Dec. 30, 1941. G. A. REHM 2,267,839

FURNACE WALL

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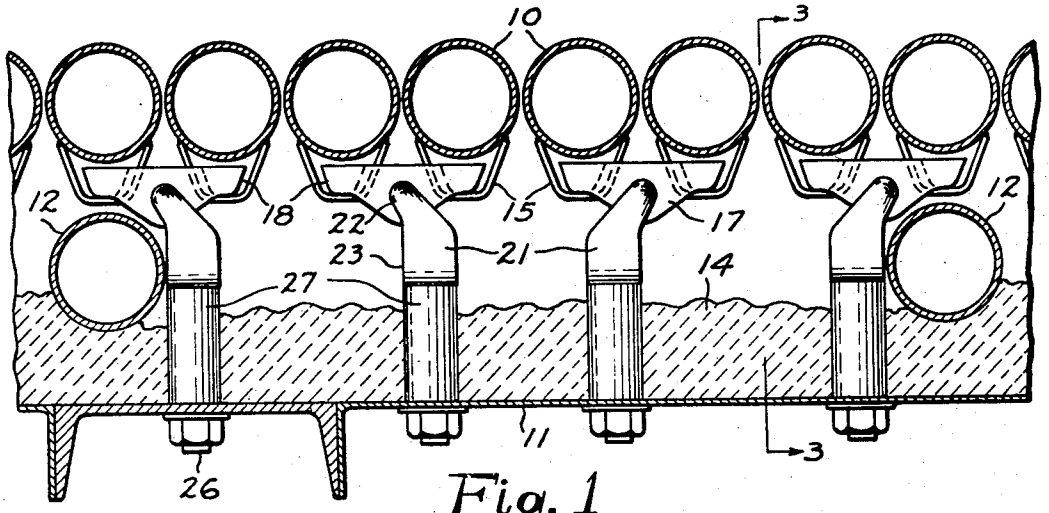


