Nov. 18, 1941. M. H. KUHNER 2,263,004

FURNACE WALL

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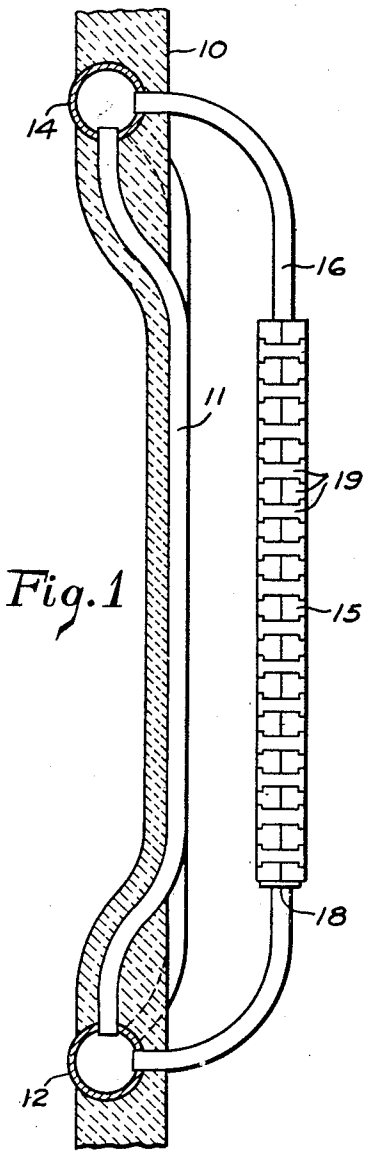


Fig. 1

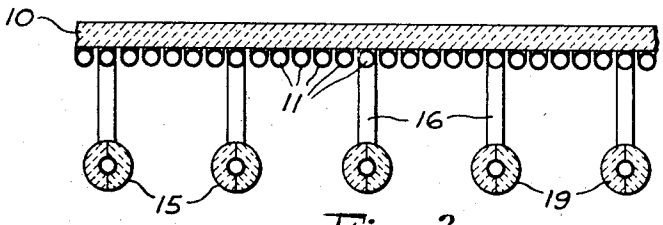


Fig. 3

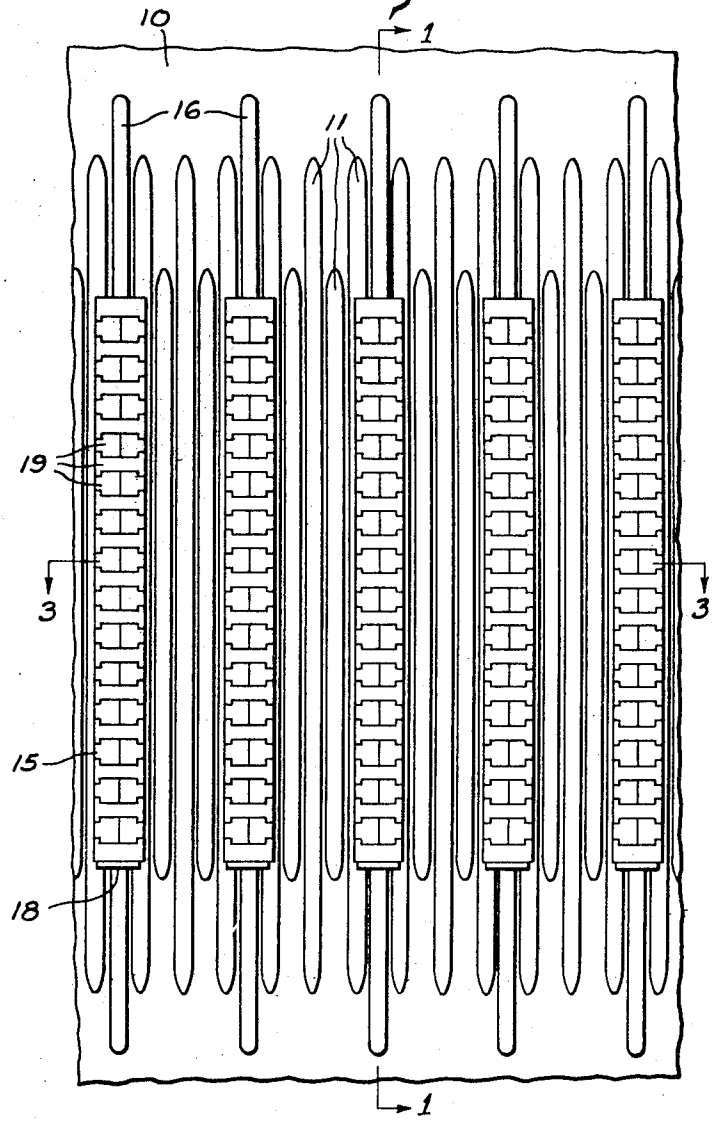


Fig. 2

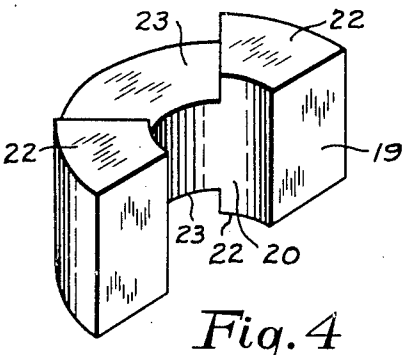


Fig. 4

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FURNACE WALL

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2 Claims. (Cl. 122—6)

This invention relates to furnace walls, and more particularly to walls of the type having metal tubes through which water is circulated for the purpose of steam generation.

