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COAL BURNING BOILER

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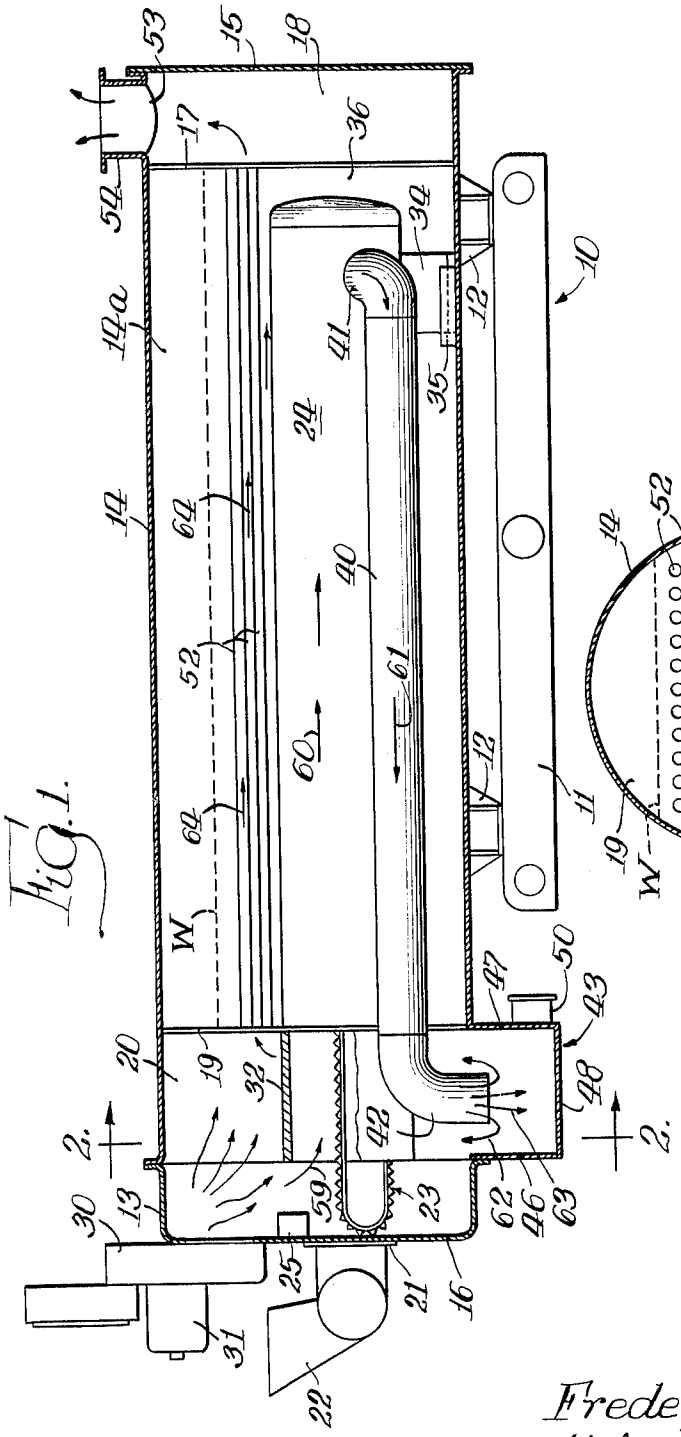


FIG. 1.

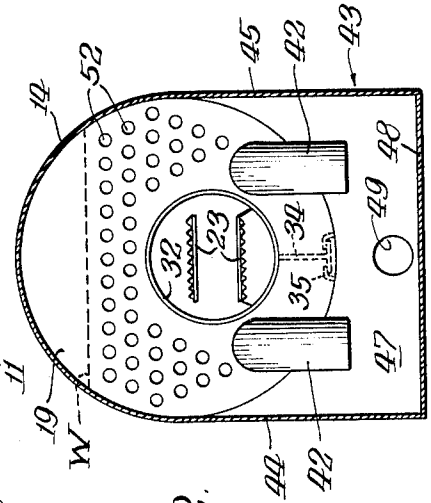


FIG. 2.

INVENTOR.
Frederick A. Loebel,
BY
Hofgren, Wegner, Allen,
Stellman & McCord Attys.

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COAL BURNING BOILER

Frederick A. Loebel, Milwaukee, Wis., assignor to Cleaver-Brooks Company, a corporation of Wisconsin

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1 Claim. (Cl. 122—149)

This invention relates in general to boilers, and more particularly to boilers using a solid fuel, such as coal, or the like.

