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(54) **Method operating a coal burner.**

(57) A method of operating a coal burner in which particulate coal is fed to the burner main nozzle (21) in which pulverized coal is fed to the main burner (21) and a mixture of ultrafine pulverized coal and a gaseous medium are additionally fed to the burner at a sufficient temperature significantly to increase the reactivity of the ultrafine pulverized coal at least during the light up of the burner. The coal may be pulverized in a pulverizer vessel (12) by interparticle collision in at least one stream of gaseous medium to produce the ultrafine pulverized coal and a flow of the mixture of the ultrafine pulverized coal and the gaseous medium is fed directly from the pulverizer vessel to the burner.

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DESCRIPTION

TITLE: METHOD OPERATING A COAL BURNER

The present invention relates to a method of operating a coal burner.

It has been traditional to operate pulverized coal burners by feeding particulate coal of approximately 72-75% by weight less than 76 microns in particle size to a coal burner combustion chamber via a nozzle and to provide at a location adjacent said nozzles, for example coaxial therewith, a supply of gas or oil which is injected via an atomizer into the combustion chamber, particularly during the light up and low load firing of the burner. Once sufficient heat has been evolved by the oil burner, ignition of the coal itself can take place. Furthermore, during low duty operation, for example 50% of full load, the oil is again required to provide stability of the flame.

United States Patent 4 147 116 shows a similar light up arrangement for a burner using ultrafine coal of a particle size less than 40 microns, the arrangement there being to centrifuge the coal particles to the periphery of the burner tube, so that it is adjacent the incoming combustion air. Unless the oil or gas burner is provided at the centre, such a system would be totally unstable at low load or during light up.

The use of oil as a low load support fuel and during light up or ignition has certain disadvantages. Firstly, the oil itself is significantly more expensive, and in some parts as much as five times more expensive, than the coal for a particular calorific value. Secondly, it has been suggested to use, in place of the oil, an ultrafine pulverized coal which is stored in a bin and fed, when required, in place of, or in addition to the oil. However, it has been found that the use of such ultrafine pulverized coal poses a significant number of problems and produces quite considerable fire and explosion hazzards associated

with the reactive nature of ultrafine pulverized coal.

GB-A-2093979 discloses a burner system for burning coal dust, which is usually recognized as referring to a pulverised fuel of which 70% is less than 70 microns. There are seven coaxial tubes arranged with their common axis vertical. The outermost tube is used as a main air inlet, the next tube for the power fuel dust. An innermost tube is used as a supply for an igniting gas and this is surrounded by a tube for air for this gas, this in turn being surrounded by a tube for ignition coal dust. Outside this is a tube for the air for this dust and then surrounding this and inside the tube for power fuel dust, is a tube for additional ignition coal dust. All of the coal dust, i.e. the power coal dust, the ignition coal dust and the additional ignition coal dust flow vertically downwardly under gravity, but can be blown in. Such a system is extremely complex and is unlikely to operate in a stable manner.

Further methods of operation of coal burning are disclosed in U.S. Patent Nos. 4 190 005; 4 241 673; 4 226 371 and 4 270 895, but these are relatively complex and/or likely to be unstable in operation.

It is now proposed, according to the present invention, to provide a method of operating a coal burner said method comprising feeding pulverised coal to a main burner of a combustion chamber and mixing it with primary air at the outlet of the main burner, producing a separate supply of combustible fuel comprising a stream of ultrafine pulverised coal in a gaseous medium, by interparticle collision of said coal in at least one stream of said gaseous medium in a pulverizer vessel and feeding a mixture of the ultrafine coal and the gaseous medium directly from the pulveriser vessel to a point adjacent the outlet of the main burner.

Such a method allows the ultrafine coal to be used in a fully safe way as an ignition fuel and as a low load

support fuel with a stable flame. This produces a very significant saving in cost as compared with the use of oil or gas. The method can readily be applied by making a relatively minor modification to an existing burner, by replacing its ignition/low load burner with a single modified assembly.

While the gaseous medium may be air, it is preferably an inert medium such as steam or flue gas. Advantageously, the stream of ultrafine pulverized coal is raised to a temperature, which is preferably of the order of 130 to 190^{o}C, so that its reactivity is greatly increased and behaves much more like a fuel such as oil than coal and it greatly reduces the requirement for fuel oil during the light up procedure. As indicated, the coal is also capable of acting as a support or auxiliary fuel under low load conditions.

Best results are achieved if the size of the particles of the ultrafine pulverized coal is such that at least 50% by weight of the coal is of a particle size of less than 12 microns in diameter.

Because the coal is pulverized in a pulverizer vessel by interparticle collision in at least one stream of gaseous medium preferably inert, to produce said ultrafine pulverized coal and a flow of the mixture of the ultrafine pulverized coal and the inert gaseous medium are fed directly from the pulverizer vessel to the burner, problems of storage and the inherent dangers associated therewith can be avoided

Preferably, between the pulverizer vessel and the burner, the stream of gaseous medium and ultrafine coal is passed through a separator, whereby some of the gaseous medium is removed from the stream, and the remaining stream which thus has a greater concentration of coal, is fed to the burner to act as the igniter or low load back up fuel.