Fig. 1

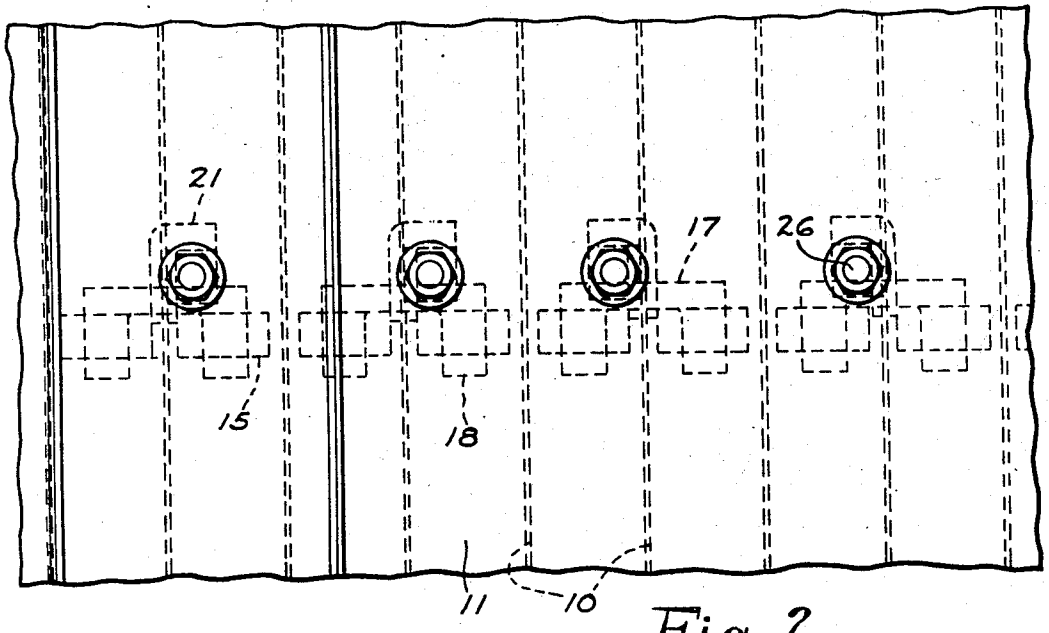


Fig. 2

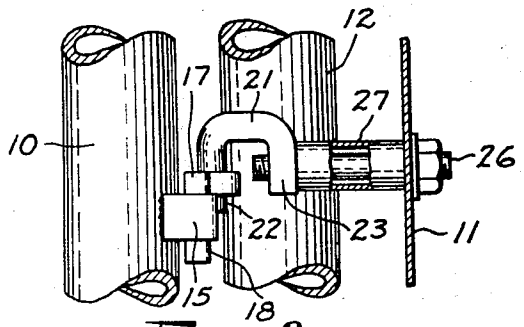


Fig. 3

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FURNACE WALL

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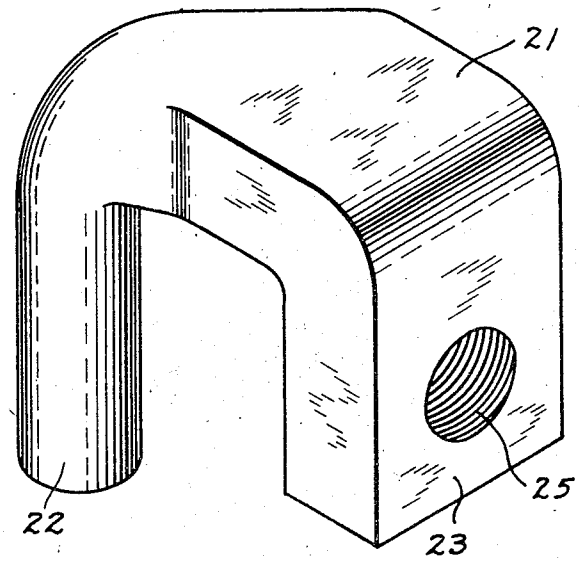


Fig. 5

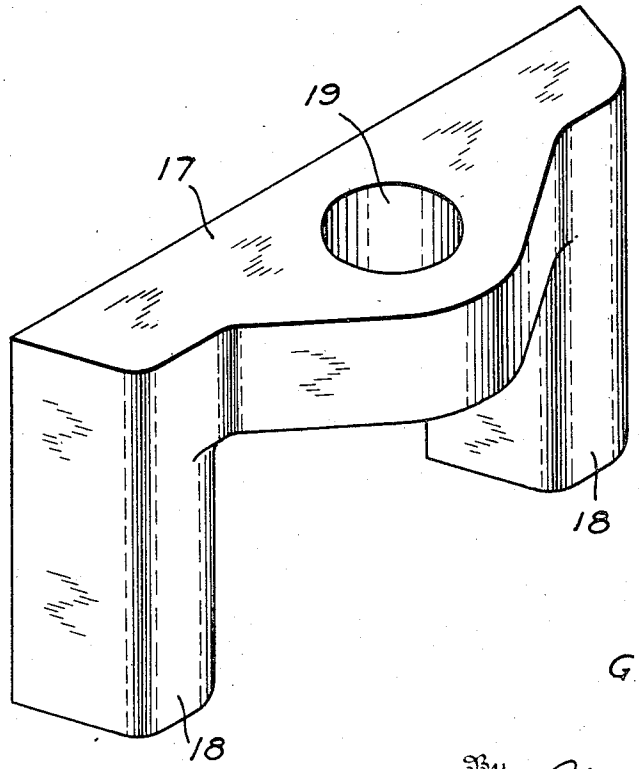


Fig. 4

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FURNACE WALL

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7 Claims. (Cl. 122—510)

This invention relates to furnace walls, and more particularly to walls of the type comprising parallel metal tubes through which water or other cooling fluid is circulated.

