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FUEL BURNING APPARATUS

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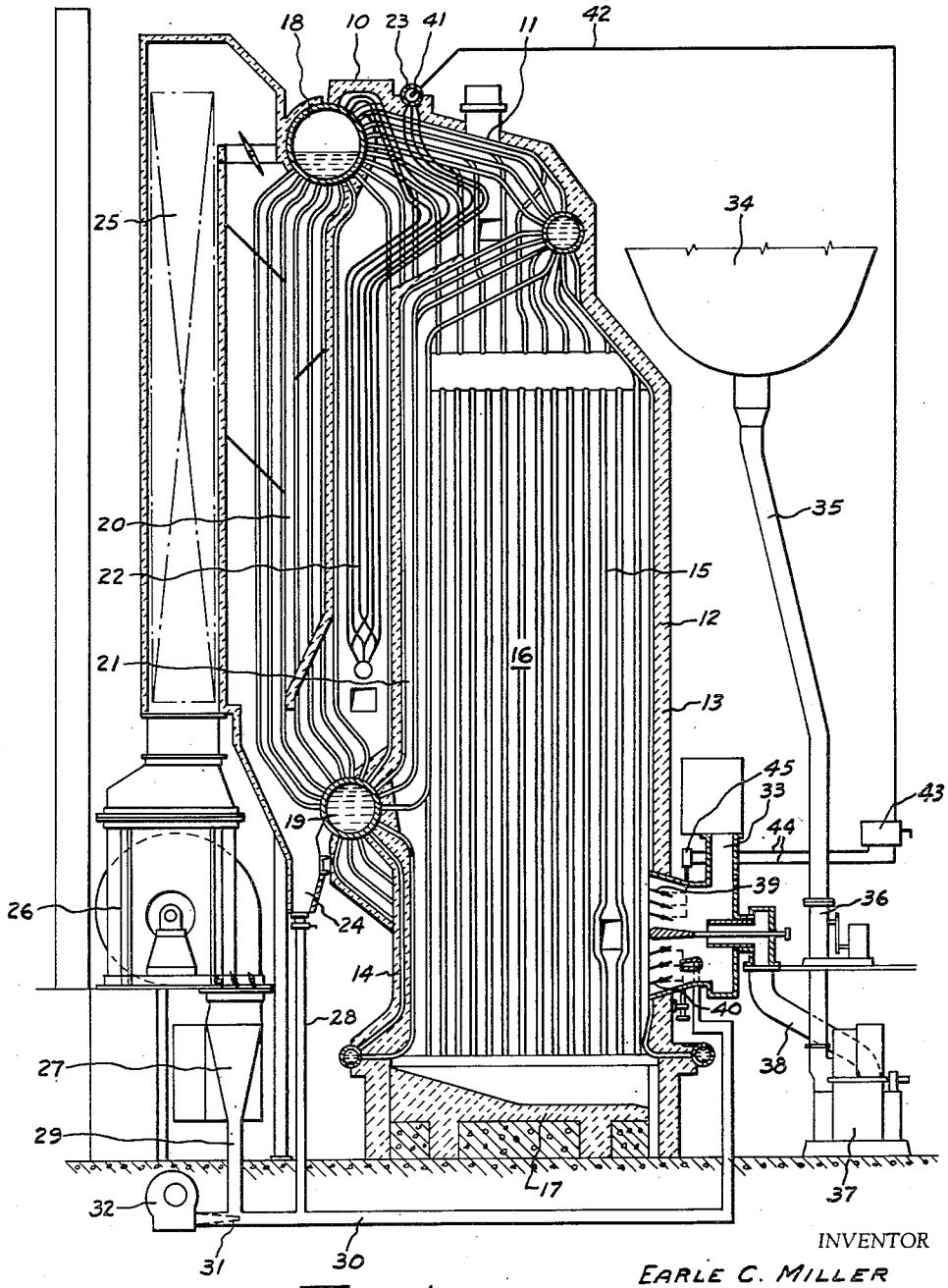


