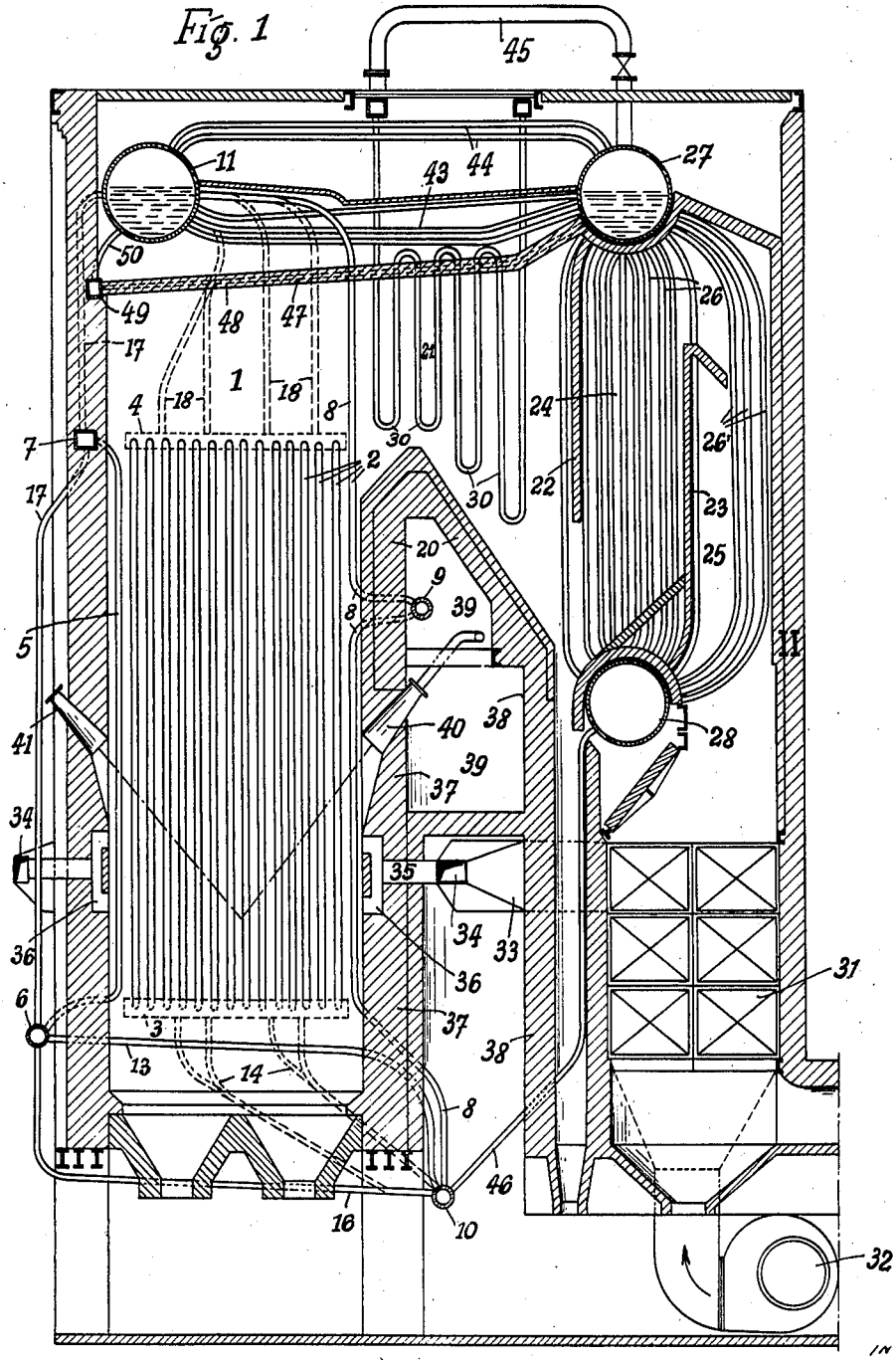
Sept. 20, 1932. L. STEINMÜLLER 1,878,908

