May 9, 1933. S. W. ALLEN 1,907,940

BOILER FURNACE

Filed Oct. 8, 1930

Fig. 4.

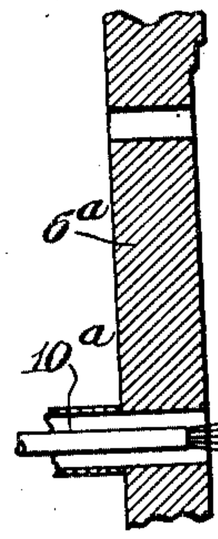


Fig. 1.

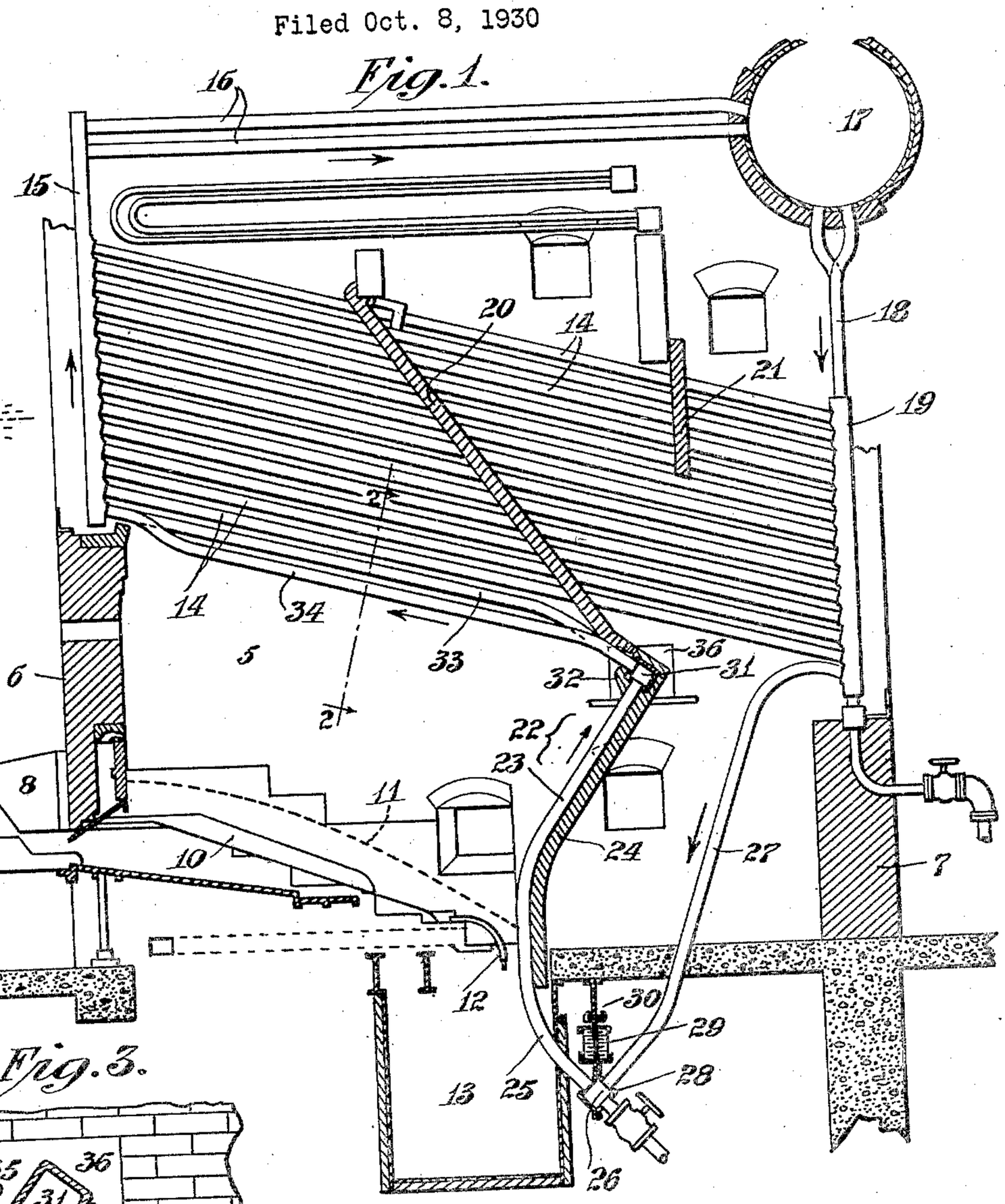


Fig. 3.

