Sept. 16, 1941. R. SHELLENBERGER 2,256,106

FURNACE

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Fig. 2

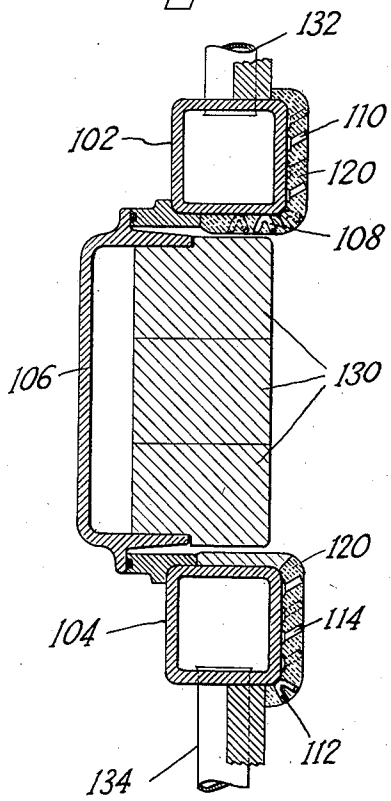


Fig. 3

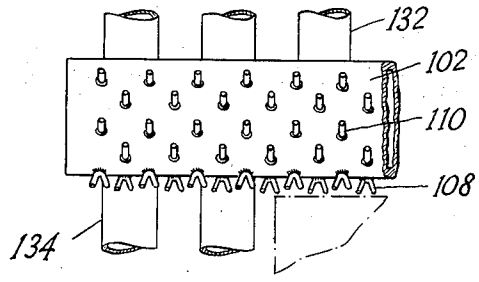
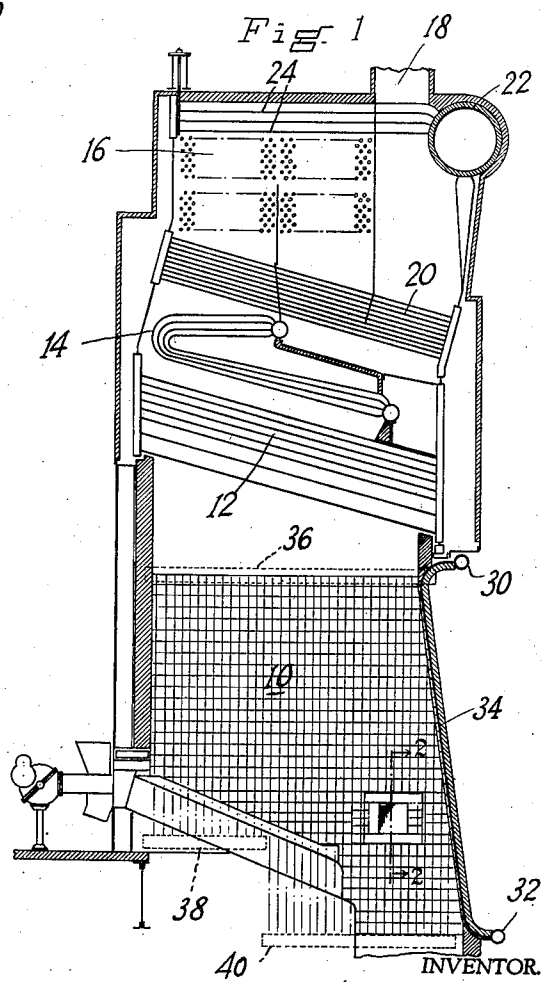