In order that the invention may more readily be understood, the following description is given, merely by

way of example, reference being made to the accompanying drawing, in which the sole Figure is a schematic side view of one embodiment of apparatus for carrying out the method of the invention.

Referring to the drawing, the apparatus illustrated comprises a feed coal bunker 10 from which coal with a top size of between 6 mm and 36 mm is fed via a feeder 11 to a pulverizer vessel 12. Air or preferably an inert gaseous medium, such as a flue gas or steam, is fed at an elevated temperature to a plurality of nozzles (not shown) which are mounted in an annular array with the nozzles each arranged to point upwardly and at an angle between a radius and a tangent to the annulus.

The pulverizer vessel 12 is shown with three outlet ducts 13, 14, 15, only one of which, duct 15, is shown being used according to the present invention. This duct passes via a discharge valve 16 to a burner indicated by the general reference number 17. The burner comprises a combustion chamber indicated generally at 18 and having an opening 19 for the inflow of combustion air from left to right as seen in the Figure. A main nozzle 21 is mounted coaxially to the opening 19 and is fed via a feed duct 22 with particulate pulverized coal of a significantly higher diameter than the ultrafine pulverized coal flowing together with gaseous medium mixture from the pulverizer 12.

Mounted coaxially within the main nozzle 21 is an igniter nozzle 23 having mounted coaxially therewithin an auxiliary oil inlet pipe 24 provided with an atomizer 25 at its discharge end. Within the nozzle 23 and surrounding the atomizer 25 is a swirler 26.

The igniter nozzle 23 is fed with light up air along its axis and with ultrafine coal via a tangential connection 27 from a feedline 28 which is connected to the heavy fraction outlet 29 of a centrifugal separator 30. This separator is fed via an inlet 31 which is connected to a pipe 32 which in turn is connected to the outlet 15 of the

pulverizer 12. A diverter valve 33 is positioned within the pipe 32 and can be moved from the position illustrated in which fluid flowing in is directed along inlet 31 to the separator 30 to a second position in which the fluid flowing in is directed along the extension 34 of the pipe to a tangential inlet 35 to the main nozzle 21.

The light fraction outlet 36 of the centrifugal separator is provided with a throttle valve 37 by means of which the light fraction can be returned to the pipe extension 34 for feeding into the main nozzle 21.

In operation of the above described apparatus, coal is fed from the feed bunker 10 to the pulverizer 12 in which it is pulverized to an ultrafine state, that is with typically 50% by weight of the particles having a diameter of less than 12 microns. The relevant portion of the mixture of gaseous medium, that is superheated steam, or flue gas or some other inert gas, and the ultrafine coal is then passed via line 15 to the burner. In the ignition position indicated, the mixture flows into the separator 30 and a portion of the gaseous medium discharges via outlet 36 to the pipe 34 and thence is caused to flow tangentially with a swirl in the main nozzle 21.

The heavier fraction, that is a more concentrated mixture of ultrafine pulverized coal and gaseous medium flows along the feedline 28 and is again caused to swirl in the igniter nozzle 23 with the same direction of swirl. The mixture is at an elevated temperature, preferably of the order of 130 to 150^{o}C and in this condition is readily capable of igniting. When the temperature has risen sufficiently high within the combustion chamber, the main nozzle 21 can have the coal in a pulverized condition fed along it through feed pipe 22 and can be burned in a conventional way. Thereafter the supply of ultrafine pulverized coal can be cut off by closing the valve 16. In a low load condition, it is possible to reintroduce the ultrafine coal and in this condition it is possible to have

the valve 33 in the non-illustrated position so that the coal and gaseous medium mixture is fed directly to the main burner without any concentration.

In certain circumstances, it is advisable for the ignition to take place with oil initially and for this reason the oil pipe 24 is provided and oil can be projected from that via the atomizer 25.

As indicated above, the tangential inlet 27 to the igniter nozzle 23 produces a measure of swirl and this can be increased by the swirler 26 adjacent the outlet to the igniter nozzle. The presence of this swirl produces a central recirculating zone of hot gases and hot ultrafine coal which further enhances the flame stability.

By using ultrafine coal instead of oil, or in certain circumstances in addition to oil, a very significant saving in expense can be achieved and furthermore downstream of the furnace there is less fouling of economiser and air heater surfaces if one uses the coal rather than the oil.

In the preferred construction illustrated, the igniter nozzle is located coaxially within the main nozzle. It is also contemplated that it could be other than coaxial and it could be coaxially outside the main nozzle.

It is also contemplated that in the support condition, the pulverized coal in the ultrafine condition could be fed other than at an elevated temperature although this is not preferred.

C L A I M S

1. A method of operating a coal burner, in which pulverised coal is fed to a main burner of a combustion chamber and mixed with primary air at the outlet of the main burner and a separate supply of combustible fuel is fed as an ignitor to a point adjacent the outlet of the main burner, characterised in that the separate supply of combustible fuel comprises a stream of ultrafine pulverised coal in a gaseous medium, in that the ultrafine coal is produced in a pulveriser vessel by interparticle collision in at least one stream of said gaseous medium and in that a mixture of the ultrafine coal and the gaseous medium is fed directly from the pulveriser vessel to the separate supply of the burner.

