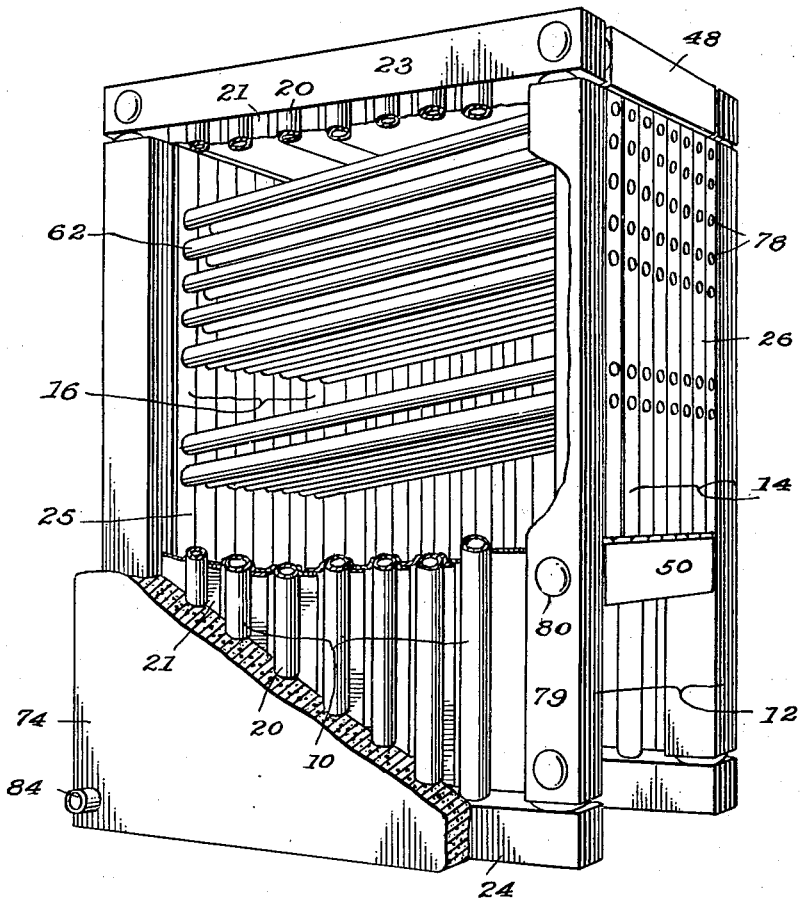
June 2, 1936. T. E. MURRAY 2,042,618

BOILER

Filed May 31, 1923 2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

Fig. 2.