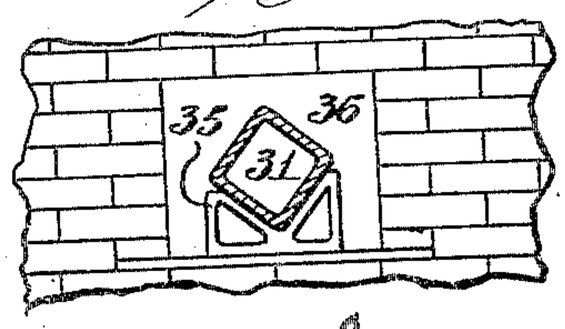
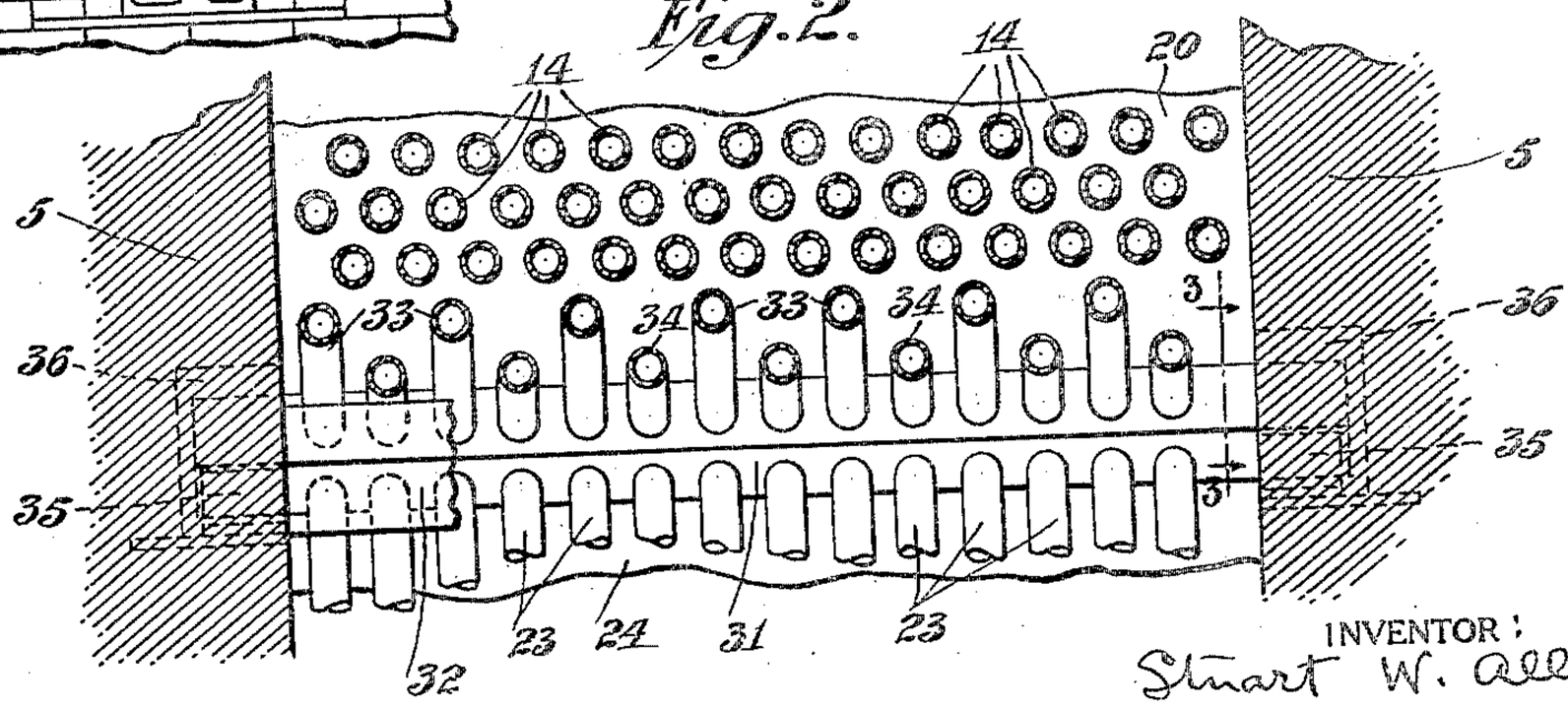