Fig. 1

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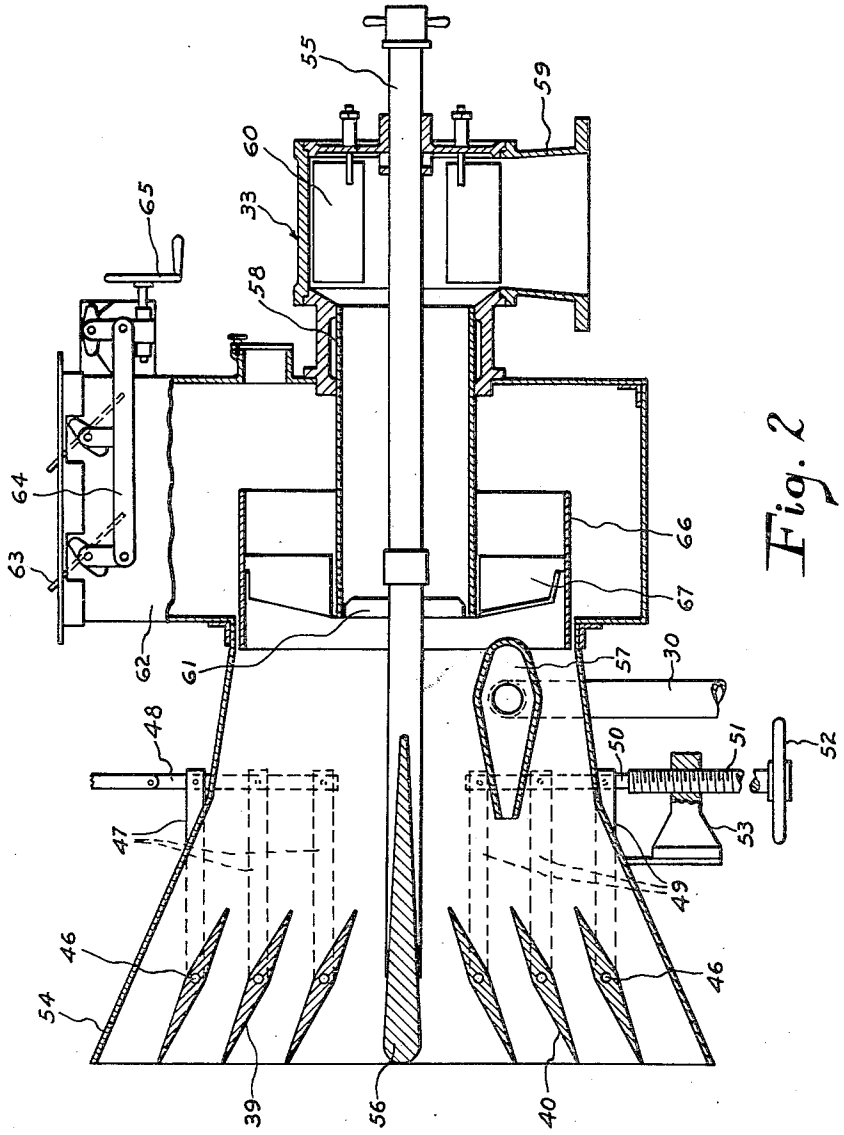


Fig. 2

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FUEL BURNING APPARATUS

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2 Claims. (Cl. 122—479)

This invention relates to fuel burning apparatus and more particularly to apparatus arranged to be used with a steam generating unit.

In the past it has been a common practice to provide for the control of superheat in a steam generating unit by controlling the angle to the horizontal of the flame produced by the burners in the furnace serving a boiler. By the use of a directional flame burner it is possible to provide for a considerable range of superheat temperature by adjustment of the flame from an extreme downward position in the furnace to an extreme upward position in the furnace. The selection of various positions of the directional flame burner to provide a desired superheat temperature is accompanied by certain disadvantages. One of these disadvantages is that the temperature in the lower portion of the furnace is changed at the same time that the angle of the burner is changed and this results in varying degrees of slagging. It can be understood that, when the burner is directed in an extreme upward position, there is a tendency to set up conditions in the lower portion of the furnace which do not permit ease of flow of slag. At the same time, a definite position of a burner in a furnace may be selected to obtain complete or almost complete combustion. However, when the flame position is changed to control superheat, the degree of combustion may also change, resulting in excessive flyash, particularly in the case of pulverized coal. By use of the present invention it is possible to obviate some of these difficulties while at the same time obtaining a desirable degree of control of superheat.

It is therefore an outstanding object of the present invention to provide an apparatus for burning fuel which will permit a wide range of control of superheat and at the same time bring about the optimum amount of slagging in the lower portion of the furnace.

It is another object of the present invention to provide a fuel burning apparatus in which the waste of unburned carbon in flyash is minimized.

A still further object of the present invention is the provision of a fuel burning apparatus which provides for the control of superheat and at the same time permits the complete burning out of carbon from flyash and the maintenance of optimum slagging conditions.

A still further object of this invention is the provision of fuel burning apparatus for maintaining a slag pool in an optimum condition and for the disposal of flyash along with the slag.