In the construction of combustion furnaces for steam generators it is a common practice to utilize walls having vertical water tubes which absorb radiant heat from the combustion flame and serve to produce steam at a high rate, while preventing excessive furnace temperatures. These tubes are ordinarily connected at their ends to headers in a well-known manner, but the intermediate portions of the tubes are often unsupported. When the walls are high, as in the case of large steam generators, tubes of considerable length are required, and the intermediate portions of the tubes may move laterally out of their proper positions as a result of the expansion and warping action produced by the high temperatures to which they are subjected. This may cause loosening and disintegration of the refractory insulating material which is installed between the tubes and the outer metal casing of the wall. In order to avoid this difficulty it has been proposed to secure the tubes rigidly to the metal wall casing. However, the water tubes are subjected to much higher temperatures than the casing and hence expand to a greater extent. Consequently, when the prior type of rigid connection is employed, the parts are subjected to excessive forces which often cause distortion and breakage.

It is accordingly one object of the invention to provide a furnace wall having fluid-cooled tubes and provided with simple and dependable means for holding the intermediate portions of the tubes in substantial alignment.

It is a further object of the invention to provide a simple and rugged construction for anchoring the intermediate portions of furnace wall tubes to the outer casing of the wall while allowing relative movement between these parts as a result of differences in temperatures.

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 drawings illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is a horizontal section through a fluid-cooled furnace wall, certain parts being broken away for clearness of illustration;

Fig. 2 is an elevation of the wall, viewed from the outer side thereof;

Fig. 3 is a section on the line 3—3 of Fig. 1, the refractory insulating material being removed for clearness of illustration;

Fig. 4 is a perspective view of an anchor lever; and

Fig. 5 is perspective view of a fulcrum block.

The embodiment illustrated comprises a row of closely spaced upright water wall tubes 10 adapted to be exposed to the radiant heat of a furnace and to generate steam in a well-known manner. A supporting structure in the form of an upright metal casing 11 of known construction is spaced outwardly from the water wall tubes. Between the tubes 10 and the casing 11 there are shown upright downcomer tubes 12, fewer in number than the tubes 10 and preferably located directly opposite certain of the tubes 10. The space between the water wall tubes 10 and the outer casing 11 is preferably filled with refractory insulating material 14 in known manner, but for clearness of illustration this material has been partially broken away in Fig. 1 and entirely omitted in Fig. 3.

The present invention provides means for anchoring the water wall tubes 10 to the casing 11 in such a manner as to maintain the tubes in substantial alignment while minimizing the stresses on the various parts. For this purpose a loop 15, U-shaped in plan, is secured to each tube 10 on the outer side thereof. These loops may be conveniently formed from flat metal bars bent to the proper shape and welded at their ends to the tubes. Adjacent loops 15 are connected in pairs by means of anchor levers 17, each of which as shown in Fig. 4 is provided with two downwardly extending lugs 18 and a central recess in the form of a vertical cylindrical opening 19. The lugs 18 are located at opposite ends of the lever. When the parts are assembled, each anchor lever 17 rests on the top of two loops 15, with the lugs 18 extending downwardly through the loops, thus providing pivotal connections between the tubes and the ends of the levers. In order to secure the levers 17 in a desired manner, I provide a series of fulcrum blocks 21, each of which is shaped as an inverted U in side elevation. As shown particularly in Fig. 5, each block 21 comprises two downwardly extending lugs 22 and 23. The inner lug 22 is cylindrical in shape and fits within the opening 19 in the corresponding lever 17 to provide a fulcrum on which the lever may pivot. The outer lug 23 is rectangular in shape and is provided with a horizontal tapped

hole 25. At assembly this hole 25 receives a horizontal bolt 26 which serves to secure the block 21 to the casing 11. The bolts 26 are shown surrounded by spacer sleeves 27 between the blocks and the casing, but these sleeves may be omitted and the blocks bolted directly against the casing if the wall is sufficiently thin to render this desirable.

It will be noted that the lugs 22 and 23 of each block 21 are offset laterally, as shown in Fig. 1, some of the blocks being "right hand" and others "left hand." This construction makes it possible to install the blocks without interference with the downcomer tubes 12. Obviously, if no downcomer tubes were utilized this offset could be omitted if desired.

