April 28, 1931. J. E. BLACK 1,802,750

FURNACE

Filed Aug. 16, 1927 2 Sheets-Sheet 1

Fig. 1.

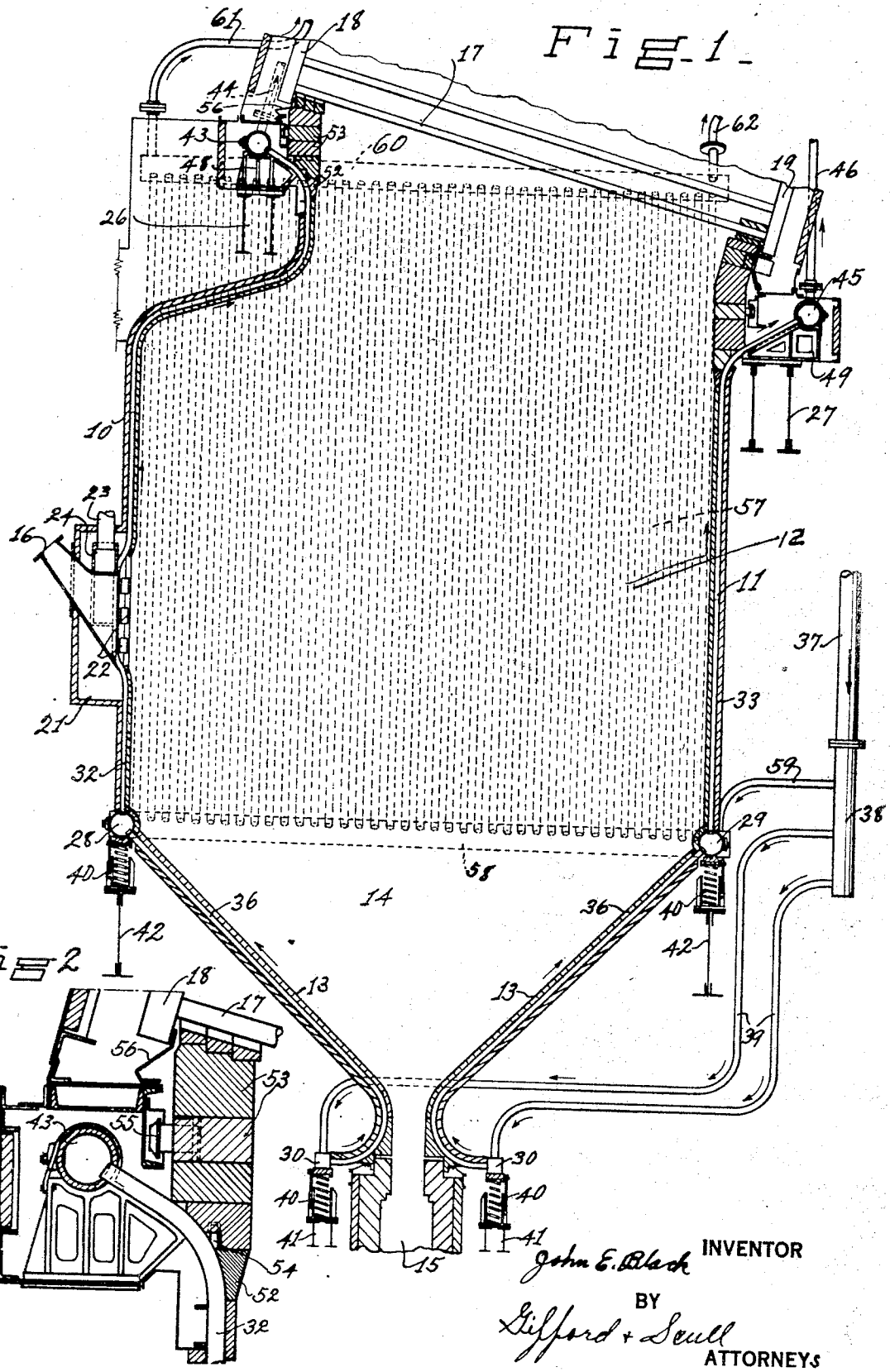


Fig 2

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Fig. 3.