Another object of the invention is the provision of apparatus for use in the burning of pulverized coal in a furnace of the slag-pool type, wherein provision is made for the control of superheat and the maintenance of optimum slagging conditions as well as complete disposal of flyash.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself as to its objects and advantages, the mode of its operation,

and the manner of its organization may be better understood by referring to the accompanying description taken in connection with the accompanying drawings forming a part thereof, in which

Figure 1 is a longitudinal sectional view of a steam generating unit constructed after the teaching of the present invention, and

Figure 2 is an enlarged longitudinal view of a burner embodying the principles of the invention.

Like reference characters denote similar parts in the several figures of the drawings.

Referring first to Figure 1, wherein is best shown the general aspects of the invention, a steam generating unit, designated generally by the reference character **10**, is shown as comprising a boiler **11** and a furnace **12**. The furnace **12** is made up of a forward wall **13**, a rear wall **14**, and side walls **15** defining a combustion chamber **16**. A refractory basin **17** forms the lower portion of the furnace in which a slag pool may be maintained. Suitable provision, not shown, is provided for tapping the slag pool in the usual manner. The boiler **11** comprises in the usual way a steam-and-water-drum **18**, a mud drum **19**, downcomer tubes **20**, and steaming tubes **21**. A convection superheater **22** is connected on its inlet end to the steam-and-water-drum **18**, and at its outlet end to a header **23** from which it is carried to turbines not shown. Below the tube banks of the boiler is situated a flyash-collecting hopper **24**. A breaching **25** of the usual type is connected to an induced draft fan **26** to which is also connected a cyclone-type flyash separator **27** for cleaning the gases before projecting them into a chimney, not shown. A conduit **28** is connected to the lower portion of the hopper **24**, while a conduit **29** extends downwardly from the flyash collector **27**. Conduits **28** and **29** are connected to a flyash conduit **30** in which resides an ejector **31** provided with pressure air by a fan **32**. In the front wall **13** of the furnace **12** is situated a burner **33** which will be described more fully hereinafter. The burner **33** is provided with heated secondary air from the air heater **25**. It is also provided with flyash through the conduit **30**. A coal bunker **34** sends coal down a chute **35** and through a feeder **36** into a coal pulverizer **37**. The outlet of the coal pulverizer is connected to the burner through a conduit **38**. As is evident in the drawings, the burner **33** comprises a set of upper directing vanes **39** and a set of lower directing vanes **40**. A temperature indicating means **41** resides in the superheated steam header **23** and is connected by a lead **42** to a controller **43**. The controller **43** in turn sends a signal through leads **44** to a motor **45** which actuates the upper directing vanes **39** in a manner which will be described more fully hereinafter. This superheat control means may be either electrical or hydraulic.

Referring next to Figure 2 wherein are best shown the details of the burner **33**, it can be seen that the upper directing vanes **39** and the lower directing vanes **40** are independently adjustable and controllable. All the vanes, however, are of an elongated, diamond-shaped cross-section and are mounted on a horizontal pivot **46** passing generally through the center of gravity of the cross-section. The upper directing vanes **39** are connected by links **47** to an actuating shaft **48** which is in turn connected to the motor **45** for the actuation thereof. The lower directing vanes **40** are connected by links **49** to an actuating shaft **50**, the outer extremity of which is threaded at **51** and is provided with a hand wheel **52**. The threaded portion **51** passes through a fixed nut **53**, whereby the actuating shaft **50** may be moved longitudinally, thus changing the angularity of the directing vanes **40**. The vanes are enclosed by a housing **54** which flares outwardly toward the furnace. An ignition torch **55** of

the usual type is provided centrally of the burner. On either side of the torch and horizontally thereof is a large fixed separator vane 56 which divides the flared portion of the burner housing 54 into upper and lower portions in which reside the upper directing vanes 39 and the lower directing vanes 40, respectively. Directly behind the lower directing vanes 40 is situated a flyash injecting nozzle 57 connected to the flyash conduit 30. The nozzle opening is directed toward the vanes; that is to say, downstream of the flow of fuel and air.

The outer portion of the burner comprises a fuel tube 58 which is connected at its outer end to a fuel distributing head 59 whose inlet is connected to the pulverized coal conduit 38 connected to the pulverizer 37. The usual adjustable vanes 60 are provided for controlling coal distribution within the tube 58. The inner end of the tube 58 is provided with fuel spreading vanes 61 in the usual way. Surrounding the tube 58 is a secondary air housing 62 whose entrance is provided with adjustable vanes 63 for controlling the entrance of hot secondary air originating in the air heater 25. The vanes 63 are adjustable through a linkage mechanism 64 and a hand crank 65. A suitable air directing tube 66 and mixing vanes 67 are also provided.

