Nov. 20, 1928. 1,691,934

E. A. PACKARD

BOILER FURNACE

Filed Nov. 5, 1925 2 Sheets-Sheet 1

Fig. 1.

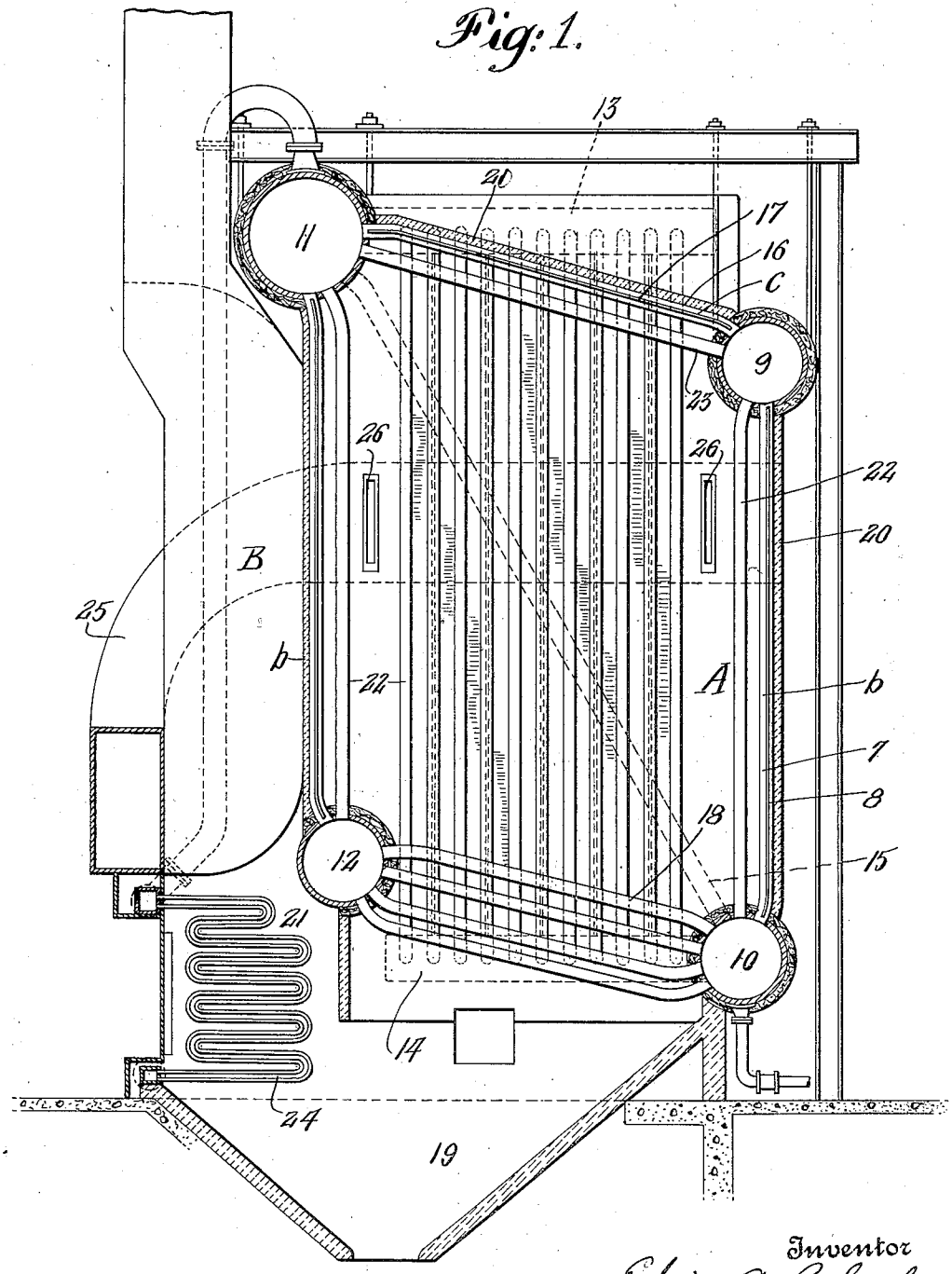

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Fig: 2.