When the furnace is placed in operation, the water wall tubes 10 will become heated and they will increase in length, causing the loops 15 and the anchor levers 17 to move upwardly or downwardly (depending upon whether the lower or the upper ends of the tubes are fixed). This longitudinal expansion of the tubes is in no respect impeded by the anchoring device disclosed, since the levers 17 are free to slide vertically on the lugs 22. Moreover, the levers 17 are free to swing slightly in a horizontal plane about the lugs 22 as fulcrums, thereby equalizing the outward forces applied by the two lugs 18 of each lever to the corresponding water wall tubes 10. With this construction the tubes 10 are held outwardly and prevented from buckling inwardly to any appreciable extent, and yet slight relative movements of the tubes will be permitted without imposing severe stresses on the anchoring parts. The construction is simple, inexpensive and dependable.

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

1. A furnace wall comprising a row of tubes, a supporting structure spaced outwardly from the tubes, a series of levers located outside the tubes and extending transversely thereof, the ends of each lever being pivotally connected to two of the tubes about parallel axes transverse to the lever, and anchor members secured to the supporting structure and each pivotally connected to the central portion of an adjacent lever about an axis parallel with the first-mentioned axes.

2. A furnace wall comprising a row of tubes, a supporting structure spaced outwardly from the tubes, a series of levers located outside the tubes, the levers extending transversely of the tubes and the ends of each lever being pivotally connected to two of the tubes about axes substantially parallel with the tubes, and anchor members secured to the supporting structure and each pivotally connected to the central portion of an adjacent lever about an axis parallel with the first-mentioned axes.

3. A furnace wall comprising a row of tubes, a supporting structure spaced outwardly from the tubes, a device secured to the outside of each tube, a series of levers located outside the tubes and extending transversely thereof, the ends of each lever being pivotally connected to two of the said devices about parallel axes transverse to the lever, and anchor members secured to the supporting structure and each pivotally connected to the central portion of an adjacent lever about an axis parallel with the first-mentioned axes.

4. A furnace wall comprising a row of tubes, a supporting structure spaced outwardly from the tubes, a device secured to the outside of each tube shaped to provide a recess, a series of levers located outside the tubes, each lever having lugs at its opposite ends which enter the said recesses adjacent two of the tubes to provide pivotal connections therewith, said lugs extending substantially parallel with the tubes, and anchor members secured to the supporting structure, the anchor members being shaped to provide lugs which extend substantially parallel with the tubes and engage the central portions of the adjacent levers to form fulcrums therefor on which the levers may pivot.

5. A furnace wall comprising a row of tubes, a supporting structure spaced outwardly from the tubes, a U-shaped loop secured to each tube on the outside thereof, a series of levers located outside the tubes, each lever having a recess at its center and lugs at its opposite ends which enter the loops on two of the tubes to provide pivotal connections therewith, said lugs extending substantially parallel with the tubes, and anchor members secured to the supporting structure and each formed with a lug which extends substantially parallel with the tubes and engages the recess in the adjacent lever to form a fulcrum therefor on which the lever may pivot.

6. A furnace wall comprising a row of tubes, a supporting structure spaced outwardly from the tubes, a U-shaped loop secured to each tube on the outside thereof, a series of levers located outside the tubes, each lever having an opening at its center and lugs at its opposite ends which enter the loops on a pair of adjacent tubes to provide pivotal connections therewith, said lugs extending substantially parallel with the tubes and anchor members secured to the supporting structure and each formed with a lug which extends substantially parallel with the tubes and passes through the opening in the adjacent lever to form a fulcrum therefor on which the lever may pivot.

7. A furnace wall comprising a row of closely spaced substantially vertical tubes, a metal casing spaced outwardly from the tubes, a U-shaped loop welded to each tube on the outside thereof, a series of horizontal levers located outside the tubes, each lever having a vertical opening at its center and integral lugs at its opposite ends which extend downwardly through the loops on a pair of adjacent tubes to provide pivotal connections therewith, and anchor members secured to the casing and each formed with a lug which extends substantially parallel with the tubes and passes through the opening in the adjacent lever to form a fulcrum therefor on which the lever may pivot.

GUSTAV A. REHM.