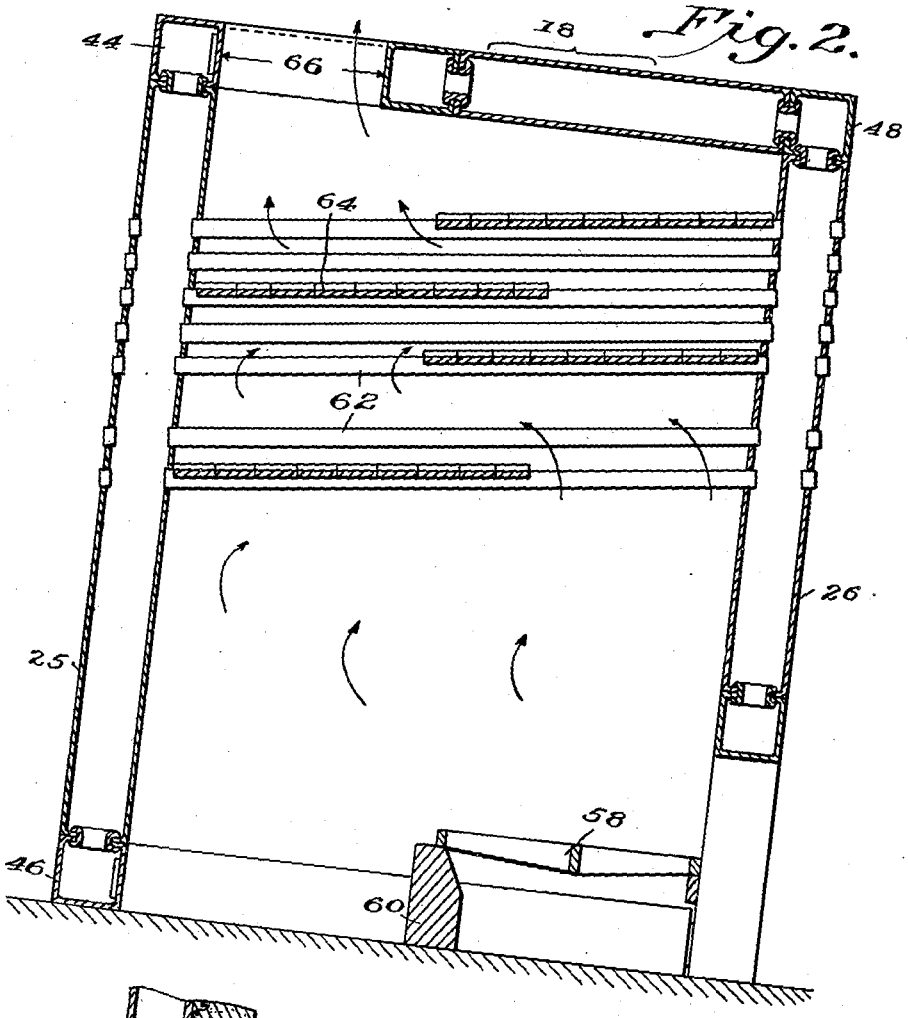


Fig. 3.

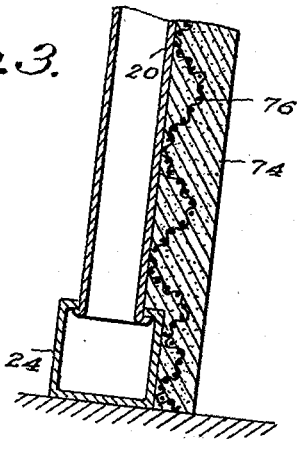
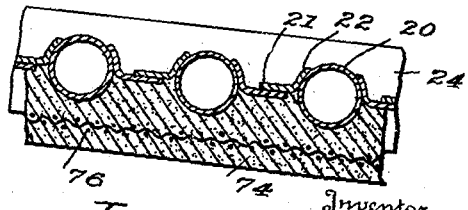


Fig. 4.



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2,042,618

UNITED STATES PATENT OFFICE

2,042,618

BOILER

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Application May 31, 1923, Serial No. 642,427

4 Claims. (Cl. 122—235)

This invention relates to boilers and particularly to the construction of boiler walls and boiler furnace walls.

In the accompanying drawings—

Figure 1 is a perspective view of the boiler partly broken away;

Figure 2 is a diagrammatical longitudinal section of the same;

Figure 3 is a vertical section of a detail; and

Figure 4 is a horizontal section of the same.

Referring to the embodiment of the invention illustrated, the boiler comprises side walls 10 and 12, a front wall 14 and rear wall 16, and a top wall or roof 18.

The side walls 10 and 12 are formed of a series of upright units comprising tubes 20 with lateral metal extensions such as the flanges 21, for instance, Fig. 4, welded to the tubes or otherwise attached thereto with good heat conducting joints. Inner curved portions 22 partly overlying the tubes facilitate such a welded connection.

The tubes 20 are connected into the circulation of the generator, communicating at the top and bottom, respectively, with hollow headers 23 and 24.

The rear wall 16 of the boiler is formed of a multiplicity of upright tubular sections 25 which may be similar to the members 20, 21, or may be ordinary tubular headers, and which are united at the top and bottom to transverse headers 44 and 46 (Fig. 2). The hollow members 26 forming the front wall 14 are connected at the top to a header 48, and at the bottom to a header 50 by communicating nipples or other suitable connection. The header 50 is elevated to leave an opening for the entrance of a known type of stoker. Instead of such stoker, the boiler can be fired manually, in which case fire doors and ash pit doors, not shown, will be provided. The boiler may be provided with a suitable grate diagrammatically shown at 58, Fig. 2, and bridge wall 60 and boiler tubes 62 extending approximately horizontally overhead and heated chiefly by convection. The tubes 62 communicate at their opposite ends with the hollow header members 25 and 26. Suitable baffles 64, such as tile, water tubes or brickwork, are secured in known manner to the boiler tubes so as to cause the products of combustion to follow a sinuous path through the boiler. A flue opening 66 is formed in the roof, leading to the stack.

The tubular side walls are combined with an outer layer or covering of refractory material, such, for example, as the layer or sheathing 74 of plastic insulating material held in place by a reinforcement of woven wire mesh 76 which is bent to the shape shown in Fig. 3 and welded or otherwise secured at intervals to the tubular units, either the tubes 20 or the projections 21, or both. This insulating material can be plastered on after the metal work has been erected and, if desired, may be enclosed by a thin sheet metal shell. This insulating material may be a magnesia mixture or plastic compounds of asbestos and like heat insulators.

The boiler tubes 62 may be of the usual round shape secured to the hollow headers 25 and 26; these being provided with openings opposite the ends of the tubes, which openings are closed by suitable plugs 78. The upright hollow corner tubes 79 are provided with plugged openings 80 which give access to the interior. Similar openings and plugs may be used in the various members for insertion of tools in assembling, or for cleaning sediment or scale.