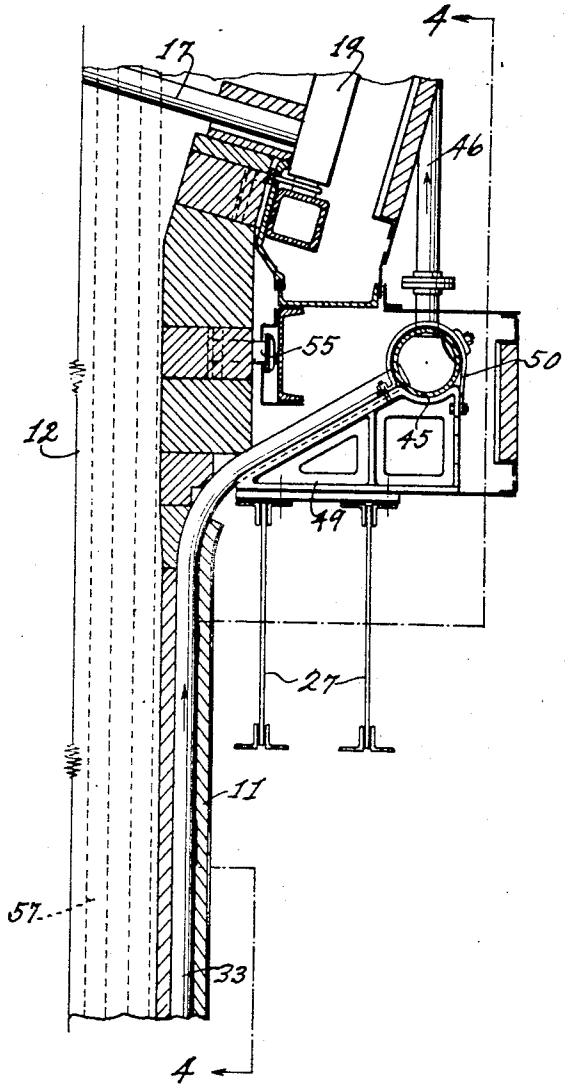
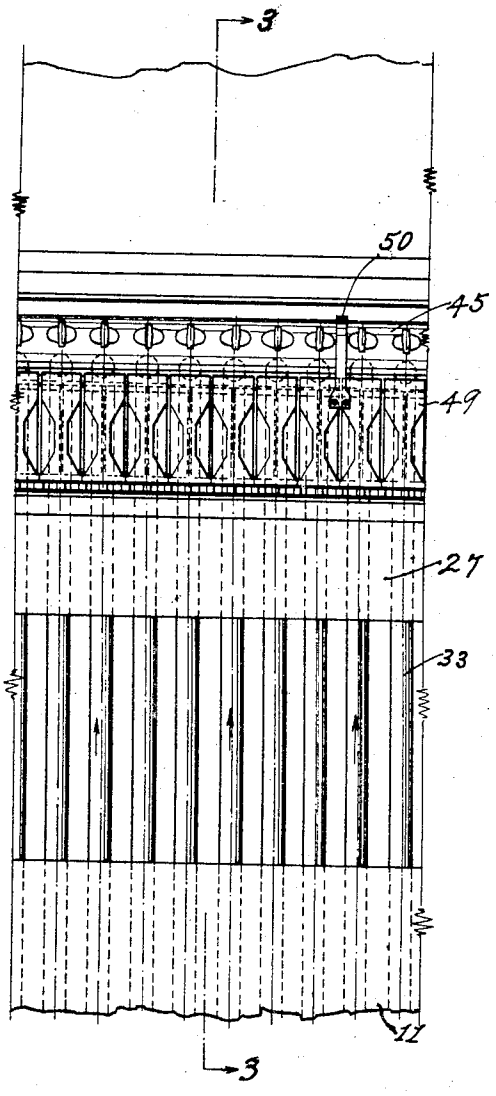


Fig. 4.



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Patented Apr. 28, 1931

1,802,750

UNITED STATES PATENT OFFICE

JOHN E. BLACK, OF RUMSON, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO FULLER LEHIGH COMPANY, A CORPORATION OF DELAWARE

FURNACE

Application filed August 16, 1927. Serial No. 213,424.

My present invention relates to furnaces and more particularly to the type wherein the wall cooling tubes and their connections both cool and support the wall and in such a manner as to permit it to expand more or less freely. This invention is particularly useful in the case of a furnace for burning finely divided fuel and enables the use of thin outer walls which may be relatively flexible, but it is not limited to such uses.

