Nov. 1, 1932. T. E. MURRAY 1,886,214

BOILER

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Fig. 1.

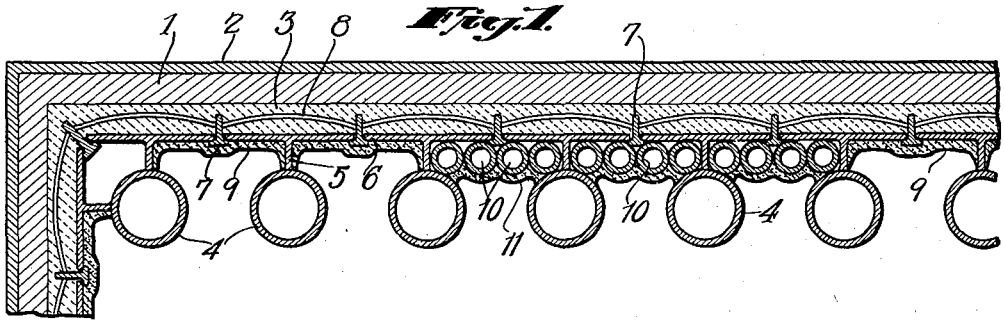


Fig. 3.

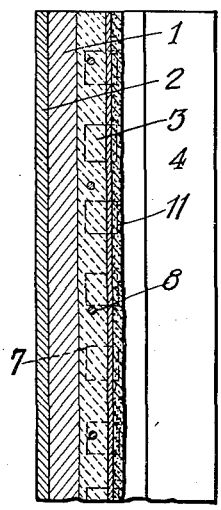


Fig. 2.

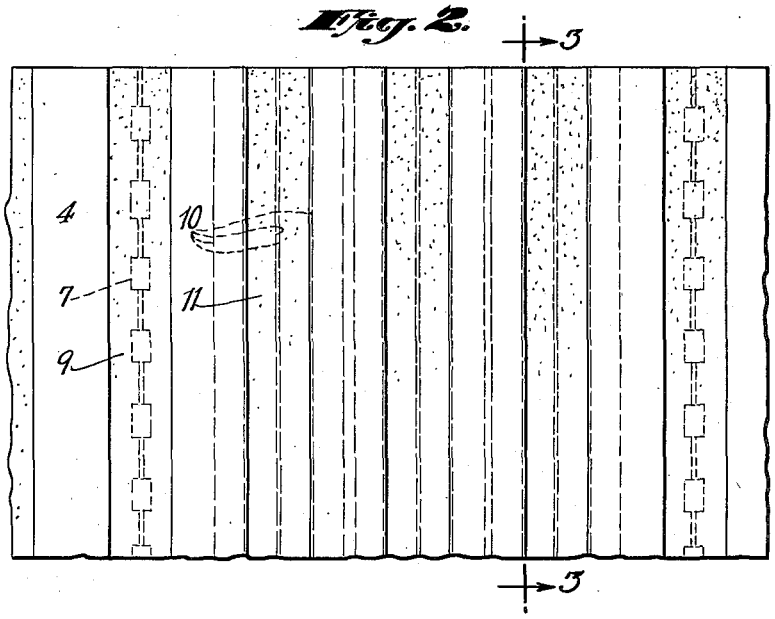


Fig. 4.

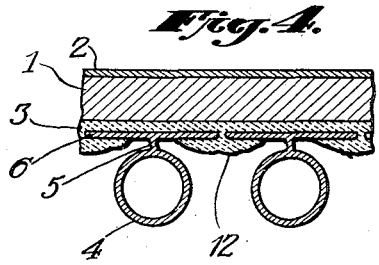
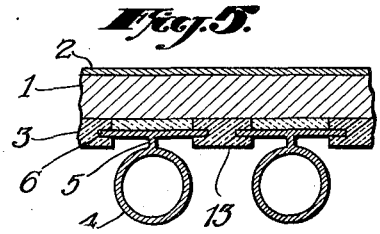


Fig. 5.



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BOILER

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Fig. 6.

