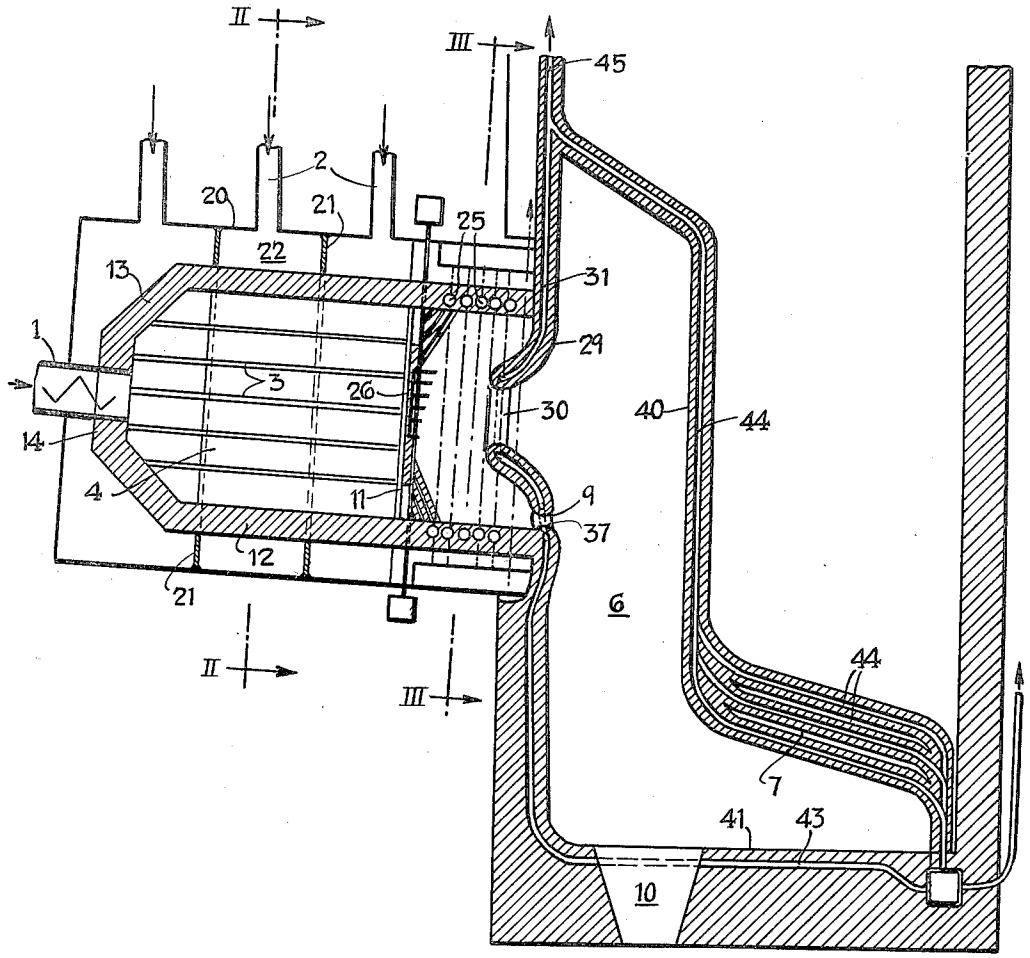
Jan. 24, 1956 E. LENHART ET AL 2,731,955

PULVERIZED COAL FURNACE

Filed Oct. 4, 1951 2 Sheets-Sheet 1

Fig. 1



INVENTORS.
EMIL LENHART.
JOHANN ZAORALEK.

BY K. B. Mayr

ATTORNEYS.

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Filed Oct. 4, 1951 2 Sheets-Sheet 2

Fig. 2.

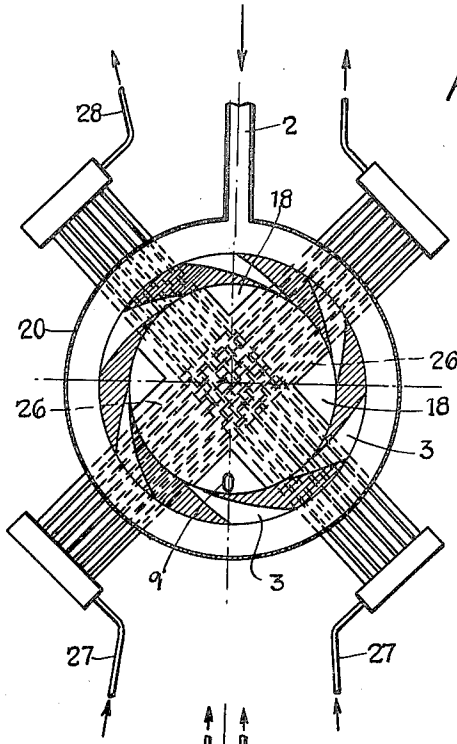
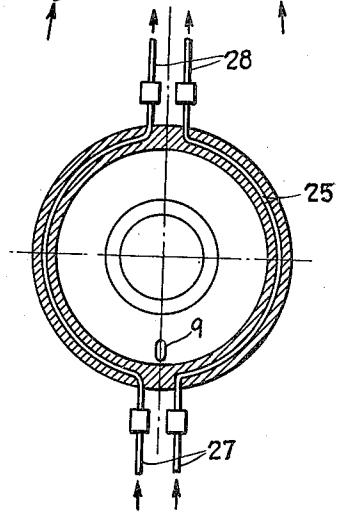