Such water walls are often used with furnaces in which pulverized fuel is burned in suspension, and if the metal tubes are fully exposed to the combustion flame they will absorb radiant heat at a very high rate, thus lowering the furnace temperature. If too much water cooled metal surface is exposed there is a possibility of lowering the furnace temperature excessively and causing difficulty in maintaining ignition of the fuel, particularly at low combustion rates. This has been recognized, and various schemes have been proposed for securing blocks to the tubes or otherwise protecting them to some extent from the radiant heat. These prior constructions, however, have been complicated and expensive, subject to rapid deterioriation in service, and not readily adaptable to changes which may take place in the operating conditions.

It is accordingly one object of the invention to provide a water cooled wall of simple and inexpensive construction particularly suitable for furnaces in which pulverized fuel is burned in suspension.

It is a further object of the invention to provide a water cooled furnace wall adapted to facilitate ignition of the fuel and capable of withstanding severe operating conditions throughout a long life of service.

It is a further object of the invention to provide a water cooled furnace wall which can be readily altered to vary the furnace temperature as may be desirable due to changes in the fuel used or other conditions of operation.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawing illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is a vertical section through a water cooled furnace wall, the section being taken on the line 1—1 of Fig. 2;

Fig. 2 is an elevation of the wall as viewed from the inside of the furnace;

Fig. 3 is a section on the line 3—3 of Fig. 2; and

Fig. 4 is a perspective view of a refractory block.

The embodiment illustrated comprises an upright wall 10 of refractory material and a row of closely spaced vertical water tubes 11 on the furnace side of the wall to support the refractory material and protect it from the heat of the furnace, these tubes serving also for the generation of steam. The lower ends of the tubes 11 are connected to a horizontal header 12, and their upper ends are connected to a horizontal header 14. In order to avoid undue weakening of the headers, the ends of the tubes are staggered. As shown particularly in Fig. 1, the successive tubes enter each header alternately in a vertical plane passing through the axis of the header and in an axial plane inclined inwardly toward the furnace at an angle of approximately 45 degrees from the vertical. Any suitable and well-known connections may be provided to deliver water to the lower header 12 and to remove water and steam from the upper header 14.

The construction as so far described presents toward the furnace a water-cooled metallic surface which will absorb radiant heat at a high rate, thereby reducing the temperature of the combustion chamber. In some cases, particularly when burning pulverized fuel under conditions of relatively low demand, the temperature may be reduced below the point at which ignition of the fuel can be maintained, and the flame will be extinguished.

In order to avoid this difficulty I provide a row of spaced upright columns 15 of refractory material, located in a vertical plane parallel with the tubes 11 and spaced inwardly therefrom toward the furnace. In order to support and cool these columns, I provide upright water tubes 16 which extend through the columns. These tubes 16 are bent at their ends to connect with the headers, and as shown in Fig. 1 they preferably enter each header in the horizontal axial plane. Moreover, each tube 16 is located directly opposite one of the tubes 11 which connects with the headers in the vertical axial plane, this construction contributing to the maintenance of adequate strength in the headers. The weight of the columns 15 rests upon suitable lugs or shelves 18 which are welded or otherwise secured to the tubes 16.

While the columns 15 may be constructed in various ways, they are preferably formed of separate preformed blocks 19 of refractory material. As shown particularly in Fig. 4, each block 19 is shaped as a semi-circle, with a semi-circular groove 20 therein to fit the outside of the tubes 16. At each end of the block there is provided a pair of projecting lugs 22 separated by a recess 23. Each lug 22 extends through an

angle of approximately 45 degrees, and each recess 23 extends through an angle of approximately 90 degrees. The blocks are mounted on the tubes 16 in pairs, with each pair of blocks turned 90 degrees with respect to the pair therebeneath. In this manner the lugs 22 enter the recesses 23 on the adjacent blocks, and all the blocks are firmly held in position on the tubes.

In the operation of the furnace, the refractory columns 15 will reach a high temperature by reason of the heat which is radiated to them from the combustion flame, and the columns in turn will radiate heat into the furnace and toward the incoming fuel. At the same time these columns will serve as shields to decrease the transmission of radiant heat from the furnace to the bare water tubes 11. As a result the furnace temperature will be raised, combustion conditions will be more stable, and ignition can be maintained even at low fuel-burning rates. By adding more blocks 19 or removing some of these blocks, the height of the columns 15 can be varied to provide the best average operating conditions in a particular installation. The water tubes 16 not only support the blocks 19 but they also serve to protect these blocks from overheating, and in addition they generate steam and thus increase the capacity of the installation. The entire construction is relatively simple and inexpensive, and well adapted for a long life of service.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A water cooled furnace wall comprising a row of relatively closely spaced upright water tubes, a second row of relatively widely spaced upright water tubes spaced inwardly from the first row, refractory material mounted on the tubes of the second row to form vertical columns which are spaced apart to allow the passage of radiant heat outwardly between them, a substantially horizontal header connected to the lower ends of both rows of tubes and arranged to supply water thereto for the generation of steam, and a substantially horizontal header connected to the upper ends of both rows of tubes and arranged to receive steam and water therefrom.

2. A water cooled furnace wall comprising two vertically spaced horizontal headers, spaced upright water tubes connected at their ends to the headers in substantially the vertical axial planes of the headers, other upright water tubes located between the first-mentioned tubes and connected at their ends to the headers in axial planes which are inclined inwardly, an inner row of upright water tubes spaced apart comparatively widely and connected at their ends to the headers in substantially the horizontal axial planes of the headers, each tube in the inner row being located directly opposite one of the first-mentioned tubes, and refractory material mounted on the tubes of the said inner row to form vertical columns which are spaced apart to allow the passage of radiant heat outwardly between them.

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