Fig. 1



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Fig. 4

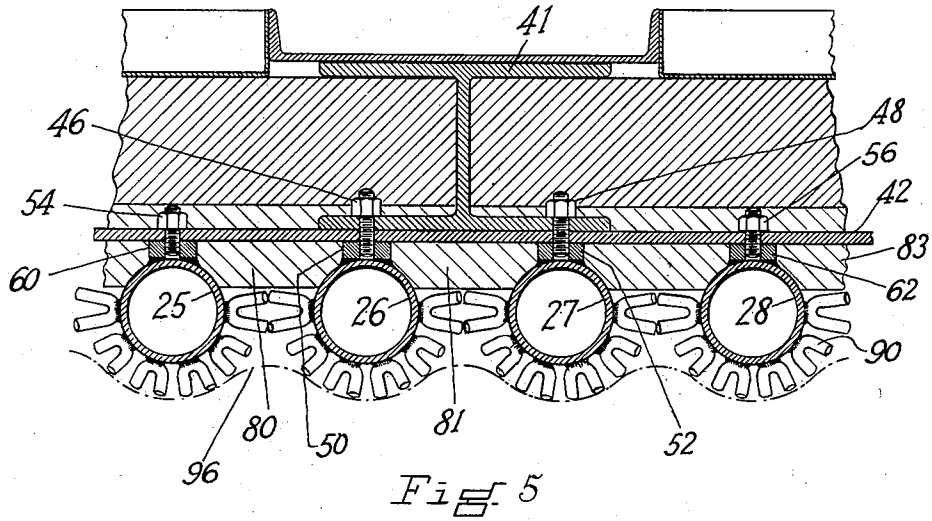
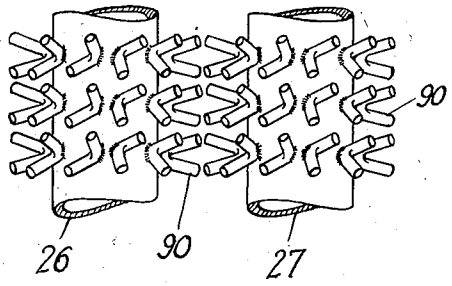


Fig. 5



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UNITED STATES PATENT OFFICE

2,256,106

FURNACE

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Application May 20, 1938, Serial No. 208,991

1 Claim. (Cl. 122—6)

This invention relates to improvements in furnaces, and it is more particularly concerned with furnace boundary structures in which wall cooling tubes support ceramic refractory material presenting a furnace face. The invention involves the provision of a particular type of metallic extensions on the tubes, these extensions being so arranged that they project into the ceramic refractory material to thermally maintain it and anchor it in operative position.

Among the objects of the invention are the provision of a fluid cooled furnace wall which can be produced at relatively low cost; the anchoring of the ceramic refractory furnace face material to the tubes in an advantageous manner; and the provision on the wall cooling tubes of integral bifurcated metallic extensions which contribute to intimate and extended contact between the tubes and the ceramic refractory portions of the wall.

Other objects of the invention will appear as the following description proceeds.

In accordance with the Revised Statutes, the distinctions which characterize the invention are pointed out in the claims forming a part of this specification. For a better understanding of the invention, however, reference should be made to the accompanying drawings and descriptive matter in which there are illustrated certain preferred embodiments of the invention.

In the drawings:

Fig. 1 is a vertical section of a steam boiler including an application of an embodiment of the invention;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a detail view in the nature of an elevation of the upper header of the Fig. 2 structure with the ceramic refractory covering removed;

Fig. 4 is a partial horizontal section of a furnace wall illustrating another embodiment of the invention; and

Fig. 5 is a detail view of the wall of the Fig. 4 construction showing a portion of the wall tubes with the illustrative metal extensions secured to the tubes.

In the drawings, the Fig. 1 boiler includes the stoker fired furnace 10 from which the furnace gases pass in succession over a bank of steam generating tubes 12, a superheater 14, and a fluid heater 16, to a flue 18. This boiler is a natural circulation boiler with the banks of steam generating tubes 12 and 20 having their inlet ends connected to the water space of the drum 22 and their outlet ends connected to the drum through the horizontal circulators 24.

When the water walls of the furnace 10 embody the wall construction indicated in Figs. 4 and 5 of the drawings, the tubes 25, 26, 27, and 28 are such wall tubes as those connected to the headers 30 and 32 associated with the rear wall 34 of the Fig. 1 boiler furnace, and such tubes as those connected to the headers 36, 38, and 40 associated with a side wall of the same furnace. The headers for these furnace walls may be appropriately connected into the boiler circulation with the upper headers 30 and 36 directly connected to the drum 22, and the headers 32, 38, and 40 connected with that drum.

