

SPECIFICATION

Burner for burning fuels in the form of dust

5 The invention relates to a burner for burning fuels in the form of dust, the burner being of the kind consisting of a core air tube with a centrally disposed igniting device, a dust tube surrounding the core air tube, a jacket air tube surrounding the dust tube with an axially displaceable ring of swirl vanes disposed at the air inlet and a burner mouth which widens out in a taper towards the combustion chamber.

15 In order to ignite the burner flame, ignition energy is generally supplied to the combustion mixture of fuel and air. In annular burners of the above-mentioned kind, the preparation and supply of the ignition energy is effected by so-called igniting burners which are operated with oil or gas. In this case, the oil or the gas is ignited by means of an electrical ignition spark. The use of oil or gas as an ignition energy carrier is effected in view of its readiness to ignite and the combustion stability, which is particularly necessary with cold combustion chamber influences.

For reasons of cost and of the available reserves, it is becoming ever more desirable to use coal or another solid fuel as an igniting fuel instead of natural gas or petroleum as an ignition energy carrier, particularly with coal-dust firing.

It is therefore the object of the present invention to develop a burner for burning fuels in the form of dust wherein a solid fuel can be used as an ignition energy carrier.

In order to solve this problem, the burner of the kind described is so formed that disposed in concentric arrangement in the core air tube is a dust igniting burner which consists of an igniting dust tube disposed concentrically round an igniter and a jacket air tube surrounding the igniting dust tube for the igniting dust flame, with an axially displaceable ring of swirl vanes disposed at its air inlet and an outlet which widens out in a taper.

Preferably, the cone angle of the outlet of the dust igniting burner is equal to or larger than the cone angle of the outlet of the main burner.

Furthermore, the outlet of the dust igniting burner preferably ends before the beginning of the widening out of the main burner in a taper.

In order to ignite the igniting burner, the igniter can be operated gas-electrically, oil-electrically or purely electrically.

In a preferred construction of the burner of the invention, the jacket air for the dust igniting burner and the jacket air for the main burner are supplied through separate passages with regulating flaps, the two air passages being in communication with the master air passage of the main burner.

As a result of the arrangement of the igniting burner in the core air passage of the main burner, the effect is achieved that the jacket air passage of the igniting burner forms the core air passage of the main burner at the same time.

Although a dust flame displays a more sluggish behaviour with regard to its readiness to ignite than the gas or oil flames hitherto used, nevertheless allowance can be made for this circumstance by influencing the construction of the igniting burner.

It has been found that the relative unreadiness of a dust igniting flame to ignite and the associated ignition difficulties can be counteracted if the construction principle of the main burner is used largely as a basis for the igniting burner. Thus, according to the invention, the burner is extended, in burner principle, to dust-dust flames in the annular burner.

A coal-dust annular burner of known construction with an igniting burner according to the invention disposed in the burner axis is illustrated in the Figure and described below.

The annular burner operated with coal dust consists of a central core air tube 1 which is used to receive the dust igniting burner. The dust igniting burner consists of an igniting dust tube 3 which is disposed concentrically round an igniter tube 2 and which in turn consists of a jacket air tube 4 with an axially displaceable ring of swirl vanes 5 disposed at its air inlet and of an outlet 6 which widens out in a taper. Regardless of the constructive similarity of the igniting burner to the main burner, however, there are necessary differences in construction and operation which are specific to the method.

The constructional differences consist in the formation of the conical outlet 6 of the igniting burner, the cone angle of which is generally greater than the cone angle of the outlet 7 of the main burner. Furthermore, the ratio of the axial length of the outlet cone to the diameter of the jacket air tube is greater (0.75 to 1.5) than that of the main burner (0.4). Furthermore, the core air tube is lacking in the igniting burner with a view to the production of a rich mixture of dust and air which will thus ignite more readily. A further constructional difference lies in the fact that the igniting dust flame, after emerging from the burner cone 6, in contrast to the main burner flame through the main burner cone 7, is protected from excessive heat loss, which has a favourable effect on the readiness to ignite and the ignition stability.

A constructional feature specific to the method is also to be seen in the fact that the stream of combustion air for the igniting dust flame is supplied to the igniting burner through the core air passage of the main burner and can be regulated by a separate regulating member independently of the stream of jacket air of the main burner.

The operational differences of the igniting burner in comparison with the main burner consist in that the ratio of dust-laden air to dust weight is selected considerably lower (0.5 to 1.0) than in the main burner (1.5 to 2.0) in order to encourage the readiness to ignite. Furthermore, the dust igniting flame is operated with a lower air number ($\lambda = 0.8$ to 1.1) than that of the main burner flame ($\lambda = 1.1$ to 1.3), with the object of keeping the mixture of dust and air for the igniting flame in a rich range which therefore ignites more readily. Furthermore, the combustion air of the main burner has different air velocity components, and the axial air velocity component is smaller than that of the main burner as a result of which the dwell time of the particles of fuel dust in the ignition region is increased and so the ignition stability is improved. The tangential air velocity component, which can be adjusted through the ring of swirl vanes 5, on the other hand, is greater than that of the main burner so as to ensure that the resulting combustion air velocity vector, which predominantly influences the turbulence or the mixing operation, is always kept in the optimum range.