WATER TUBE BOILER

Filed June 5, 1930 4 Sheets-Sheet 1

Fig. 1



INVENTOR

Albrecht Steinmüller,

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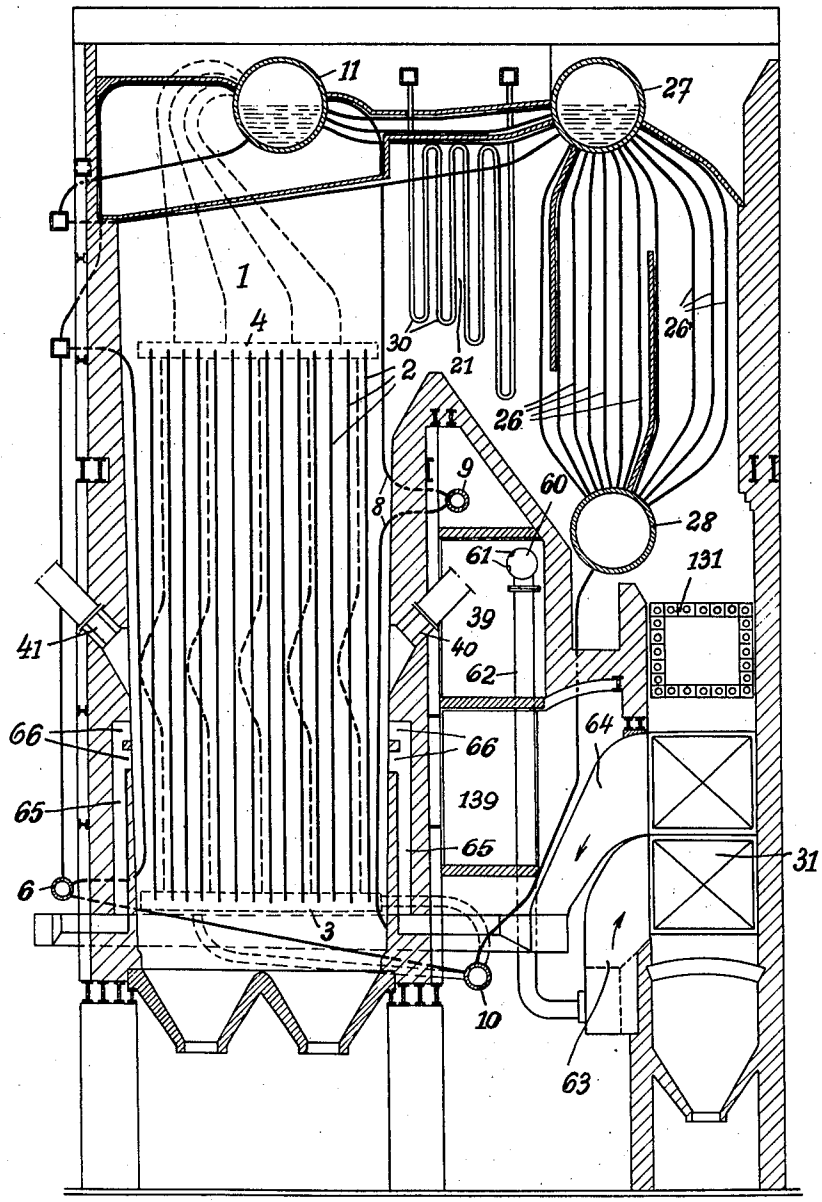
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Fig. 2