My invention will be best understood from the following description and the accompanying drawings of an illustrative embodiment thereof, in which Fig. 1 is a vertical cross-section through a powdered fuel furnace; Fig. 2 is a cross-section through an upper header in the front of the furnace; Fig. 3 is a detail showing the construction of the support for an upper header and its connecting tubes and is taken on line 3—3 of Fig. 4, and Fig. 4 is a view taken on the line 4—4 of Fig. 3.

In the illustrative embodiment of my invention, a front wall 10, a rear wall 11, side walls 12, and a floor consisting of two opposed sloping sections 13 partially enclose a furnace chamber 14. The two-part sloping floor 13 leads to a central gravity ash outlet 15. A downwardly directed fuel nozzle 16 enters the front wall. Boiler tubes 17 extend across the upper portion of the furnace chamber and are connected to the uptake and downtake headers 18 and 19 of a water tube boiler.

The fuel inlet port or nozzzle 16 enters the front wall 10 through a surrounding air box or jacket 21. Suitable ports 22 discharge a blast of air from the air box around and into the jet from this nozzle. A gas pipe 23 furnishes fuel gas under pressure to a chamber 24 located within or surrounded by the air chamber 21. Thus a gas flame may be used to start the combustion of the powdered fuel or to sustain its combustion.

Rigid girders 26 and 27 carry the upper portion of the furnace and the superincumbent boiler. The lower portion of the furnace structure is resiliently mounted to move freely under the influence of changing temperatures. This is accomplished by the use of resiliently supported headers including a lower front header 28, rear header 29 and a still lower pair of headers 30, these headers being spring supported. The furnace walls will expand downwardly upon a rise in temperature, carrying with them the headers and compressing the respective supporting springs. A suitable expansion joint, or stepped sliding joint, seals the ash outlet passageway while permitting the complementary parts of the sliding joint to move relatively to one another and to an appreciable extent.

The front and rear walls of the furnace, which are relatively thin, are built upon tubes 32 and 33 located approximately in the center of their respective walls. The front wall 10 has a portion of reversed curvature adjacent the upper end. This construction allows some slight flexing for relief of stresses due to temperature changes and, at the same time, provides a reverberatory arch above the flame. The rear wall 11 is vertical from its supporting header 29 adjacent the sloped floor.

The inner surface of the furnace wall may be made of metal blocks interposed between the cooling tubes and the flame in the chamber 14. Alternatively any other structure, such as tile, may be used. Any suitable plastic or cementitious covering may be used for the exterior covering of the wall tubes, or a block or a tile structure may be used for the outer furnace covering for protecting these tubes.

Each portion of the sloping floor 13 is carried on tubes 36 which are connected into the parallel headers 29 and 30 arranged exteriorly of the furnace and placed at different elevations. This arrangement gives a portion of each of the floor sections a curved formation of relatively large radius adjacent the ash outlet 15. This curved portion may flex slightly to relieve temperature stresses. The floor may have a covering of metal blocks or of refractory blocks or a covering of any combination of these materials.

The cooling circulation through the floors and walls of the furnace is independent of the main boiler circulation. A downcomer

pipe 37 and a distributor header 38 are connected by tubes 39 to the headers 30. The cooling tubes 36 enter their respective headers 30 with their connections lying in a horizontal plane. The curved portions of the tubes 36 adjacent the ash outlet are followed by straight portions which connect into a lower wall header either 28 or 29 of the front or rear wall, respectively.

The headers 30 are resiliently supported on coil spring units 40 carried on their supporting girders 41 and the headers 28 and 29 are likewise resiliently mounted on spring units 40 supported above girders 42. These spring units 40 may be of any design to insure strength and the necessary sideways rigidity in the support of the headers and the walls. The headers are mounted on a cap portion which is shaped to fit the header. Guide-ways or guiding pieces keep the movable portions of the spring bolster in alignment to permit a linear motion only.

The water tubes 32 of the front wall are parallel with one another throughout the greater portion of their length but are separated to admit the fuel inlet 16 and the air inlet ports 22. In addition to the portion of reversed curvature in the tubes and front wall, the tubes have another curve of relatively large radius, where they pass through the front wall to enter the upper header 43. From the header 43 the steam and water returns to the boiler through pipe 44. The header 43 and the front wall tubes 32 are supported on saddles or frames as will be described below.