Coal fired boilers are well known in the art, and are used widely in areas where gas is expensive and relatively scarce. However, heretofore, coal fired boilers have had many disadvantages which have limited their commercial acceptability. For example, in known types of coal fired boilers, it is conventional for the solid products of combustion, commonly known as ash, to be blown through the heat exchange tubes with the heated air and then out to exhaust. This type of construction is undesirable, in that it creates a health hazard because of air pollution. Additionally, as the ash passes through the heat exchange tubes, there is a tendency for the ash to settle out of the air flow and to eventually build up to a point so as to block the flow of air through the heat exchange tubes. Blockage of the heat exchange tubes is a very serious problem in certain types of boilers, since the small diameter of certain heat exchange tubes makes it extremely difficult to clean the tubes. Accordingly, the general purpose of the present invention is to provide an improved coal fired boiler which obviates the problems encountered in the pror art by removing ash from the boiler.

An object of the invention is to provide a coal fired wet back boiler.

Another object of the invention is to provide a coal fired boiler with an ash collection device to prevent the passage of ash through the small diameter heat exchange tubes.

A further object of the invention is to provide a coal fired boiler wherein ash may be removed in a simple and inexpensive manner.

Still another object of the invention is to provide a coal fired boiler with improved means for removing the ash from the coal burning furnace, and with additional novel means for removing the ash from the boiler itself.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the annexed drawing, in which:

FIG. 1 is a sectional view taken generally centrally through a preferred embodiment of the invention, with certain parts being broken away for clarity of illustration; and

FIG. 2 is a sectional view taken generally as shown along line 2—2 of FIG. 1.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawing and will herein be described in detail a preferred embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claim.

Referring now to the drawing, wherein like reference characters designate like or corresponding parts in both FIG. 1 and FIG. 2, the illustrated boiler includes a base 10 in the form of cross braced skids 11, only one of which is shown. Skids 11 are adapted to support the boiler from a floor or other support structure, and a pair of cradle brackets 12 are secured to, and project upwardly from skids 11. Cradle brackets 12 support the boiler on the base 10 with the boiler being slidable for expansion and contraction of the boiler lengthwise.

The illustrated embodiment of the boiler includes a

generally cylindrical shell 14 having a water inlet (not shown) and a steam or hot water outlet, also not shown. The illustrated boiler is of the wet back variety, and the structural details not specifically described herein are set forth in detail in the pending application of Frederick A. Loebel, Serial No. 310,437, filed September 20, 1963, now Patent No. 3,211,134. The wet back boiler includes a rear end wall 15 which may be bolted, hinged, welded, or otherwise secured to the shell 14. A front wall 16 is provided at the opposite end of the boiler from rear wall 15 and may be defined by a hinged door, such as that shown in the above mentioned Loebel application. Front wall 16 is preferably provided at the end of a cup shaped closure member 13 having a flange which is abutted against and secured to an adjacent flange on shell 14.

A rear tube sheet 17 is fixed within shell 14 at a point spaced forwardly from rear wall 15 to define an exhaust chamber or manifold 18. A front tube sheet 19 is fixed in shell 14 at a point spaced inwardly from front wall 16, so as to define a manifold 20 therebetween. The function of manifolds 18 and 20 will hereinafter become more fully apparent.

The illustrated wet back boiler is of the coal fired variety, and accordingly a coal inlet is provided at 21 in front wall 16. A suitable coal hopper 22 is fixed to the front wall 16 in surrounding relation with inlet 21. A traveling grate conveyer 23 may be positioned interiorly of front wall 16 adjacent inlet 21 to convey coal from the hopper 22 into a furnace 24. It will be understood, of course, that stoker 23 is motorized, and that the stoker is mounted in the boiler by any suitable means. While a hopper and traveling grate stoker have been illustrated as means for conveying coal from outside of the boiler into the furnace, it should also be understood that other arrangements are contemplated by the present invention, such as for example, by providing a nozzle in front wall 16 through which suitably pulverized coal may be injected into the furnace. Suitable ignition means may be provided as at 25 on the front wall 16, or the firing means may be placed within the furnace 24, if desired.

A fan, not shown, is mounted within a housing 30 that is secured to the upper portion of front wall 16, and a suitable motor 31 is provided to drive the fan. It will be understood, of course, that an appropriate air inlet is provided in front wall 16 through which the air is drawn into manifold 20. A suitable cylindrical baffle 32 may be mounted on front tube sheet 19 in concentric relation with furnace 24 to direct the flow of air past the ignited coals into the furnace 24.

The furnace 24 is an elongate cylindrical member which is supported in the shell 14 in a manner fully described in the aforementioned Loebel application, including T bar 34 and brackets 35. It will be readily apparent that the boiler portion between tube sheets 17 and 19, and within shell 14, defines a liquid receiving chamber 14*a*. Furnace 24 extends substantially from end to end of chamber 14*a* but is spaced from rear tube sheet 17, in typical wet back boiler fashion.