Fig. 3.



INVENTORS.
EMIL LENHART
JOHANN ZAORALEK.

BY K. A. Mayr

ATTORNEYS.

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PULVERIZED COAL FURNACE

Emil Lenhart, Bonn, and Johann Zaoralek, Essen, Germany, assignors to Firma Steinkohlen-Elektrizitat Aktiengesellschaft, Essen, Germany

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2 Claims. (Cl. 122—336)

It is known that in conventional pulverized fuel furnaces about 80–90 percent of the ash contents of the fuel are carried away by the combustion gases. These ashes cause disturbances in the operation of the boiler served by such a furnace, depending more or less on their chemical composition, and are generally eliminated by electrical or mechanical ash removers.

A large reduction of the amounts of solids carried away by the flue gas was achieved by fusing the ash into slag in slag furnaces or slag funnel furnaces.

The highest degree of such ash envelopment in slag was obtained, when a whirl-current burner, also called cyclone burner was employed, in which a mixture of primary combustion air and fuel is set in rotation in the center of the combustion chamber, with the secondary air introduced tangentially through one single inlet. As a result, a flue gas was produced, which contained only 15–20 percent of the original ash contents.

The desired degree of ash elimination is thus reached and the removal of the remnants may be left to simple mechanical purifiers.

The cyclone burner, however, allows only the use of fuels that contain up to a certain percentage of volatile matter and a certain percentage of ash. It also requires a certain granular size of fuel.

However, it is generally desired by the gas and power generating industry to utilize low-grade fuels of a high moisture and ash content which fuels are found as by-products of coal washing plants or in the form of winnow or coke dusts. For fuels of this sort, the cyclone firing is still unsuited.

There is also known a furnace for pulverized fuels, named after its inventor Burg furnace. The chamber of the Burg firing system also forms a whirl-current furnace, however, with inlets for secondary air distributed equally over the entire circumference through which the air enters in the direction of the rotation of the burning mixture. This part of the combustion chamber is followed by another without air inlets, where the ash is separated.

This Burg firing system is well adapted to burn the above mentioned fuels, after appropriate conditioning. It does lack, however, the ash enveloping properties of the cyclone firing.

The present invention is concerned with pulverized fuel furnaces or gas generators capable of burning the above mentioned fuels and to effectively envelop the ash by liquid slag. Its particular features are: a combustion chamber, in which a mixture of fuel and air is in rapid rotation, with secondary air inlets distributed evenly over the circumference of the chamber, through which the air is tangentially blown in the direction of the rotation of the burning fuel. This chamber is followed by another, water cooled chamber, without air inlets, where the ash is separated by centrifugal force.

It is of advantage to provide between the combustion chamber zones, with, or without secondary air inlets, baffles, which provide guiding surfaces, which increase the centrifugal and consequently the ash enveloping effect.

It appears further to be of advantage to have one zone of the combustion chamber equipped with tangentially entering secondary air inlets, extending over the entire length and circumference, and to leave one zone without such inlets. The cooling of the combustion chamber arch with the air inlets, may be effected by the air required for the combustion, and the cooling of the arch that has no such air inlets may be obtained through cooling coils, inserted in the boiler water circulation. It is also of advantage to arrange baffles in form of cooling coils between the zones of the combustion chamber and to give the latter an inclined position, with the slag outflow at its lowest point.

The annexed drawing shows diagrammatically in several sections one example of performing the invention.

Fig. 1 is a vertical view of a furnace according to the invention adapted to heat a steam boiler;

Fig. 2 is a vertical sectional view of the furnace shown in Fig. 1, the section being taken along line II—II in Fig. 1;

Fig. 3 shows a vertical section of the furnace of Fig. 1 along line III—III of Fig. 1.