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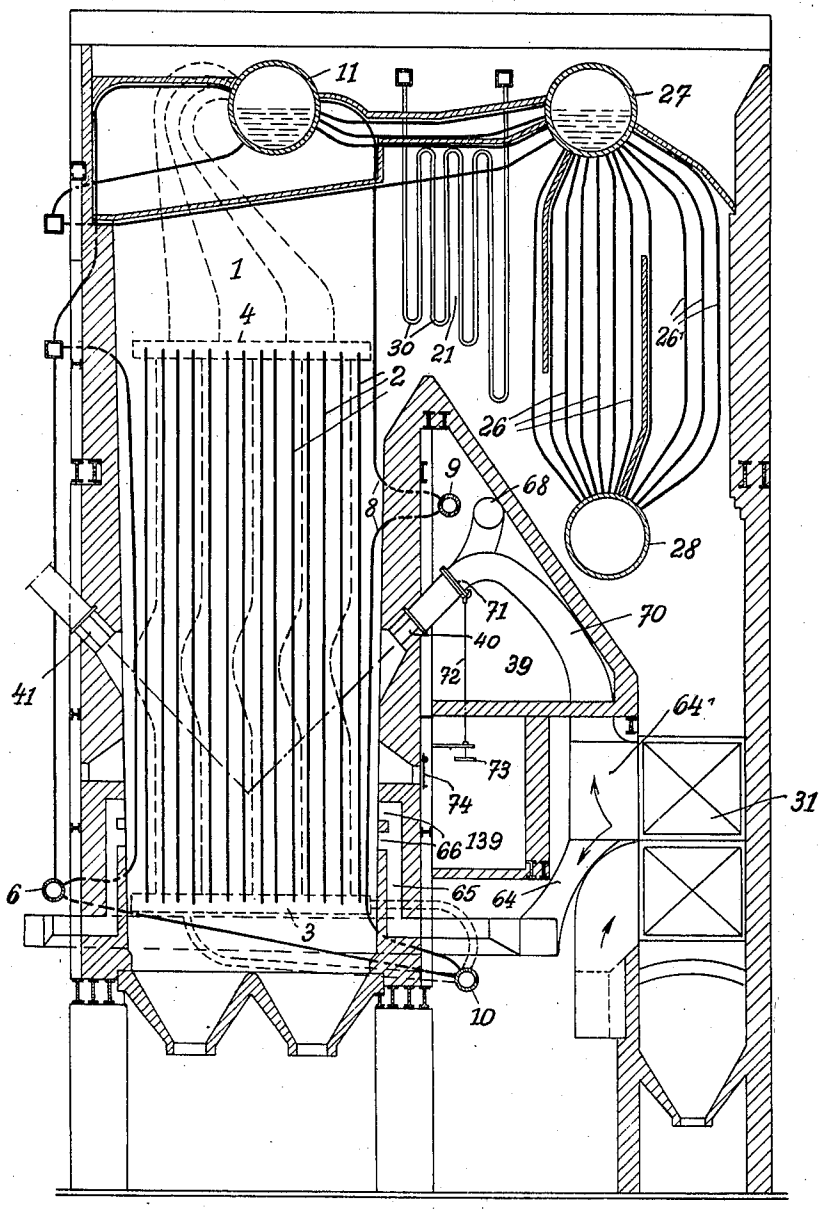
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Fig. 3