Fig. 2.



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UNITED STATES PATENT OFFICE

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BOILER FURNACE

Application filed October 8, 1930. Serial No. 487,180.

This invention is a novel boiler furnace, having especial reference to the water tube type of boiler having one or more baffles causing the products of combustion to travel successively through the passes of the boiler, and the furnace being fired in various ways for example by stoker or by the burning of injected or fluent fuel as a flame.

The general objects of the invention are to improve the operation and the efficiency of such a furnace and boiler and to reduce the maintenance cost thereof. A further object is to afford, in a practical manner, a bridge wall beneath the baffle, which bridge wall is water cooled, and to afford at the same time an effective slag screen between the combustion chamber and the boiler. Further and more specific objects and advantages of the invention will be pointed out in the hereinafter following description of an illustrative embodiment thereof or will be understood by those conversant with the subject.

To the attainment of such objects and advantages the invention consists in the novel boiler furnace and the novel features of operation, combination, arrangement and structure herein illustrated or described.

In the accompanying drawing Figure 1 is a general side elevation of the elements of the boiler furnace of this invention, with the front wall, rear wall, bridge wall and baffles shown in section.

Fig. 2 is a section taken on the inclined line 2—2 of Fig. 1 looking from the front and with certain parts broken away.

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2.

Fig. 4 is a view corresponding to a portion of Fig. 1 but showing the combustion chamber fed with fuel by an injector or burner rather than by a stoker.

As will appear more in detail the present construction comprises the water tube boiler with its higher header at what will be termed the front of the furnace and its lower header at the rear, with a baffle wall extending through the boiler, and a bridge wall below the baffle, the bridge wall comprising a system of ascending water tubes and means closing the spaces between the tubes, with downward tubes or connections bringing water to the lower ends of the bridge wall tubes and extension tubes connecting from the upper ends of the bridge wall tubes to the boiler.

The drawing indicates side walls 5, front wall 6 and rear wall 7 all supported on suitable foundations. As the indication is only illustrative, and to some extent diagrammatic, it will be understood that the sizes, proportions and illustrated arrangements may be varied indefinitely in accordance with the type of boiler and furnace to which the invention is applied.

In Fig. 1 the invention is shown applied to a stoker fired furnace. Exterior to the front wall 6 is a coal hopper 8 and therebelow coal infeeding means conventionally indicated at 9. The grate 10 may be of the retort type into the retorts of which the coal is underfed. The fuel bed for example may build up along the dotted line 11 and as the bed travels progressively toward the rear the burned out fuel is dumped intermittently or continuously by a dumping grate 12 into an ash pit 13.

Instead of the stoker and coal feeding arrangements as shown in Fig. 1, the furnace may be fired by pulverized coal, or other fluent fuel, such as oil or gas; and in Fig. 4 the front wall 6^a is shown as provided with a series of apertures, each containing an injecting means or burner 10^a by which the fluent fuel is injected into the combustion space to produce flames, in a well known manner, to traverse the combustion space and thence travel through the passes of the boiler.

The boiler is composed mainly of inclined tubes 14 delivering to an upper header 15 which in turn delivers by tubes 16 to the drum 17 of the boiler. From the drum are shown downtakes 18 leading to the lower header 19 of the boiler, resting upon the rear wall 7.

The combustion chamber is beneath the front portion of the boiler and this is separated from the rear portion by an inclined baffle 20, to the rear of which may be a sec-

ond baffle 21, so that the boiler is divided into three passes, the products finally traveling upwardly and to the usual stack.