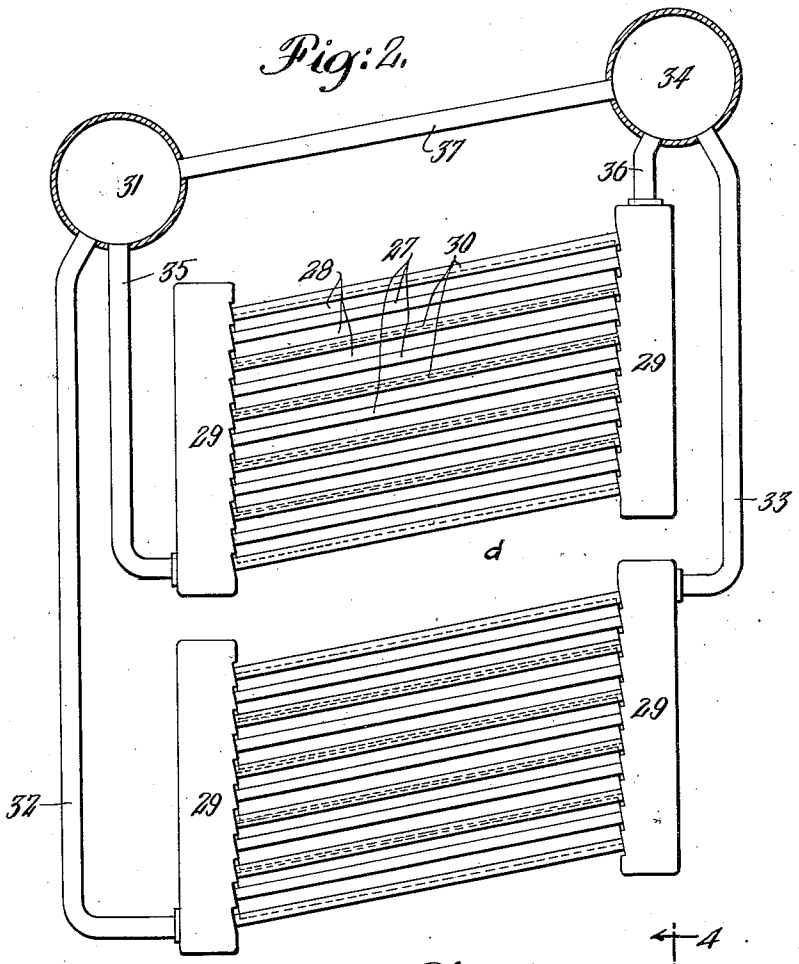

Fig: 4.

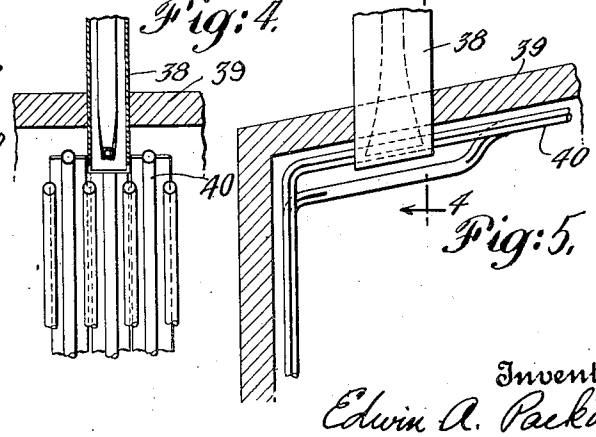

Fig: 5.

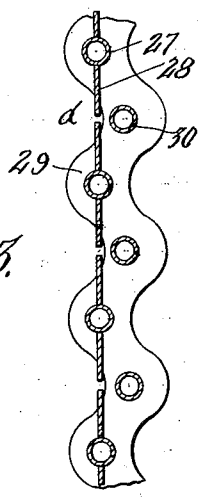

Fig: 3.

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UNITED STATES PATENT OFFICE.