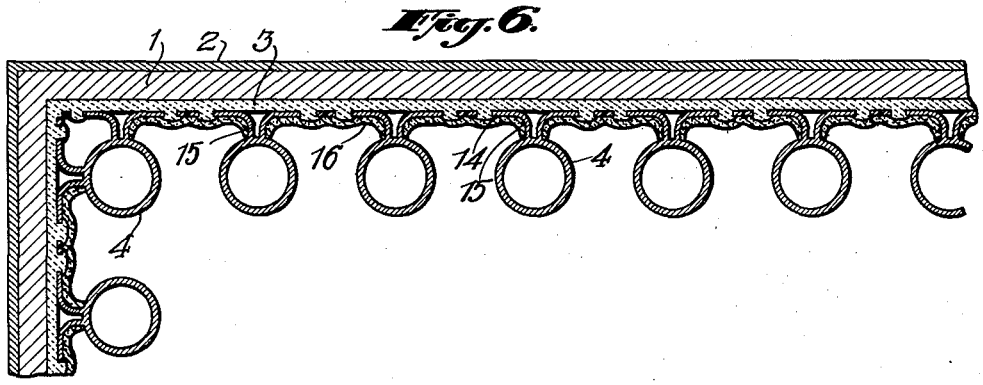


Fig. 8.

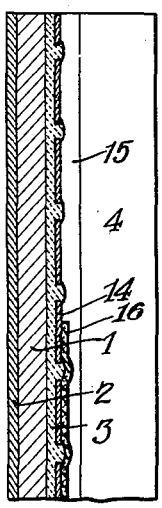
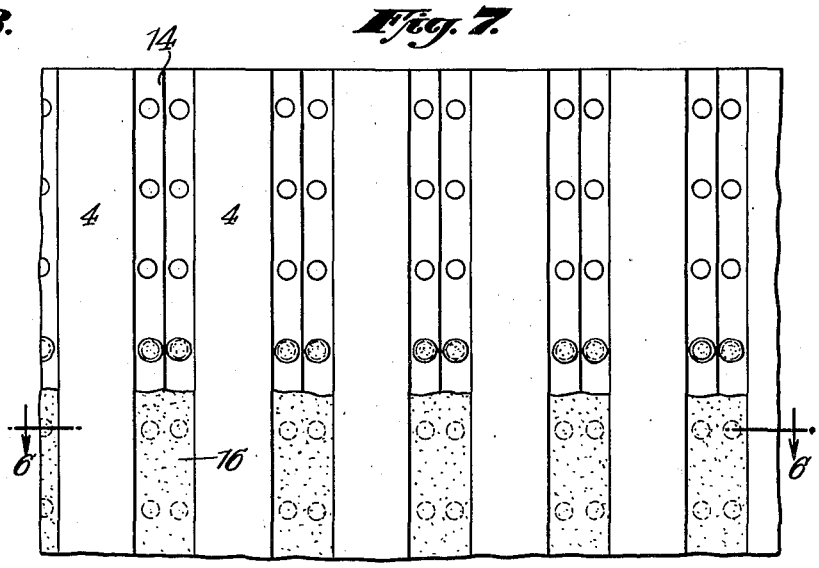


Fig. 7.



INVENTOR

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Patented Nov. 1, 1932 1,886,214

UNITED STATES PATENT OFFICE

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BOILER

Application filed March 23, 1927. Serial No. 177,534.

My invention aims to provide an improvement in boilers (and particularly furnaces of the type used for boilers) by which the capacity is increased, the improvement being particularly useful in connection with coal dust firing and the like, and utilizing most efficiently the radiant heat of the burning fuel. The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a horizontal section of a portion of the furnace wall of a boiler;

Fig. 2 is a front elevation of the same;

Fig. 3 is a vertical section of the same;

Figs. 4 and 5 are respectively horizontal sections of modified constructions;

Fig. 6 is a horizontal section on the line 6—6 of Fig. 7 of another modification;

Figs. 7 and 8 are respectively a front elevation and a vertical section of the same.

In certain previous applications I have described boilers having one or more furnace walls composed of or lined with vertical water tubes with fins in the spaces between them to expose an extended surface to the radiant heat of the burning fuel, generally coal dust, oil or other fuel projected in jets from nozzle burners. I have illustrated herein an arrangement working on the same principle and providing an even greater surface exposed directly to the radiant heat of the burning fuel in the furnace chamber.