The bridge wall 22 is arranged below the main baffle 20 and is shown composed of water tubes 23 adapted to absorb radiant heat and effect evaporation, and wall closing elements 24, which may be continued upwardly to meet the lower end of the baffle 20, so that the products of combustion are compelled to pass over the first baffle. The bridge wall is shown extending downwardly at a forward slant to a position adjacent to the dumping point of the grate, from which it is continued downwardly somewhat into the ash pocket 13, thus completing the closure of the combustion space.

The bridge wall water tubes 23 are shown as continued downwardly at 25 beyond the combustion chamber, these extensions being led out from the ash pocket through openings in the rear wall thereof and connected up to a common header 26 located at an exterior point protected from the heat of the furnace and ash pocket. From the lower end of the boiler header 19, and therefore fed by downtakes 18, is a system of downtakes 27 conducting water to the header 26 and thereby supplying water for circulation through the bridge wall tubes 23.

An advantageous structure is shown wherein the header 26 between the tubes 25 and tubes 27 is supported in a stirrup 28 which in turn is suspended by a resilient device 29 having means 30 for adjusting the height of the header. By this arrangement the bridge wall is in a substantially floating condition at its lower end, expansion and contraction being allowed for by the adjustable and resilient mounting of the lower header. The curvatures of the tubes 23 and 27 cooperate in this yielding action of the bridge wall.

Preferably all of the bridge wall tubes 23 deliver into an upper header 31, which is shown also in Figs. 2 and 3, and may be of square form. A system of shielding members or blocks 32 is shown at the fire side of the header 31, protecting it from excessive heat, and this shielding means may be composed of cast iron with or without refractory inserts, or any other material giving adequate protection to the header and the connection of the tubes therewith. From the upper bridge wall header 31 is shown a series of tubes 33 and 34 extending at a forward and upward slant to the front of the boiler, for example to the lower end of the front boiler header 15.

An advantageous construction is shown wherein the upper header 31 is solidly mounted and may be considered as a support from which the bridge wall depends and upon which the baffle may to some extent be supported. This construction is shown in Figs. 1 to 3 and involves at each end of the header 31 a saddle or support 35 solidly mounted within a recess 36 in the side wall 5. By this arrangement the entire bridge wall is substantially hung or suspended from its upper end. It is supported firmly at the top end and hangs down preferably into the ash pit in the case of a stoker furnace.

The contour of the bridge wall is of special design. It extends upwardly from the lower end and then slants or curves rearwardly at a decided incline from the center of combustion. This permits the upper header 31 to be located at a point far removed from the center of combustion. Additionally this header is protected by an interior shield. In effect the tubes 23, 33 and 34 pass to an exterior or protected point where they are connected by the header.

The lower header 26 is likewise protected at an exterior location. The bridge wall tubes extending up from the lower header are spaced fairly closely as indicated in Fig. 2, whereas the downcomers 27 are preferably spaced at least twice as widely and indeed there may be few downcomers, across the width of the furnace, so long as their total capacity will conduct all water required for circulation through the tubes 23.

The bridge wall tubes 23 are shown bare, but they may have a facing or covering so long as it is of a high heat conductive character. It is intended that the bridge wall shall absorb large quantities of radiant heat, which is carried off by evaporation in the tubes 23, thus both increasing evaporation and protecting the wall.

The spaces between the tubes 23 are closed in any suitable manner, for example by refractory or metallic closing members either at the front, or as shown at the rear, of the tubes. The manner of the closure of the bridge wall is a detail and it may be by fins or extensions of the tube.

The tubes 33 and 34 extending from the upper header 31 to the front of the boiler, or to the boiler header 15, are preferably separated or spaced into two rows, as well shown in Figs. 1 and 2. These tubes are shorter than the full length boiler tubes and they extend across the top of the combustion space. They are spaced from each other twice as widely as the spacing of the boiler tubes, as seen in Fig. 2. This arrangement gives the effect of a slag screen with two rows of widely spaced tubes. Such slag screen protects the boiler from slagging. The tubes receive radiant heat so that molten ash particles are cooled and solidified before passing into the boiler. The two rows of tubes may enter the front boiler header at two levels, but preferably they are bent near each end, as shown, so that both rows enter

the header at the same level, just as they enter the header 31 at the same level.