In addition, in special cases, the mode of operation of the igniting burner can differ from the main burner in that it is operated with a fuel differing from the main fuel in grain size and/or consistency, if this is necessary for reliable ignition and ignition stability.

The main burner consists, for its part, not only of a core air tube 1 with an adjustable air supply 8 but also a dust-laden air tube 9 which is disposed coaxially and which is connected to the dust conduit 11 by a dust distributor chamber 10. Disposed coaxially round the dust-laden air tube 9 is a jacket air tube 12 which is connected to the main air passage 14 through flaps 13. A ring of swirl vanes 15, through which the jacket air flows axially can be displaced axially through a plurality of spindles 16 and the hand wheel 17. The jacket air passage 18 is connected to the combustion chamber through the main burner outlet 7 which widens out in a taper. The ring of swirl vanes 15 and the tapered burner outlet 7 ensure the development of a return flow zone encouraging the ignition of the main burner, as is known. The main burner outlet 7 is made of ceramic composition, for example; it is installed in a tube basket 19 which is formed from the tubes of the wall tubing of the combustion chamber.

CLAIMS

1. A burner for burning fuels in the form of dust, consisting of a core air tube with a centrally disposed igniting device, a dust tube surrounding the core air tube, a jacket air tube surrounding the dust tube with an axially displaceable ring of swirl vanes disposed at the air inlet and a burner mouth which widens

out in a taper towards the combustion chamber, characterised in that disposed in concentric arrangement in the core air tube (1) is a dust igniting burner which consists of an igniting dust tube (3) disposed concentrically round an igniter (2) and a jacket air tube (4) surrounding the ignition dust tube for the ignition dust flame with an axially displaceable ring of swirl vanes (5) disposed at its air inlet and an outlet (6) which widens out in a taper.

2. A burner as claimed in claim 2, characterised in that the core angle of the outlet (6) of the dust igniting burner is equal to or larger than the core angle of the outlet of the main burner.

3. A burner as claimed in claims 1 or 2, characterised in that the outlet (6) of the dust igniting burner ends before the beginning of the widening out of the main burner in a taper.

4. A burner as claimed in any of claims 1 to 3, characterised in that the igniter is operated gas-electrically, oil-electrically or purely electrically.

5. A burner as claimed in any of claims 1 to 4, characterised in that separate supply passages with air regulating flaps are provided for the jacket air of the dust igniting burner and of the main burner, and both air passages are in communication with the master air passage of the main burner.

6. A burner as claimed in any of claims 1 to 5, characterised in that the jacket air passage of the igniting burner forms the core air passage of the main burner at the same time.

7. A burner as claimed in any of claims 1 to 6, characterised in that the ratio of the axial length of the outlet cone of the igniting burner to the diameter of its jacket air tube is greater (0.75 to 1.5) than that of the main burner (0.4).

8. A burner for burning fuels in the form of dust, substantially as hereinbefore described with reference to the accompanying drawing.



The operational differences of the igniting burner in comparison with the main burner consist in that the ratio of dust-laden air to dust weight is selected considerably lower (0.5 to 1.0) than in the main burner (1.5 to 2.0) in order to encourage the readiness to ignite. Furthermore, the dust igniting flame is operated with a lower air number ($\lambda = 0.8$ to 1.1) than that of the main burner flame ($\lambda = 1.1$ to 1.3), with the object of keeping the mixture of dust and air for the igniting flame in a rich range which therefore ignites more readily. Furthermore, the combustion air of the main burner has different air velocity components, and the axial air velocity component is smaller than that of the main burner as a result of which the dwell time of the particles of fuel dust in the ignition region is increased and so the ignition stability is improved. The tangential air velocity component, which can be adjusted through the ring of swirl vanes 5, on the other hand, is greater than that of the main burner so as to ensure that the resulting combustion air velocity vector, which predominantly influences the turbulence or the mixing operation, is always kept in the optimum range.

In addition, in special cases, the mode of operation of the igniting burner can differ from the main burner in that it is operated with a fuel differing from the main fuel in grain size and/or consistency, if this is necessary for reliable ignition and ignition stability.

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2. A burner as claimed in claim 2, characterised in that the core angle of the outlet (6) of the dust igniting burner is equal to or larger than the core angle of the outlet of the main burner.

3. A burner as claimed in claims 1 or 2, characterised in that the outlet (6) of the dust igniting burner ends before the beginning of the widening out of the main burner in a taper.

4. A burner as claimed in any of claims 1 to 3, characterised in that the igniter is operated gas-electrically, oil-electrically or purely electrically.

5. A burner as claimed in any of claims 1 to 4, characterised in that separate supply passages with air regulating flaps are provided for the jacket air of the dust igniting burner and of the main burner, and both air passages are in communication with the master air passage of the main burner.

6. A burner as claimed in any of claims 1 to 5, characterised in that the jacket air passage of the igniting burner forms the core air passage of the main burner at the same time.

7. A burner as claimed in any of claims 1 to 6, characterised in that the ratio of the axial length of the outlet cone of the igniting burner to the diameter of its jacket air tube is greater (0.75 to 1.5) than that of the main burner (0.4).

8. A burner for burning fuels in the form of dust, substantially as hereinbefore described with reference to the accompanying drawing.