EDWIN A. PACKARD, OF YONKERS, NEW YORK, ASSIGNOR TO INTERNATIONAL COMBUSTION ENGINEERING CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

BOILER FURNACE.

Application filed November 5, 1925. Serial No. 66,929.

This invention relates to boiler-furnaces and it is particularly useful where the fuel is to be burned in finely divided form in suspension, as for example, in the form of powdered coal.

It has recently been proposed in pulverized coal burning installations to at one and the same time greatly decrease the size of the boiler as well as of the whole installation and to obtain the same or greater steaming capacity than heretofore obtained in what would be corresponding standard constructions.

In accordance with such arrangement, it has been proposed to practically define the combustion space with the tubes of the boiler, i. e. to provide a furnace shaped boiler within which the fuel is burned so that the tubes of the boiler are subjected to radiant heat, the amount of work done by convection being relatively small. The tubes defining the upright sides of the combustion space, according to such proposal, have been provided with longitudinally extending fins so as to provide in effect continuous water walls.

In such arrangement, however, the width of the fins must be comparatively narrow in order to prevent the edges of the fins from burning off and consequently the tubes must be relatively closely spaced altho they are more widely spaced than if no fins were employed.

According to one phase of my invention, I propose to obtain the advantages of the water wall construction described, while at the same time making it possible to decrease the number of tubes and to increase the width of the fins employed.

Another of the advantages of the general construction previously described is that the extensive and heavy refractory side walls are eliminated for the reason that the water walls themselves define the boundaries of the combustion space, comparatively light sheathings to prevent radiation to the exterior being substantially all that is required in place of the usual refractory walls.

As to this phase of my invention I propose to obtain these advantages by employing a novel arrangement of tubes to be more particularly hereinafter described.

The foregoing, together with such other objects as may hereinafter appear, or are incident to my invention, I obtain by means of a construction illustrated in preferred form in the accompanying drawings wherein,

Fig. 1 is a vertical section thru a boiler-furnace installation embodying my invention;

Fig. 2 is a diagrammatic view illustrating a modification of my invention;

Fig. 3 is a fragmentary sectional view illustrating a detail of the arrangement of Fig. 2, and

Figs. 4 and 5 are sectional views illustrating a different manner of firing the fuel from that shown in Fig. 1, Fig. 4 being a section taken on the line 4—4 of Fig. 5.

Referring now to Fig. 1, the reference character A denotes the combustion space of the boiler-furnace. Four upright water walls *b* define the four upright sides of the furnace, such walls being composed of tubes 7 provided with the longitudinally extending fins 8 previously described. The tubes 7 constituting the front water wall have their ends connected in the upper drum 9 and the lower drum 10, and the tubes 7 of the rear water wall have their ends connected to the drums 11 and 12 respectively. The drum 12 lies above the level of the drum 10 and the drum 11 lies above the level of the drum 9. The tubes 7 of the side water walls have their upper ends connected into the header 13 and their lower ends connected into the header 14, the headers 13 connecting with the drum 11 and headers 14 connecting with the drum 10. Sufficiently large downcomer tubes 15 connect the drum 11 with the drum 10. The top of the combustion space is defined by a water wall *c* composed of tubes 16 provided with fins 17 as above. A number of inclined tubes 18 extending from the drum 10 to the drum 12, define the bottom of the combustion space, such tubes being spaced sufficiently far apart to permit the refuse to freely gravitate therefrom into the ash space 19 therebelow.

The upright water walls described are closed by a sheathing 20, and a similar sheathing 21 is carried by the tubes 16. The ash hopper 19 closes the bottom of the furnace, the offtake 21 for the waste gases of combustion leading from the space defined by the hopper.