The feed water may be introduced at one or more points and for this purpose, I have shown in Fig. 1 a pipe 84 entering the lower header 24. Similar feed pipes may be located at the opposite side of the boiler, or the feed water can be supplied from a common header to several of the tubular members 20.

The boiler walls may be supported in the usual manner on a floor or other foundation. Or walls of the kind described can be hung or suspended from the structural beams or girders in a power house or other building.

Boilers of the present type are designed to generate large quantities of steam at high temperature and pressure by the use of water walls immediately surrounding the combustion chamber, and utilizing the radiant heat of the burning fuel in addition to the inclined tubes above the combustion chamber heated by convection.

My improved boiler is designed to produce steam at a rate of several hundred per cent of the usual rating based on area exposed to the heating gases and requires for this result a high volume of intensely hot gas. It becomes important therefore to prevent the exposure of the usual masonry wall to the fire. Experience shows that such walls are rapidly deteriorated under modern high temperature firing. The metal fillers or extensions of my improved boiler form a shield which protects any outside sheathing, the tubes with the metal fillers or extensions constituting in effect a wall of the combustion chamber so that the plastic material on the out-

side may be a mere insulating sheathing supported by the wall of tubes and fillers.

The fillers or extensions have an additonal function to conduct heat to the water tubes so rapidly as to utilize the intense heat of the fire. In installations of this character the distance to which the extensions may be carried beyond the tubes is limited. It must be so short that the heat is conducted to the tubes sufficiently rapidly to prevent the outer portions of the extensions from being burned away or distorted sufficiently to crack them. Such conduction of heat to the tube is affected by the area and the degree of contact of the extension member with the tube, but is chiefly dependent on the distance from the tube to the remotest part of the extension. Such distance puts a maximum limitation on the distance between the tubes in the case of high duty boilers (that is, steam generators as distinguished from mere water heaters or the like).

In practice, I have found that the maximum distance should not be substantially greater than the outside diameter of the tubes. The extensions beyond the tube, with such spacing, are of less width than the diameter of the tubes and can be kept within such limits as to avoid destruction by the fire.

Generally in boilers of the type on which the present invention is an improvement, particularly those designed to generate large quantities of steam at high temperature and pressure, the walls of the furnace support the overhead structure and are made of or lined with refractory brick-work which is exposed directly to the intense heat of the flame and which have a comparatively short life. There are frequent shutdowns for repair or replacement of such walls. According to this invention the principal part of the wall is the tubular metal structure. Not only does this provide for a high capacity because of the rapid generation of steam by exposure of the tubes to the direct radiant heat of the burning fuel, but also the life of the wall, cooled by the rapid circulation of water, is practically unlimited.

The insulating material outside of the metal wall is used for the conserving of heat and is protected from excessive wear by the metal structure between it and the fire.

I claim:

1. A steam generator including in combination approximately horizontal water tubes heated by convection and a furnace having a combustion chamber below said over head tubes, a wall of said combustion chamber being composed of substantially upright tubes connected into the circulation of the generator, said tubes being spaced apart a distance not substantially greater than their diameter, and metal extensions from said tubes united thereto with good heat conducting joints and practically closing the spaces between them but being free to move separately, so that only the tubes and extensions are exposed to the heat of the burning fuel and the two together constitute the wall heated only on its inner face, the other surface of such wall being covered with insulating material.

2. A steam generator including in combination water tubes heated by convection and a furnace having a combustion chamber adjacent to said tubes, a wall of said combustion chamber being composed of water tubes connected into the circulation of the generator, said tubes being spaced apart a distance not substantially greater than their diameter, and metal extensions from said tubes attached thereto with good heat conducting joints and practically closing the space between them but being free to move separately, so that only the tubes and extensions are exposed to the heat of the burning fuel and the two constitute a wall heated only on its inner face, the outer face of said wall being covered with insulating material.

3. A stationary steam generator including in combination water tubes heated by convection and a furnace having a combustion chamber, a wall of said combustion chamber being composed of a number of substantially upright tubular elements comprising tubes with lateral metal extensions united thereto with good heat conducting joints, said tubes being connected into the circulation of the generator and being spaced apart a distance not substantially greater than their diameter and said extensions lying in the spaces between the tubes and providing an increased area exposed to the radiant heat of the burning fuel and conducting such heat to the tubes, said extensions being limited in width as a maximum to the diameter of the tubes, each element being disconnected from the next but so placed that the tubes and extensions constitute a wall exposed on the inner face only to the radiant heat of the combustion gases, the outer surface of such wall being covered with insulating material.

4. The stationary steam generator of claim 3, and means for holding said cover of insulating material against the outer surface of the wall, such means being united to the tubular elements composing the wall.

THOMAS E. MURRAY.