CYCLONE FURNACE HAVING ASH REMOVAL MEANS

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ABSTRACT

In cyclone furnaces used for burning bark and similar wood refuse, the removal of ash and cinder involves a delicate problem because the combustion residues are easily fused when subjected to elevated temperature. The commonly used openings in a grate covering an ash pit is not satisfactory to remove the rotating products, and it is now proposed to arrange an opening in the side wall of the cyclone, just above the grate, and to fit an ejector means into said opening for continuously removing the combustion residues.

4 Claims, 3 Drawing Figures
CYCLONE FURNACE HAVING ASH REMOVAL MEANS

BACKGROUND OF THE INVENTION

For the combustion of wood refuse, such as bark, chips and the like, a cyclone furnace is often used. Such a furnace comprises a cylindrical, vertical combustion chamber, which, in its lower part is provided with a grate and usually also a mechanical stoking device feeding the fuel to the central portion thereof, in such a manner that the fuel will form a substantially conical mound thereon. Other ways of feeding the fuel include a chute for feeding the fuel onto the grate in a downward direction. In its upper part, the combustion chamber is provided with a number of tangentially directed air nozzles, which impart a forceful whirling motion upon the combustion gases.

The diameter of the grate is selected in such a manner with respect to the desired combustion capacity and to the angle of repose of the fuel to be used that an annular passage, free of fuel, will be formed around the mound of fuel. The grate is, within this annular passage, usually provided with openings forming a connection with ash collecting pockets located below the grate.

Due to the forceful rotation within the combustion chamber, a lot of un-burnt particles will slide down the slopes of the mound of fuel and will collect in the annular passage. Bark contains a rather substantial amount of mineral components, and wood refuse is often contaminated with sand which has been entrained when the logs are dragged along the ground. Such combustible matter will fuse when subjected to elevated temperature, and it very often happens that particles of fuel still un-burnt falling into the annular passage will be intermingled with and fused together with the mineral particles, which leads to a clogging of the ash removal openings in the grate.

SUMMARY OF THE INVENTION

One object of the present invention is to provide a continuous collection of such particles as are circulated along this annular passage by the rotating gases and to remove them from the mound of fuel. The invention is characterized in an exit passage open towards the annular passage and directed tangentially with respect to the wall of the combustion chamber, in an ejector connected to said passage, and in a conduit connecting the ejector with a conduit conveying air under pressure in such a manner that a continuous ejection is obtained in the exit passage. An outlet conduit from the ejector may be connected to the upper part of the combustion chamber, or alternatively to a combustion plant located downstream of the cyclone furnace.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section through a cyclone furnace suitable for the combustion of bark and connected to a steam boiler.

FIG. 2 shows part of a section along line II — II in FIG. 1, the view looking in the direction of the arrows, and

FIG. 3 is a view partly in elevation and partly in cross section showing a cyclone furnace fitted to a steam boiler.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The cyclone furnace has a cylindrical combustion chamber 10 with a vertical axis and is provided with a grate 11 in its lower portion. The fuel, which on this occasion consists of bark and similar wood refuse, is fed centrally onto this grate by means of a stoking apparatus 12, the details of which are not shown on the drawing, in such a manner that a substantially conical mound 13 will be formed upon the grate. The diameter of the grate and of the furnace chamber is selected in such a manner with respect to the desired combustion capacity and the angle of repose of the fuel to be used that, during use, an annular passage 14, free of fuel, will be formed around the mound of burning fuel.

In the upper part of the combustion chamber a number of nozzles 16 for the injection of secondary air are provided. These nozzles are directed tangentially with respect to an imaginary cylinder concentric with the axis of rotation and are supplied with preheated air from a duct 17 connected to a fan (not shown). The combustion chamber is connected to a furnace 18 of a steam boiler, which is indicated above the cyclone furnace.

The air issuing from the secondary air nozzles 16 induces a forceful whirling motion within the chamber. A great many particles of un-burnt matter are carried by this vortex and will be finally combusted carried by the gases. A number of heavier particles will, however, slide down along the wall of the combustion chamber, ending up in the annular passage, where they, while still burning, may be baked together with ash particles sliding down along the slope of the mound of fuel and will form a sintered slag clogging the air entrance opening in the outer portion of the grate, as well as possible ash removal openings in the annular passage.

As long as the glowing particles are kept in motion they will do no harm, but if a local braking of the movement occurs, the building up of a solid coating starts. It therefore is important that the particles are continuously removed.

An exit passage 19 is provided in the wall of the combustion chamber, just above the grate and is directed towards the rotating gas-swirl. All larger particles will be collected in this passage. The passage is connected to an ejector 20, which, by way of a first conduit 21, is connected to the duct 17 supplying secondary combustion air. The particles collected will, in this manner, by way of a second conduit 22, be transported from the ejector to the furnace of the steam boiler, downstream of the cyclone furnace, in which they will be finally burnt. The resulting ash has the consistency of light cinder, and will facilitate the cleaning of the heating surfaces of the steam boiler while passing through the latter.

As indicated at 23, it is, of course possible, to connect the conduit 22 to the upper part of the combustion chamber to the cyclone furnace, above the level of the secondary air nozzles 16. The final combustion of the collected particles will then start in the cyclone furnace, but will be finalized in the second furnace, with the particles following the gas stream passing through the throat connecting the two furnaces.

An inspection and cleaning opening having a cover 15 is provided at the ejector 20 in such a manner that the latter, as well as the exit passage may be cleaned,
which may be brought about by means of a whisk which is periodically introduced into the passage.

FIG. 3 shows the cyclone furnace 10 fitted to a steam boiler, the combustion chamber 18 of which is provided with oil burners 30 or other fuel combustion means operable independently of the cyclone furnace.

The combustion gases leaving the steam boiler will pass through a dust separator 31 connected to the smoke stack. Conduit 22 from the ejector 20 at the cyclone furnace is connected to the dust separator at 32, and will pass through a feed water heater 33 or some similar heat exchanger for cooling of the mixture of air and ash particles.

What we claim is:

1. In a cyclone furnace having a vertical axis, a combustion chamber provided with upper and lower portions, a grate in the lower portion of the combustion chamber, means for feeding solid fuel onto the grate to form, in use, a conical mound of burning matter thereon, said grate having such an extension in relation to the desired combustion capacity and to the angle of response of the fuel utilized that an annular passage, free of fuel is formed around the mound, a number of nozzles in the upper portion of the combustion chamber for the introduction of secondary air tangentially with respect to an imaginary cylinder concentric with the longitudinal axis of the chamber, and an axial outlet for the combustion gases, a gas passage to which said axial outlet leads, the improvement including an exit passage in a side wall of the cyclone furnace located level with an open towards the annular passage and directed tangentially away therefrom, an ejector means fitted into said exit passage, the ejector means having an outlet end, a first passage connecting said ejector means with a source of pressure fluid, and a second conduit connecting the outlet end of the ejector means with the gas path downstream of the air introduction nozzles.

2. The cyclone furnace according to claim 1, in which said source of pressure fluid supply is the conduit conveying secondary air to the air introduction nozzles.

3. The cyclone furnace according to claim 1, in which said gas passage forms part of a heat producing plant having a smoke stack and a dust collector connected to the smoke stack and in which the second conduit opens into said dust collector.

4. The cyclone furnace according to claim 3, including a device for cooling of the mixture of gases and solid matter therein through which the second conduit passes before entering the dust collector.

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