The tubes 7 and the tubes 16 are relatively widely spaced apart and the fins carried thereby are correspondingly wide (see for

example Fig. 4). In the absence of provision to the contrary the edges of the fins would be burned off because the width of the fins is preferably so great that heat cannot be conducted into the tubes from the edges with sufficient rapidity to prevent such edges from burning. I, therefore, provide in front of each of the side water walls and below the top water wall, boiler tubes which are staggered with reference to the tubes constituting the side and the top water walls so as to come opposite the edges of adjacent fins, thereby shading the fins and shielding them from the direct radiant heat. The shading tubes for the upright walls are indicated at 22. The shading tubes for the front and rear water walls are connected respectively to the drums 9 and 10 and the drums 11 and 12, while the shading tubes for the side water walls are connected to the headers 13 and 14. The shading tubes 23 for the upper water wall are connected to the drums 11 and 9.

It will be seen from the foregoing that circulation is established from the drum 11 to the drum 10 and thence upwardly thru all of the tubes described back thru the drum 11. The tubes constituting the water walls and the shading tubes as well are all subject to radiant heat and, therefore, heat is transmitted at a very high rate and a very small boiler can be employed to produce a very large quantity of steam. By virtue of the employment of the shaded tubes the water wall tubes can be widely spaced apart and large fins may be employed without encountering the difficulty of burning off and thus a practically continuous metallic wall can be employed. Also, if desired, the fins may be dispensed with by virtue of the employment of the shading tubes, because the shading tubes in such case would shade that portion of the sheathing not directly covered by the tubes of the water walls.

Steam from the drum 11 is led thru the super-heater 24 located in the bottom of the offtake 21 and the air heater B is located in such offtake immediately above the superheater elements.

The gases leaving the combustion space defined by the radiant heat tubes is at a very high temperature, much higher than usual, in order that a high degree of preheated air may be obtained in the air preheater. This highly heated air is used for combustion and is taken from the heater by the ducts 25 leading to the burners 26 located at the four corners of the combustion space, preferably near the upper portion thereof. These burners discharge into the corners in a manner to produce vortical mixture and combustion, the combustion being intense and turbulent, whereby a high flame temperature and short length of flame travel is obtained.

Referring now to Figs. 2 and 3, I have diagrammatically shown an arrangement of tubes in which the tubes instead of being vertical are of the approximately horizontal type. According to this arrangement the upright walls would be defined by water walls *d* comprising tubes 27 provided with fins 28, the tubes 27 being connected into sinuous headers 29. Shading tubes 30 connect into the sinuous headers and come opposite the edges of adjacent fins as described above. While any suitable arrangement may be employed, I have shown each upright water wall as being composed of two pairs of headers 29, the lower-most header being connected to the drum 31 by downcomers 32, while the upper portion of the next header is connected by upcomers 33 to the drum 34, downcomers 35 connecting the lower-most of the upper part of headers to the drum 31 and upcomers 36 connecting the upper of the two higher headers to the drum 34. Tubes 37 connect the two drums 31 and 34. It is obvious that the arrangement of Figs. 2 and 3 may be employed with fuels other than pulverized coal.

Referring now to the arrangement of Figs. 4 and 5, the burners 38, in this case, extend downwardly thru an arch 39 supported on tubes 40 constituting an outer water wall. Certain of such tubes are formed so as to shade the edges of the burner casting, the fins being interrupted for this purpose. The object of so shading the burner casting is to prevent burning thereof, particularly where intense turbulent combustion is employed.

What I claim is:

1. In a boiler furnace, water walls defining combustion space and comprising tubes having longitudinal fins of such width that in normal operation of the furnace a portion thereof would burn off and means shading said fins to prevent such burning off.

2. In a boiler furnace, water walls defining combustion space and comprising tubes having longitudinal fins of such width that in normal operation of the furnace a portion thereof would burn off and other tubes also subject to radiant heat spaced inwardly from said first tubes and coming opposite the fins to prevent such burning off.

3. In a boiler furnace, water walls defining combustion space and comprising tubes having longitudinal fins of such width that in normal operation of the furnace the heat absorbed by said fins could not be conducted to the said tubes rapidly enough to prevent burning off of said fins, and other tubes also subject to radiant heat spaced inwardly from said first tubes and coming opposite the said fins to prevent such burning off.

In testimony whereof, I have hereunto signed my name.

EDWIN A. PACKARD.