2. A method according to claim 1, characterised in that the gaseous medium is an inert gaseous medium.

3. A method according to claim 2, characterised in that the stream of ultrafine pulverized coal and inert gaseous medium are fed to the burner at a sufficient temperature significantly to increase the reactivity of the ultrafine pulverized coal.

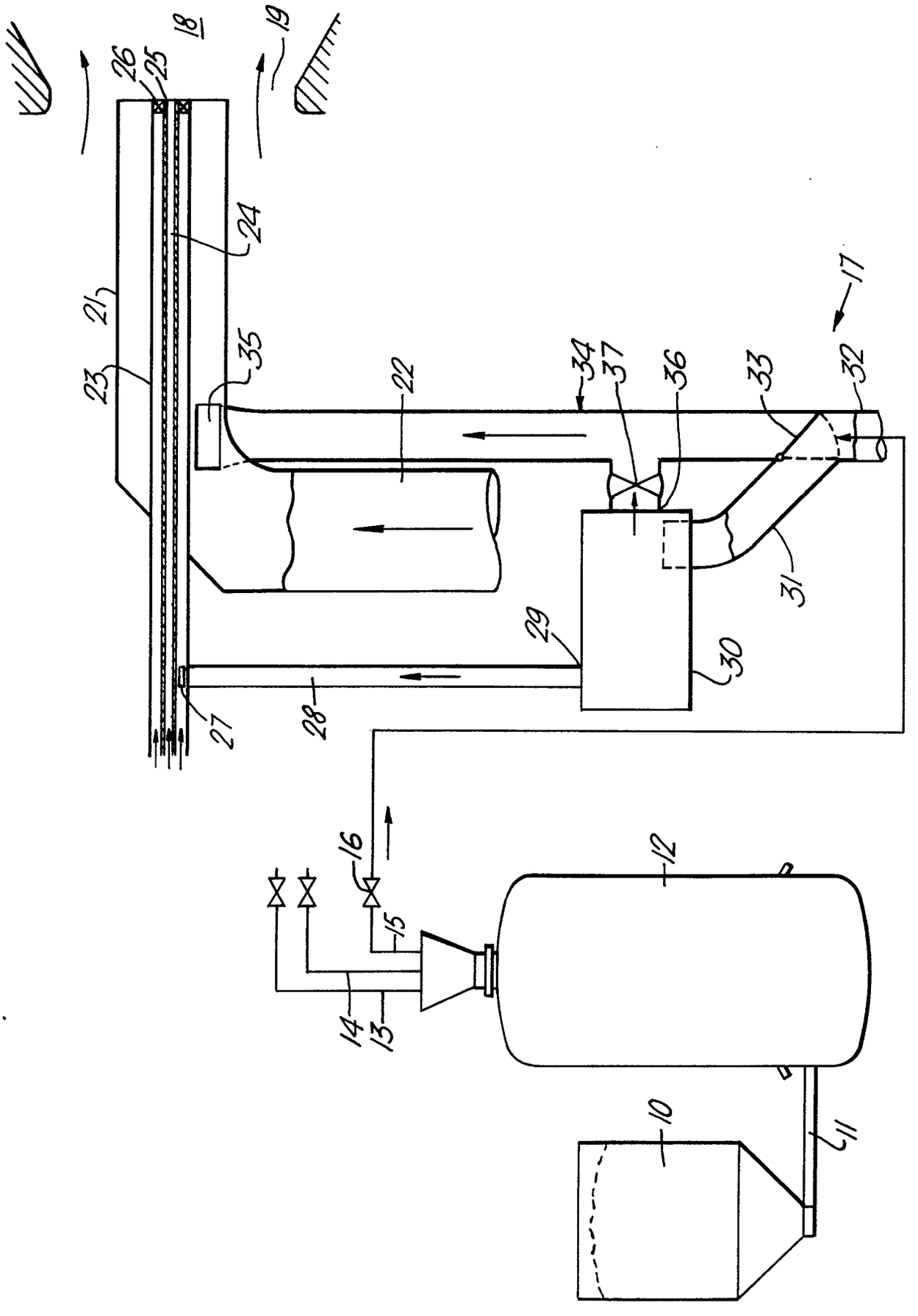
4. A method according to claim 3, characterised in that the temperature of the mixture is between 130 and 190°C.

5. A method according to any preceding claim, characterised in that the pulverizer vessel includes an annular array of nozzles producing a plurality of streams of inert gaseous medium, with the nozzles being directed between a radius and a tangent to the annulus.

6. A method according to any preceding claim,

characterised in that the particle size of ulrafine coal is such that typically 50% by weight of the coal is of a particle size of less than 12 microns in diameter.

7. A method according to any preceding claim, characterised in that between the pulverizer vessel and the burner, the stream of gaseous medium and ultrafine coal is passed through a separator, whereby some of the gaseous medium is removed from the stream, and the remaining stream which thus has a greater concentration of coal, is fed to the burner to act as the igniter or low load back up fuel.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