The rear wall cooling tubes 33 rise vertically from the header 29. They pass through the upper wall of the furnace on a curve of relatively large radius, and enter header 45 disposed exteriorly adjacent the top furnace wall. This header 45 is connected to the boiler by a pipe 46.

The upper front header 43 and the upper rear header 45 are carried on a plurality of saddles or cast frame members 48 and 49, respectively. These saddles are grooved transversely to fit and support the headers. At right angles to this groove, each saddle has another groove to fit and support the tube in a sloping position. These supporting castings are arranged closely adjacent to one another and retain the headers by suitable straps 50.

A row of castings 52 surmounts the metal blocks which form the inner front wall or lining of the furnace. A tile wall 53 rests on this row of castings and is secured thereto by dowels 54 extending upwardly from each casting. Pins 55 extend outwardly from the tile wall and are connected to the steel frame adjacent the header 43. This connection may be arranged to permit relative horizontal movements of the steel frame and the tile wall of the furnace chamber.

The tile wall 53 is spaced below the boiler tubes 17 to allow expansion of the headers 18. A sealing plate 56 provides a flexible sealing connection between the headers 18 and the steel frame and the front wall 53, while permitting an unrestrained movement of the headers 18 relative to the wall 53.

A similar construction may be used in the tile wall adjacent the header 45 at the rear of the furnace.

The side wall 12 is provided with cooling tubes 57 connected into a lower header 58. The header 58 is connected to the distributor header 38 by a connecting tube 59. The side wall tubes discharge into an upper header 60 horizontally disposed adjacent the upper portion of the furnace chamber. This header is connected to the steam and water spaces of the boiler by tubes or pipes 61 and 62. The side wall tubes 57 may be curved outwardly in the same manner as the front or rear wall tubes. Likewise the lower header 58 may be resiliently supported. It will be understood that any of the tube and header supporting combinations may be used wherever desired or available.

My invention provides a suitable combination structure wherein expansive movements of the wall of a furnace chamber are guided without injury to the supporting tubes or the thin walls carried thereupon. It will be obvious that various modifications may be made without departing from the spirit of the invention.

I claim:

1. A saddle for the support of a header and of a tube entering therein, having an upper portion grooved to support a header and grooved at an angle thereto, to support a tube.

2. A saddle for the support of a header and of a tube entering therein, having an upper portion grooved transversely to fit and support a header and grooved at right angles thereto to fit and support a tube.

3. A saddle for the support of a header and of a tube entering therein, having an upper portion grooved transversely to fit and support a header and grooved at right angles thereto to fit and support a tube and a lower portion having a face on which the saddle is to be supported, the tube supporting grooved surface extending at an angle to the face on which the saddle is to be supported.

4. A saddle for the support of a header and of a tube entering therein, having an upper portion circularly grooved transversely thereof to fit and support a header and circularly grooved to fit and support a tube, a face on which the saddle is to be supported, the tube supporting grooved surface extending at an angle to said face, and means to secure the header to the saddle.

5. Means for cooling a furnace, said means including a plurality of tubes having por-

tions of said tubes in a single plane, a header disposed at one side of the plane of and connecting to the tubes, and saddles supporting said header, each saddle being grooved for said header, and grooved at an angle thereto to accommodate and fit a tube, said tubes being bent adjacent one end to approach the saddle on a curve and rest in said grooved saddle.

6. Means for cooling a furnace, said means including a plurality of tubes having portions of said tubes in a single plane, a header disposed at one side of the plane of and connecting to the tubes, saddles supporting said header, each saddle being grooved for said header, and grooved at an angle thereto to accommodate and fit a tube, and a second header connected to said tubes, said second header being resiliently supported.

7. Means for cooling a furnace, said means including a plurality of tubes having portions of said tubes in a single plane, a header disposed at one side of the plane of and connecting to the tubes, saddles supporting said header, each saddle being grooved for said header, and grooved at an angle thereto to accommodate and fit a tube, said tubes being bent adjacent one end to approach the saddle on a curve and rest in said grooved saddle, and a second header connected to said tubes, said second header being resiliently supported.

JOHN E. BLACK.