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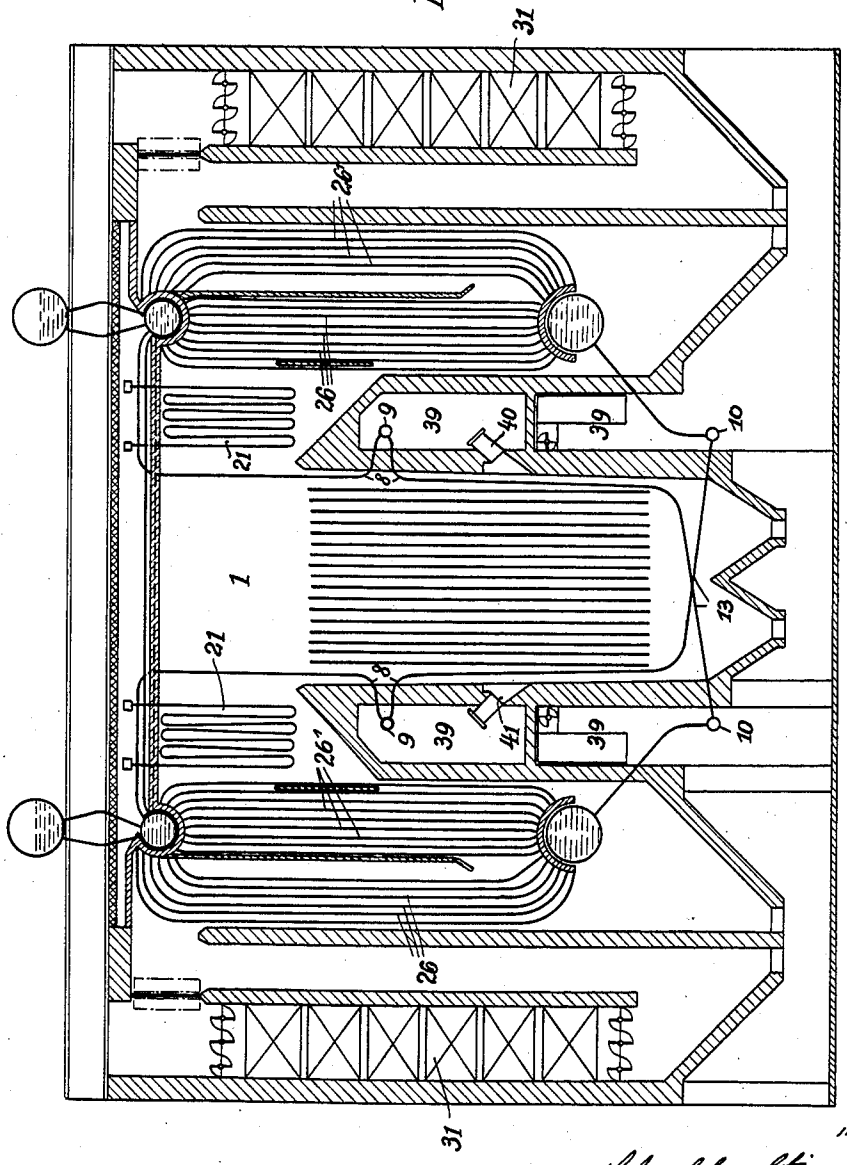
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Sept. 20, 1932. L. STEINMÜLLER 1,878,908

WATER TUBE BOILER

Filed June 5, 1930 4 Sheets-Sheet 4

Fig. 4



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Patented Sept. 20, 1932 1,878,908

UNITED STATES PATENT OFFICE

LEBRECHT STEINMÜLLER, OF GUMMERSBACH, GERMANY

WATER TUBE BOILER

Application filed June 5, 1930, Serial No. 459,280, and in Germany June 12, 1929.

This invention relates to a water tube boiler using coal dust as a fuel and having a combustion chamber, the walls of which are lined with tubes in which a considerable portion of the generation of steam of the entire boiler takes place.

According to the invention at the rear side of the combustion chamber is a separate chamber inside the boiler or in a recess in the masonry of the boiler from which the coal dust nozzles extend into the combustion chamber.

As is well known it is very important for the proper functioning of coal dust firing to arrange the burner nozzles at two opposite side walls of the combustion chamber. Hitherto this could only be done by arranging the nozzles on the two side walls of the boiler plant or boiler block. If, however, as is frequently the case several boilers have to be arranged next to one another, the arrangement of burners referred to results in a great deal of space being required. The burners with their regulating, feeding and other arrangements require a considerable amount of space in order to make them readily accessible and, if they are mounted on the sides of the boiler, sufficient space can only be obtained by placing the individual boilers a considerable distance apart.

According to the invention the burners are arranged partly at the front side and partly at the rear side of the combustion chamber by utilizing the above-mentioned accessible tunnel-like space. The nest or nests of tubes belonging to the boiler are then placed behind this accessible space, so that the latter separates the nest or nests of tubes from the combustion chamber. This provides a combustion chamber entirely surrounded by walls covered with protective tubes and having an outlet flue for the fire gases, which lies above the accessible space and conveys the gases into the nests of water tubes. This flue-like intermediate space above the accessible space may then be conveniently utilized for housing the superheater which can be so constructed that it is in part exposed to the radiating action from the combustion chamber and in part, namely the rear part, is more exposed to the flowing action of the heating gases.

With the usual combination of several single boilers to form a complete plant the accessible spaces in the individual boilers may be so arranged that they extend through the adjacent boilers like a tunnel. The individual boilers can then be placed very close together as the accessibility of the parts in question is ensured by the recesses lying next to one another forming a tunnel which can be entered from the outsides of the boilers which are combined to form a single block.