The operation of the apparatus will now be understood in view of the above description. Feedwater is introduced near the steam-and-water-drum 18, passes downwardly through the downcomer tubes 20, and, after circulating through the tubes of the boiler, passes upwardly into the space over the water in the steam-and-water-drum and passes into the superheater 22. The superheated steam leaves the superheater, enters the header 23, and passes eventually to the turbines. The temperature of the superheated steam is measured by the indicator 41 and a proportionate signal is transmitted through the lead 42 to the controller 43. Gas originating in the combustion chamber 16 passes through the furnace over the steaming tubes, the superheater, and the downcomer tubes and passes through the air heater 25, the induced fan 26, and the cyclone separator 27. Flyash is separated from the gases and the cleaned gases are passed to the chimney. Heavier grit and flyash particles also fall into the hopper 24. Air heated by the air heater 25 passes to the burner 33 by means of the housing 62. Fuel leaving the bunker 34 passes downwardly through the chute 35 through the feeder 36 and is reduced to a powder in the pulverizer 37. The pulverized coal leaves through the conduit 38 and enters the distributing head 59. Pulverized coal and air are mixed by the vanes 67 and pass into the burner housing 54. The mixed fuel and air is split by the central dividing vane 56 into an upper and a lower component. The direction of the flame produced by the burning of the upper component is controlled by the upper directing vanes 39, while the flame produced by the lower component is controlled by the lower directing vanes 40. As the operation of the steam generating unit progresses, the controller 43 will receive signals from the indicator 41 indicative of the superheat temperature being obtained and will adjust the vanes 39 to produce a change in superheat temperature, if such be necessary. Slag forming on the walls of the combustion chamber 16 will pass downwardly to the refractory basin 17 and will collect, forming a slag pool. In order that this slag pool may remain in the proper viscosity for tapping, the operator is able to direct the flame formed by the vanes 40 in the proper direction to maintain the desired slag condition. He does this by actuation of the wheel 52, thereby changing the angularity of the vanes 40 through the threaded portion 51, the actuating shaft 50, and the links 49. At the same time flyash originating in the hopper 24 and the separator 27 falls down the respective conduits 28 and 29 into the flyash conduit 30. The flyash is propelled under the action of the fan 32 and the ejector 31 and passes into the burner housing 54 through the nozzle 57. Since the nozzle is

situated in the lower portion of the burner, the flyash will take the direction dictated by the vanes 40 and will reside in the lower flame controlled by the vanes 40 and will be projected in a downward direction toward the slag pool. The carbon remaining in the flyash will be completely burned out in the hot flame and the remaining flyash will be caught in the sticky slag pool. The flyash will thus be completely burned out and disposed of.

As is evident from the above, there are distinct advantages in mixing the flyash, coal, and air in the burner and then directing it into the furnace. This will permit preheating of the flyash before it hits the slag pool. It will also prevent the flyash striking the slag pool. Of course, any heavy concentration of flyash would cause the slag to thicken.

It should be noted that flyash is very difficult to ignite and burn due to the fact that flyash is high in fixed carbon and low in volatiles. By the means described, each flyash particle will be surrounded by burning coal particles and air high in oxygen, thus promoting complete combustion of the flyash.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions, and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A fuel burning apparatus comprising a pulverized coal fired steam generating unit having a convection superheater and a refractory slag basin, a burner having provision for directing a portion of the flame in an upward direction and controlling the angle to the horizontal occupied by the said portion, the burner also having a provision located just above the basin for directing the remaining portion of the flame in a downward direction into the basin and controlling the angle to the horizontal occupied by the said remaining portion, means for injecting flyash into the said remaining portion only of the flame, and means responsive to the temperature of the steam leaving the superheater to actuate the burner to change the angle of the upwardly directed portion of the flame to cause the said temperature to change to a desired level.

2. A fuel burning apparatus comprising a pulverized coal-fired steam generated unit having a convection superheater and refractory slag basin, a burner having provision including horizontally-pivoted vanes for directing a portion of the flame in an upward direction and controlling the angle to the horizontal occupied by the said portion, the boiler also having a provision including horizontally-pivoted vanes located just above the basin for directing the remaining portion of the flame in a downward direction into the basin and controlling the angle to the horizontal occupied by the said remaining portion, means for injecting flyash into the said remaining portion only of the flame, and means responsive to the temperature of the steam leaving the superheater to actuate the burner to change the angle of the upwardly-directed portion of the flame to cause the said temperature to change to a desired level.

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