The tubes 25–28, inclusive, of the Fig. 4 furnace wall are attached, at vertically spaced positions, to upright supporting members 41. The specific construction by which this attachment is secured includes the horizontal tie-bar 42 which is rigidly secured to the member 40 by the stud bolts 46 and 48. These bolts pass through a flange of the member 41 and the tie-bar, and are screw-threaded into metallic pads 50 and 52 welded to the outer sides of the tubes 26 and 27. Similar stud bolts 54 and 56 pass through the tie-bar adjacent the tubes 25 and 28 and are screw-threaded into metal pads 60 and 62.

Before the tubes 25—28, inclusive, are secured to the tie-bar, as indicated in Fig. 4 of the drawings, blocks of heat insulating material 80–83, inclusive, may be placed in position between adjacent tubes. In front of these blocks ceramic refractory material, in a semi-plastic condition, may be forced into position between the tubes and around the metallic extensions 90 to build up a ceramic refractory furnace lining covering the extensions and presenting a furnace face at the surface indicated at 96.

The metallic extensions 90 are secured to the tubes in such manner that they will resist damage to themselves by overheating, under normal operating conditions, and they are therefore of adequate cross-section in relation to their length. When they are welded to the tubes, the area of welded contact has such a relation to the cross-section of the extensions that the temperature differential between the tips of the extensions and their bases will not be excessive. The extensions are also such that they permit the application of a relatively stiff refractory material by tamping that material in place around the tubes and extensions. They are not damaged or broken off by this action. They also act to hold the ceramic refractory material in place

during service, even when cracks develop therein. The cost of such stud tubes as the tubes 25–28, inclusive, is considerably reduced by the practice of this invention, inasmuch as the number of welding operations is halved, when compared to prior art structures in which single uni-linear studs are welded to the tubes. The metallic extensions of the present invention are cut from a straight rod or bar of steel of the desired shape and cross-section. They are then bent to the shape indicated in the drawings so that a single welding operation provides a plurality of refractory holding studs. This welding is preferably done by the resistance method by pressing the bight of each metallic extension structure against the tube, passing the welding current across only one diameter of current flow path, and by continuing the pressure after a welding temperature is reached so that the original point of contact (which promotes quick heating) is enlarged to the desired area of welded surface, preferably greater than twice the cross-section of the original material from which the extension is formed.

In the structure indicated in Figs. 1, 2, and 3 of the drawings, the illustrative furnace wall is applied to the headers 102 and 104 which outline the upper and lower edges of an opening for the access door 106. The header 102 has the U-shaped extensions 108 applied to its lower surface, and uni-linear studs 110 applied to its vertical face, and similar metallic extensions 112 and 114 are applied to corresponding surfaces of the lower header 104. Thereafter, the semi-plastic ceramic refractory material 120 is tamped into its operative position covering the furnace faces of the headers and the surfaces of the metallic extensions. The metallic member forming the frame for the access door 106 is shown as supporting the ceramic refractory blocks 130.

Tubes 132 connect the header 102 with the header 36 and other wall tubes 134 connect the header 104 to the header 140, the headers being directly connected by other tubes to complete the circulation therethrough.

Whereas the invention has been described with reference to certain specific embodiments, in compliance with the Revised Statutes, and particularly Sec. 4888 R. S., it is to be understood that the invention is not limited thereto, but is rather of a scope corresponding to the scope of the sub-joined claim.

What is claimed is:

Apparatus of the character described comprising, in combination, a tubular wall cooling member defining a furnace boundary surface and adapted to be connected into fluid circulation, metallic extensions welded to the tubular member and distributed over its furnace face, each of said extensions being a unitary structure including an intermediate welding base from which a plurality of spaced legs or studs extend outwardly relative to the axis of said member, and ceramic refractory material over at least a part of the furnace face of the tubular member and covering said legs to present a furnace face, the zone (longitudinally of the extension) determined by the legs of each extension being oblique to the longitudinal axis of the tubular member with the legs of adjoining extensions overlying large connecting bodies of refractory which extend both longitudinally and transversely of the furnace face of said member.

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