The arrangement according to the invention may also be such that there will be an accessible tunnel-like space not only at the back of the combustion chamber but also at the front, that is to say, at the front side of the boiler. The boiler may then as regards the nests of water tubes be constructed in the manner of a so-called double sided boiler, that is to say, one or more nests of water tubes can be arranged in front of the combustion chamber, in which case the flue gases do not leave the combustion chamber on one side only, that is to say into a rear bundle of water tubes, but divide when leaving the chamber and flow partly out of the back and partly out of the front of the combustion chamber, which has a favourable effect on the entire boiler.

In the accompanying drawings

Figure 1 is a vertical sectional view of a boiler and combustion chamber constructed in accordance with the present invention; and

Figures 2, 3, and 4 are corresponding views illustrating slightly modified constructions.

According to Fig. 1 the combustion chamber 1 of rectangular cross-section is lined on all four sides with rows of tubes, a simple and readily accessible arrangement for supplying the water and conveying away the steam being thus provided for these tubes. The tubes covering the side walls of the combustion chamber open at the top and bottom into headers 3 and 4 which are arranged outside the combustion chamber. The tubes 5 lining the front wall of the chamber are led to headers 6 and 7 at the top and bottom lying

outside the combustion chamber and the tubes 8 lining the rear wall, which on account of their great length are divided by an intermediate drum 9, are connected at the bottom to a low lying header 10 and at the top directly to the front upper drum 11.

The low lying drum 10 serves the purpose of distributing the water to all the tubes belonging to the combustion chamber. As already stated this drum is directly connected to the tubes 8 which cover the rear wall of the combustion chamber. The drum 10 is connected to the drum 6 for the front row of tubes 5 by a number of suitably distributed tubes 13 which form the clinker granulator for the combustion chamber. A number of tubes 14, the lower ends of which are connected to the drum 10, connect the said drum to the headers 3 for the rows of tubes 2 covering the two side walls.

A further row of tubes 16 connects the drum 10 with the drum 6 and serves the purpose of returning the water to the drum 10.

Between the drums 6 and 7 are downcomer tubes 17 which together with the row of tubes 5 form a closed element, the effect of which is that the mixture of water and steam rising in the tubes 5 is saturated in the drum 7 such that the generated steam rises through the tubes 17 to the forward upper drum 11 while the water returns through the tubes 17 to the lower drum 6 from where it partly rises again in the pipes 5 and partly flows through the tubes 16 to the drum 10. A similar arrangement can of course be provided for the headers 3 and 4 of the tubes 2 covering the side walls of the combustion chamber, the drums 3 and 4 being also connected outside the combustion chamber by tubes as at 17. In the drawings only the upper tubes 18 are shown, which are evenly distributed over the length of the upper drums 4 and open into the upper drum 11, and the lower tubes 14 which establish the connection between the drums 3 and 10.

Behind the combustion chamber 1 masonry 20 forms a passage 21 which connects the upper part of the combustion chamber with the first flue formed by the deflecting walls 22 and 23. In the two flues 24 and 25 which follow one another is housed a nest of tubes which is divided into two parts 26 and 26′ and which connects the rear upper drum 27 with the corresponding lower drum 28.

The convolutions of the superheater 30 fill the space 21 between the combustion chamber 1 and the nest of tubes 26. Through the opening under the deflecting wall 22 being placed low, the heating gases are caused to sweep completely over the superheater tubes and the division of the rear bundle of tubes into the two parts 26 and 26′ while the upwardly extending intermediate wall 23 causes the heating gases when leaving the boiler tubes to flow in a downward direction so that below the nest of tubes 26, 26′, that is to say, immediately following the actual boiler the air heater 31 may be placed. The latter receives its air from a blower 32 located below it and therefore also requiring very little space and the heated air flows from the upper part of the air heater 31 through a pipe 33 along a relatively short path into the distributing passage 34 extending around the combustion chamber from which passage it is conveyed through the branches 35 to the inlets 36 into the combustion chamber.

Within the space 39 bounded at the front and back by the masonry walls 37 and 38 and above the air supply ducts 34, 35 are the rear nozzles 40 for the fuel with their supply pipes and the like, while in the top part of the chamber 39 is the intermediate drum 9 which connects the parts of the tubes 8 covering the rear walls of the combustion chamber. The nozzles 41 in the front wall of the combustion chamber lying opposite the nozzles 40 are so distributed that the pipes supplying them lie between the downcomers 17.