Like parts are designated by like numerals in all figures of the drawings.

As seen in Fig. 1, the longitudinal axis of the furnace **4** declines slightly. A conical part **13** of the furnace wall extends from a front wall **14** and continues into a cylindrical part **12**. A conventional cyclone burner **1** is inserted in the front wall **14**. It introduces a mixture of primary air and fuel rotating about and along the longitudinal axis of the combustion chamber. A water cooled baffle **11** having the shape of a cross (Fig. 2) is interposed in the path of the burning mixture in chamber **4**. The baffle leaves passages **18** between the arms of the cross. Whereas refractory material may be used for forming the arms of the cross forming the baffle **11**, the refractory material can be omitted in the center of the baffle because the crossing cooling tubes form an almost solid wall in the center of the baffle. The conical wall **13** and the cylindrical wall **12** of the combustion chamber are provided with a plurality of conduits **3** extending longitudinally of the walls and terminating tangentially of the inside surface of the walls. Secondary air is introduced through the conduits **3**, forcing the hot gas away from the walls and preventing deposition of ash on the walls. The amount of air introduced through burner **1** and through conduits **3** is preferably so controlled that the temperature in chamber **4** is higher than the fusing point of the ash. Parts **12** and **13** are surrounded by an air jacket **20** which is subdivided by transverse walls **21** into a plurality of annular air chambers **22**. The latter are individually supplied with air through inlets **2**. The wall of the portion of the combustion chamber commencing with the baffle **11** is provided with internal conduits **25** (Fig. 3) which may communicate with channels **26** in baffle **11** and with pipes **27** through which cooling water is introduced and with pipes **28** through which cooling water is relieved. The rear of the combustion chamber is closed by a wall **29** having a nozzle shaped outlet **30** for the combustion gas. Wall **29** is provided with cooling channels **31**. The baffle **11** forces the combustion gas against the wall **12** along which the gas flows toward the rear wall **29**, depositing liquid and pasty slag on the inside of the wall **12**. The slag accumulates at the bottom of the chamber between the baffle **11** and the rear wall **29**. A small opening **9** is provided in the lower part of the rear wall leaving a low dam **37** over which flows the liquid slag.

Rear wall **29** extends above and below the combustion chamber forming a chamber **6** receiving the hot combustion gas from nozzle **30**. Chamber **6** contains a baffle **40** which downwardly deflects the combustion gas. Fly ash carried along by the gas is deposited on baffle **40** and drops down therealong. A water-cooled screen **7** extends

from the lower part of the baffle which is spaced from the bottom 41 of chamber 6. The downwardly deflected gas hits bottom 41 and is deflected upwardly to flow through the screen 7. The latter retains residual fly ash. Cooling conduits 43 are provided in the bottom 41 and cooling conduits 44 are provided in the screen 7 and in the baffle 40. The cooling conduits 43 and 44 and the cooling conduits 31 of the gas outlet nozzle 30 are interposed in a water or steam circulating system 45, forming part of a steam generator, not shown.

The liquid or pasty slag flowing through opening 9 and the ash deflected by baffle 40 and dropping from screen 7 collects on the bottom 41 and can be removed through an opening 10 which is disposed in line with the direction of movement of the gas which is downwardly diverted by baffle 40.

We claim:

1. A combustion apparatus for pulverized fuel comprising a substantially cylindrical combustion chamber having a cyclone burner fired first portion, said first portion having a circumferential wall and secondary air admission means equally distributed all around and over the whole length of said wall for cooling said first portion exclusively by secondary combustion air, the longitudinal axis of said combustion chamber being substantially horizontal and declining somewhat in the general direction of the flow of the combustion gases, said combustion chamber having a second portion having a water-cooled circumferential wall, and guide means for the burning gases disposed in said combustion chamber between said first and said second portion, said second portion having a rear wall and openings in said rear wall affording passage of the hot combustion gas to its place of use and flow of slag out of said second portion.

2. A combustion apparatus for pulverized fuel combined with a tubular steam boiler, comprising a substantially cylindrical combustion chamber having a cyclone burner fired first portion, said first portion having a circumferential wall and secondary air admission means equally distributed all around and over the whole length of said wall for cooling said first portion exclusively by secondary combustion air, the longitudinal axis of said combustion chamber being substantially horizontal and declining somewhat in the general direction of the flow of the combustion gases, said combustion chamber having a second portion, said second portion having a circumferential wall, a cooling coil in said last mentioned circumferential wall, guide means for the burning gases disposed in said combustion chamber between said first and said second portion, and cooling tubes in said guide means.

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