A pair of first tubes 40 extend longitudinally within chamber 14*a*, with the rear end of each tube being connected by a suitable elbow 41 in communicating relation with furnace 24. From FIG. 1, it is clear that the elbows 41 engage the furnace 24 in the two lower quadrants thereof, so as to facilitate the removal of ash from the furnace. Tubes 40 are of large diameter, as for example, ten inches, to obviate the problem of ash becoming clogged therein. A suitable elbow 42 is connected to the forward end of tube 40, so as to direct the flow from tube 40 downwardly toward a suitable ash collection device indicated generally at 43.

The ash collector 43 includes a collection chamber which is generally rectangular in cross section, and is

defined by side walls 44 and 45 which project tangentially downward from shell 14. Collector 43 further includes spaced front and rear walls 46 and 47, and a bottom wall 48. An ash removal opening 49 is provided in rear wall 47 and may be connected to a pneumatic ash conveying system, or the like, by a suitable connector 50.

A plurality of second tubes 52 are fixed between tube sheets 17 and 19, and the forward end of tubes 52 communicate with manifold 20 while the rearward end of tubes 52 communicate with exhaust chamber 18. As is clear from the drawing, tubes 52 are of small diameter, and would be susceptible of being clogged by ash, were not the major portion of the ash removed in collector 43. For purposes of example and not of limitation, it has been found that tubes 52 having a diameter of approximately three inches have functioned extremely satisfactorily with tubes 40 having a dimension of approximately ten inches to give a boiler having desirable heat transfer characteristics. It will be readily appreciated that tubes having a three inch diameter would be extremely difficult to clean were they to become clogged with ash. Thus, the removal of the ash by collector 43 provides an efficient, substantially maintenance free boiler. An exhaust opening 53 is provided in the upper surface of shell 14, and a suitable exhaust stack 54 is mounted in openings 53, and communicates with exhaust chamber 18 to convey the hot gases passing from tubes 52 to atmosphere.

In operation, the coal is inserted into the boiler from hopper 22 through inlet 21 where it is ignited and conveyed by stoker 23 into the furnace 24. Air flowing into the boiler from the fan within housing 30 is directed over the burning coals, and into the furnace 24, as shown by the directional arrows 59. The solid products of combustion will become entrained with the heated air, and together they will complete a first pass through the liquid chamber from front to rear of the furnace 24, as shown by the directional arrows 60. As the heated air and entrained ash make a first pass through the chamber 14*a*, a predetermined amount of heat is given up to the water W, or other liquid, within the chamber. The heated air and entrained ash make a second pass through the chamber 14*a* from rear to front of tubes 40, as shown by the directional arrows 61. Since the connection of tubes 40 to furnace 24 by elbows 41 is at the lower portion of the furnace, the ash will not collect excessively within the furnace. As the heated air and ash pass outwardly from elbow 42, the ash will settle in the collector 43, as shown by the directional arrows 63. The heated air will flow upwardly and toward the tubes 52 by the force of the fan within housing 30, as shown by the directional arrows 62. The heated air, substantially free of any ash, will then be conveyed in a third pass from front to rear of tubes 52, as indicated by the directional arrows 64, and thence into exhaust chamber 18 and out of the exhaust stack 54 to atmosphere.

I claim:

A solid fuel boiler for heating a liquid medium comprising: a shell having a front and a rear end; a rear tube sheet fixed in said shell and spaced from said rear end to define an exhaust chamber between said rear tube sheet and said rear end; an exhaust outlet communicating with said exhaust chamber; a front tube sheet fixed in said shell and spaced from said front end to define a manifold between said front tube sheet and said front end; the shell portion between said front and rear tube sheets defining a liquid chamber for receiving the liquid to be heated; an ash collection chamber at the lower portion of said manifold; a solid fuel inlet at the front end of said shell; a furnace within said liquid chamber and having front and rear ends; means for conveying said solid fuel from said inlet into said furnace through said furnace front end; means for igniting said fuel; means for blowing air across the ignited fuel and into said furnace so that the heated air and solid residue from the burned fuel entrained therewith make a first pass through said liquid chamber from front to rear of said furnace; a pair of large diameter first tubes having front and rear ends, the rear ends of said first tubes communicating with the lower portion of said furnace adjacent the rear end thereof and extending through said liquid chamber and said front tube sheet into said manifold above said collection chanber, the front ends of said first tubes being bent downwardly toward said collection chamber, so that the heated air and solid residue entrained therewith make a second pass through said liquid chamber from rear to front of said first tubes with the front end of said first tubes depositing the solid residue in said ash collector; and a plurality of small diameter second tubes in said liquid chamber, said second tubes each having a front end communicating with said manifold and a rear end communicating with said exhaust chamber, so that the heated air without the solid residue makes a third pass through said liquid chamber from front to rear of said second tubes and into said exhaust chamber and out of said shell through said exhaust outlet.

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CHARLES J. MYHRE, *Primary Examiner.*

FREDERICK L. MATTESON, JR., *Assistant Examiner.*