crossing each other in the mixing space and the axis of the fuel-gas outlet of the same unit lying in the mutual mirror-plane of the axes of the two combustion-air outlets in such a way that the exiting fuel-gas jet mixes with the sequential air jets, the combustion-air outlets being located in the inclined sides of wedge-shaped hollow bodies whose apexes run radially to the burner-axis, and the fuel-gas outlets being arranged in the troughs which are formed by two adjacent hollow bodies.

2. The compact burner of claim **1** wherein the apex of the hollow bodies is declined towards the burner-axis and counter to the direction of the jet of the burner.

3. The compact burner of claim **1** wherein the hollow bodies are arranged as attachment pieces on a plate which closes off the rear side of the mixing space.

4. The compact burner of claim **3** wherein the fuel-gas outlets are located in the plate.

5. The compact burner of claim **1** wherein the spaces of the hollow bodies are connected with a combustion-air chamber which surrounds the mixing space by means of openings in the wall of the mixing space.

6. The compact burner of claim **3** wherein a fuel-gas chamber is provided below the plate to which are connected the fuel-gas outlets.

7. The compact burner of claim **3** wherein a bore-hole is provided in the center of the plate as an opening means for the mounting of the pilot-burner.

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