The outer portion of the wall may be built of various materials. As illustrated in Fig. 1 there is a layer of insulating composition 1 (or it may be brickwork) with a hard finish 2 on the outer face and an inner layer 3 of highly refractory cement.

Within this wall and along one or more sides of the chamber is a row of vertical water tubes 4 connected into the circulation of the boiler. Each tube, in Figs. 1 to 5, has at the back welded to it and extending throughout its length a fin 5 the width of which is approximately half the diameter of the tube and which fin is of approximate T-shape, with side flanges 6 bearing against the inner face of the cement 3. The flanges 6 have a width approximately half the distance between centers of the tube. These flanges may contact with each other or overlap. Preferably, however, they are spaced apart slightly and are tied to the backing by means of small T's 7 placed between them overlapping their faces and extending back into the cement layer 3 and rods 8 passing through openings in the webs and imbedded in the cement. Each tube with its attached fin is separate from the others. This permits the slight relative expansion and contraction which is necessary at the high temperatures involved. For high duty boilers, for which the invention is particularly useful, it is important to provide for such differences in expansion of adjacent tubes. Also, in erection or in replacements, it is important to have each tube with its fin separate.

In building the structure the tubes are first set up with T's 7 and tie rods 8 in place, and the cement then applied and the wall completed by addition of the insulating layer 1 and the hard finish 2.

With this arrangement the direct radiant heat is applied to much more than half the circumference of the tubes themselves and to nearly the entire surface of the fins 5 and flanges 6. The result is an extraordinary acceleration of the rate of transfer of heat to the tubes, and a very rapid circulation of water through them, which is the easier because of their vertical position. Steam is generated at a correspondingly high rate.

The fins and the joint members 7 are made from standard rolled T's and the tubes are standard boiler tubes, generally seamless steel. The rapid circulation of water protects the tubes from burning out. The T-shaped fins are partially protected by the circulating water but they (as well as the small T's 7) are preferably made of non-oxidizing metal such as steel treated or coated in various known ways.

In the use of a furnace thus constructed, there is a tendency to deposit on the exposed metal surfaces a coating of powdery or granular mineral matter which is highly refractory. This coating serves the double purpose of protecting the metal from being burned out by the high temperature and also of shielding the flame against an excessive cooling effect from the metal. It is important particularly with low grades of fuel, to

prevent excessive cooling of the flame, which cooling would result in less perfect combustion and greater production of smoke.

The coating of refractory material is loose so that it may be removed by shaking or brushing and builds up only to a slight thickness. Its balance is maintained when the thickness is such as to prevent excessive cooling of the gases and further depositing of the material. It is generally maintained at the temperature of incandescence or approximately so, at which temperature the heat of the flames is maintained. This is particularly important where the gases are used to heat additional overhead tubes by convection. Such a coating is indicated at 9, accumulated on the exposed faces of the fins and the joint members. It also tends to accumulate on the tubes. But it is more useful on the fins and their flanges in protecting the back wall from excessive heating.

Instead of relying entirely on the incidental and automatic depositing of the mineral coating and the maintenance of it on the metal face of the wall, I may provide a permanent coating of this sort at the points desired. This may be done either by spreading or spraying on the metal surfaces lamp-black or similar sticky carbonaceous material, which will hold the mineral deposit produced by the flames, or by similarly applying a coating of the desired refractory mineral itself.

I have provided also, in connection with the above structure, for carrying the superheater tubes in the furnace chamber and exposing them also to the radiant heat of the burning fuel. Superheater tubes 10 are nested in groups between the fins 5 of adjacent boiler tubes; these superheater tubes being connected up to the other parts of the boiler in well known ways, not illustrated. When the heat is first applied, the superheater tubes, having no steam in them are particularly liable to be burned out. It is important therefore that they be protected by a coating 11 of mineral matter similar to the coating 9.