The described structure is a combination which gives the advantages of a water cooled bridge and of a slag screen between the combustion space and boiler. These results are obtained in a simple and practical way. The invention is well adapted to be introduced upon existing boilers since the connections to both the front and rear headers of the boiler are allowed for merely by omitting the usual lowest row of boiler tubes.

It will thus be seen that a boiler furnace has been described attaining the objects of this invention. Since many matters of operation, combination, arrangement and structure may be variously modified without departing from the principles of the invention, it is not intended to limit the invention to such matters except to the extent set forth in the appended claims.

What is claimed is:

1. In a boiler furnace, a water tube boiler having a higher front and a lower rear header, front, side and bridge walls enclosing the combustion chamber below the front portion of the boiler, an ash pit below the rear portion of the combustion chamber, a baffle wall extending through the boiler above the bridge wall, a system of water tubes comprised in the bridge wall, upper and lower headers therefor, extension tubes from the upper header to the front of the boiler, and downtakes from the rear of the boiler to the lower header; the bridge wall being supported from above and hanging into the ash pit, and the tubes of the bridge wall being continued through and from the ash pit to an exterior point whereat is said lower header.

2. In a boiler furnace, a water tube boiler having a higher front and a lower rear header, front, side and bridge walls enclosing the combustion chamber below the front portion of the boiler, an ash pit below the rear portion of the combustion chamber, a baffle wall extending through the boiler above the bridge wall, a system of water tubes comprised in the bridge wall, upper and lower headers therefor, extension tubes from the upper header to the front of the boiler, and downtakes from the rear of the boiler to the lower header; the bridge wall being supported from above and hanging into the ash pit, and the tubes of the bridge wall being continued through and from the ash pit to an exterior point whereat is said lower header, and means for yieldingly supporting the lower header.

3. In a boiler furnace, a water tube boiler having a higher front and a lower rear header, front, side and bridge walls enclosing the combustion chamber below the front portion of the boiler, the bridge wall continued into the boiler as a baffle, fixed walls enclosing an ash pit below the rear portion of the combustion chamber, a system of uptake water tubes comprised in the bridge wall, an upper header therefor and extension tubes from the upper header to the front of the boiler; the bridge wall being supported from above and hanging into the ash pit, and its water tubes being extended slidingly through the rear fixed wall of the ash pit for downward expansion thereof, and having an exterior lower header, and downtakes from the boiler to said lower header.

4. In a boiler furnace, a water tube boiler having a higher front and a lower rear header, front, side and bridge walls enclosing the combustion chamber below the front portion of the boiler, the bridge wall continued into the boiler as a baffle, fixed walls enclosing an ash pit below the rear portion of the combustion chamber, a stoker delivering to the ash pit, a system of uptake water tubes comprised in the bridge wall, an upper header therefor and extension tubes from the upper header to the front of the boiler; the bridge wall being supported from above and hanging into the ash pit, in overlapping relation to the fixed rear wall of the ash pit, and the bridge wall water tubes being continued below such overlap and extended slidingly through the rear fixed wall of the ash pit in a downward direction, for expansion thereof through such wall, and such tubes having an exterior lower header, and downtakes from the boiler to said lower header.

5. In a boiler furnace, a water tube boiler having a higher front and a lower rear header, front, side and bridge walls enclosing the combustion chamber below the front portion of the boiler, an ash pit below the rear portion of the combustion chamber, a system of water tubes comprised in the bridge wall, extension tubes from the upper ends of said tubes to the boiler, means supporting the bridge wall and its tubes from above to hang into the ash pit, and the lower ends of the tubes being connected by a header adapted to descend with expansion, and vice versa, a resilient means yieldingly positioning such lower header, and a downtake from the boiler to said lower header.

In testimony whereof, this specification has been duly signed by:

STUART W. ALLEN.