The two upper drums 11 and 27 are connected both as regards their water space and their steam space in a known manner by tubes 43 and 44 respectively. The superheater 30 is connected in the usual way by a bend 45 to the rear upper drum 27.

Owing to the fact that a large number of tubes taking an active part in the generation of steam are located within the combustion chamber, the nest of tubes 26, 26′ lying in the flues may be made relatively small and short, which is of advantage not only as regards the housing of the air heater 31 but also as regards the maintenance of an active water circulation within the whole of the boiler. The lower drum 28 for the nest of tubes 26, 26′, which is placed relatively high owing to the said arrangement, is connected by a number of downcomer tubes 46 to the low lying drum 10, from which the water passes to all the vertical rows of tubes out of the combustion chamber and to the inclined granulating tubes 13.

Through the drum 10 also being located in the intermediate chamber 39, namely in the lowest part thereof the said drum with its many connections is readily accessible. The upper closing cover 47 is supported by a separate row of tubes 48 which opens directly into the rear upper drum 27 and is connected to the water space of the forward upper drum 11 by means of the bent tubes 50. This ensures a constant water circulation in the tubes 48, the steam generated in them flowing directly into the drum 27.

In the example shown in Fig. 2 below the accessible space 39 is a separate space 139 which is also accessible.

In the boiler flue below the nest of tubes 26, 26′ and above the air heater 31 is a flue gas heater 131.

Within the accessible space (tunnel) 39 is a tube 60 which has slots or perforations 61 distributed over its entire length and which is connected up by a tube 62 to the suction branch 63 of the air heater 31. In this way the air required for the air heater is drawn from the space 39 so that the latter is always ventilated and cooled.

The delivery branch 64 of the air heater is connected by suitable ducts with the passages 65 in the masonry of the front and rear walls of the combustion chamber, which passages terminate in suitably distributed openings 66 which communicate with the combustion chamber in such a manner that they blow so-called secondary air into the fire.

In the constructional example shown in Fig. 3 the accessible space is subdivided as in Fig. 2 into an upper chamber 39 and a lower chamber 139. In the upper chamber 39 is the supply pipe 68 which conveys the coal dust with the so-called primary air to the separate burners 40 in the rear wall of the combustion chamber. The delivery branch of the air heater 31 is in this case divided in such a manner that a lower part 64 communicates directly, as explained with reference to the example shown in Fig. 2, with the combustion chamber by way of passages and openings 65, 66, while its upwardly directed branch 64′ is divided into separate pipes 70 which lead to the separate burners 40 and supply so-called secondary air directly to them. Regulating members 71 for this secondary air are provided with regulating devices represented in the drawings as a spindle 72 with a hand wheel 73. The separate hand wheels 73 are placed in the lower accessible space 139 so that in this constructional form it is not necessary to enter the space 39. In the vicinity of each hand wheel 73 is an observation opening 74 for the combustion chamber.

Preferably the quantity of coal dust and the primary air conveying it is regulated for all the burners together from the outside, the arrangement in question being located in a known manner in the supply pipe 68.

In the constructional example shown in Fig. 4 there are placed in front of and behind the combustion chamber 1 nests of water tubes 26, 26′; corresponding accessible spaces 39 are provided in front of and behind the combustion chamber so that the front burners 41 are also led from such a space 39 into the combustion chamber.

The constructional form according to Fig. 4 shows in the vertical, longitudinal plane a symmetrical arrangement of the whole of the boiler. The combustion gases leave the combustion chamber uniformly in two part streams so that a uniform loading and a uniform ignition and combustion of the coal dust entering the combustion chamber from the oppositely located rows of burners 40 and 41 is obtained.

As shown in Fig. 4 two superheaters 21 are provided between the combustion chamber 1 and the nest of tubes 26. The symmetrical arrangement of the two superheaters 21 has this advantage over the arrangement on one side only, that the heat acts more uniformly on the superheater and that it is more conveniently housed. Each part of the boiler is constructed so as to form a so-called double draught boiler so as to enable as large a subsequent heating surface as possible to be provided on both sides next to the combustion chamber. Air heaters 31 are provided on both sides, each in a separate flue, each air heater extending upward approximately as far as the adjacent nest of tubes.