It is not essential that the entire surfaces of the fins be shielded. The edges farthest from the tubes are most apt to burn out, and the protection may extend to these remote parts alone. Figs. 4 and 5 show this idea carried out in different ways. In Fig. 4 a plastic coating 12 is applied to the outermost portions of the flanges 6, leaving the inner portions of such flanges and the webs 5 directly exposed the same as the tubes 4. Also a slight space is left between the edges of the flanges 6, over which the coating 12 extends. In this figure the relative thicknesses of the parts of the wall and the dimensions of the fins are shown somewhat differently from those in Fig. 1. Such details are capable of considerable variation.

According to Fig. 5 the edges of the flanges 6 are protected by being fitted into vertical grooves in the edges of a line of tiles 13 constituting the joint between adjacent fins. Joints of the same sort may be made by plates of Stellite or other high temperature metal lapped across the adjacent edges of the flanges; serving directly to protect the flanges and serving also to accumulate a protective coating where the radiant heat is greatest, that is in line with the spaces between adjacent tubes 4.

According to Figs. 6 to 8 a different construction of fin is used. Angular plates 14, 15 have their portions 15 welded in pairs to the back of each tube 4 with the portions 14 extending in line in the same way as the flanges 6 of Fig. 1. This secures approximately the same wide exposure of the fins as in Fig. 1; providing in effect a T-shape with a double web.

In this construction also the exposed faces of the fins are shielded by a coating 16 of refractory mineral matter secured in any of the ways above described. The flanges 14 have openings through which the cement 3 passes so as to lock these parts together.

Fig. 7 illustrates the coating 16 extending over only the lower portion of the wall, the metal of the fins being directly exposed above this level. The same variation may be applied to the coatings shown in the other figures. This is to protect the fins in the lower part where the flame is hottest and to get the maximum heating effect above this zone.

With such a protected metal face, the backing of the wall will be kept fairly cool and not subject to the rapid deterioration which would occur without such protection.

The protective coating described may be applied to various other constructions. See for example my co-pending application No. 177,533, filed March 23, 1927.

Various other modifications may be made by those skilled in the art without departing from the invention as defined in the following claims.

What I claim is:

1. A boiler furnace wall of water tubes with fins having edges welded to said tubes at the back, the front half and part of the back half of the tubes being exposed to the radiant heat of the burning fuel and said fins being exposed to the heat within the furnace, the tubes with their attached fins being separate from one another.

2. The boiler furnace wall of claim 1, said fins having lateral extensions to provide additional exposed surface.

3. The boiler furnace wall of claim 1, said fins having lateral extensions to provide additional exposed surface extending substantially or approximately across the spaces between adjacent tubes.

4. The boiler furnace wall of claim 1, said fins having lateral extensions to provide additional exposed surface extending substan-

tially or approximately across the spaces between adjacent tubes and a backing of plastic refractory material.

5. A boiler furnace wall of water tubes with fins having edges welded to said tubes at the back, the front half and part of the back half of the tubes being exposed to the radiant heat of the burning fuel and said fins being exposed to the heat within the furnace, the tubes with their attached fins being separate from one another, and refractory material covering at least a part of the exposed faces of said fins and serving to shield the fins and to protect the burning gases from excessive cooling.

6. A boiler furnace wall consisting of vertical tubes with T-shaped fins having the edges of their webs welded to the backs of the tubes, the tubes being spaced apart with open spaces between them and extending clear around them to the points at the back where the fins are welded, and said fins being exposed to the heat within the furnace.

7. The boiler furnace wall of claim 1, with a coating of refractory mineral matter permanently adhering to said fins.

8. A boiler furnace wall which includes water tubes with external fins, the convex surfaces of the tubes at the inner side of the wall being uncovered and exposed directly to the heat within the furnace, and a refractory mineral matter permanently coating the inner faces of said fins so as to shield them from excessive heat and to protect the burning gases from excessive cooling.

9. A boiler furnace wall having an outer portion of insulating material at the inner side of which are water tubes having their front half and part of their back half exposed to the gases within the furnace, said tubes being slightly spaced away from said outer insulating portion of the wall and having fins extending backward from the tubes and exposed to the gases within the furnace,

10. The boiler furnace wall of claim 9, said fins extending also laterally beyond the width of the tubes to provide additional exposed surface.

11. The boiler furnace wall of claim 9, said fins extending also laterally beyond the width of the tubes to provide additional exposed surface extending substantially across the spaces between adjacent tubes.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.