As the coal dust is supplied from the front and rear side of the boiler through the spaces 39 the bunker for the coal dust may be provided on one of the end walls (front or rear wall) of the boiler, the coal supply pipes being led from the bunker through the passages or intermediate spaces between the adjacent boilers to the rows of burners. This is also of advantage for better accessibility and for saving space.

Through the general arrangement described it is possible to provide a boiler which although taking up relatively very little space provides room for very large heating surfaces of about 2000 to 3000 sq. m. and therefore a large boiler which is capable of satisfying the greatest requirements.

What I claim is:

1. In a boiler furnace fired with pulverized fuel, the combination with a combustion chamber adjacent the front wall of the furnace. of fuel discharge apparatus carried by the front wall for projecting fuel into said chamber. a tubular water heating unit disposed rearwardly of said combustion chamber, means for conducting hot gases from the combustion chamber to said unit, means forming a chamber accessible from the exterior of said furnace and located intermediate said unit and said combustion chamber, and fuel discharge apparatus disposed within said last named chamber for projecting fuel within said combustion chamber.

2. In a boiler furnace burning pulverized fuel in suspension in air, the combination with a combustion chamber, of steam generating tubes forming a lining for said chamber, a tubular water heating unit and a combustion air heating unit within said furnace and spaced from said combustion chamber, means for conducting hot gases from the combustion chamber to said units, means forming a chamber accessible from the exterior of said furnace and located intermediate said units and said combustion chamber, and fuel discharge apparatus disposed within said last

named chamber for projecting fuel within said combustion chamber.

3. In a boiler furnace burning pulverized fuel in suspension in air, the combination with a combustion chamber, of steam generating tubes forming a lining for said chamber, a tubular water heating unit, including upper and lower drums and a combustion air heating unit within said furnace and spaced from said combustion chamber, means for conducting hot gases from the combustion chamber to said units, means forming a chamber accessible from the exterior of said furnace and located intermediate said units and said combustion chamber, fuel discharge apparatus disposed within said last named chamber for projecting fuel within said combustion chamber, and a collecting drum communicating with said steam generating tubes and the lower drum of said water heating unit.

4. In a boiler furnace burning pulverized fuel in suspension in air, the combination with a combustion chamber, of steam generating tubes forming a lining for said chamber, a tubular water heating unit and a combustion air heating unit within said furnace and spaced from said combustion chamber, means for conducting hot gases from the combustion chamber to said units, means forming a chamber accessible from the exterior of said furnace and located intermediate said units and said combustion chamber, fuel discharge apparatus disposed within said last named chamber for projecting fuel within said combustion chamber, and means for withdrawing air from said intermediate chamber and supplying such air to said combustion air heating unit, whereby the temperature of said intermediate chamber is reduced.

5. In a boiler furnace fired with pulverized fuel, the combination with a combustion chamber disposed in one portion of the furnace, of a tubular water heating unit disposed in another portion of the furnace, means for conducting hot gases from the combustion chamber to said unit, means forming a chamber accessible from the exterior of said furnace and located intermediate said unit and said combustion chamber, fuel discharge apparatus disposed within said last named chamber for projecting fuel within said combustion chamber, a second chamber accessible from the exterior of the furnace and located beneath said intermediate chamber, and control means for said fuel discharge apparatus located in said second chamber.

6. In a boiler furnace fired with pulverized fuel, the combination with a combustion chamber disposed in one portion of the furnace, of a tubular water heating unit disposed in another portion of the furnace, means for conducting hot gases from the combustion chamber to said unit, means forming a chamber accessible from the exterior of said furnace and located intermediate said unit and said combustion chamber, fuel discharge apparatus disposed within said last named chamber for projecting fuel within said combustion chamber, a second chamber accessible from the exterior of the furnace and located beneath said intermediate chamber, and an observation opening between said second chamber and said combustion chamber.

In testimony whereof I affix my signature.

LEBRECHT STEINMÜLLER.