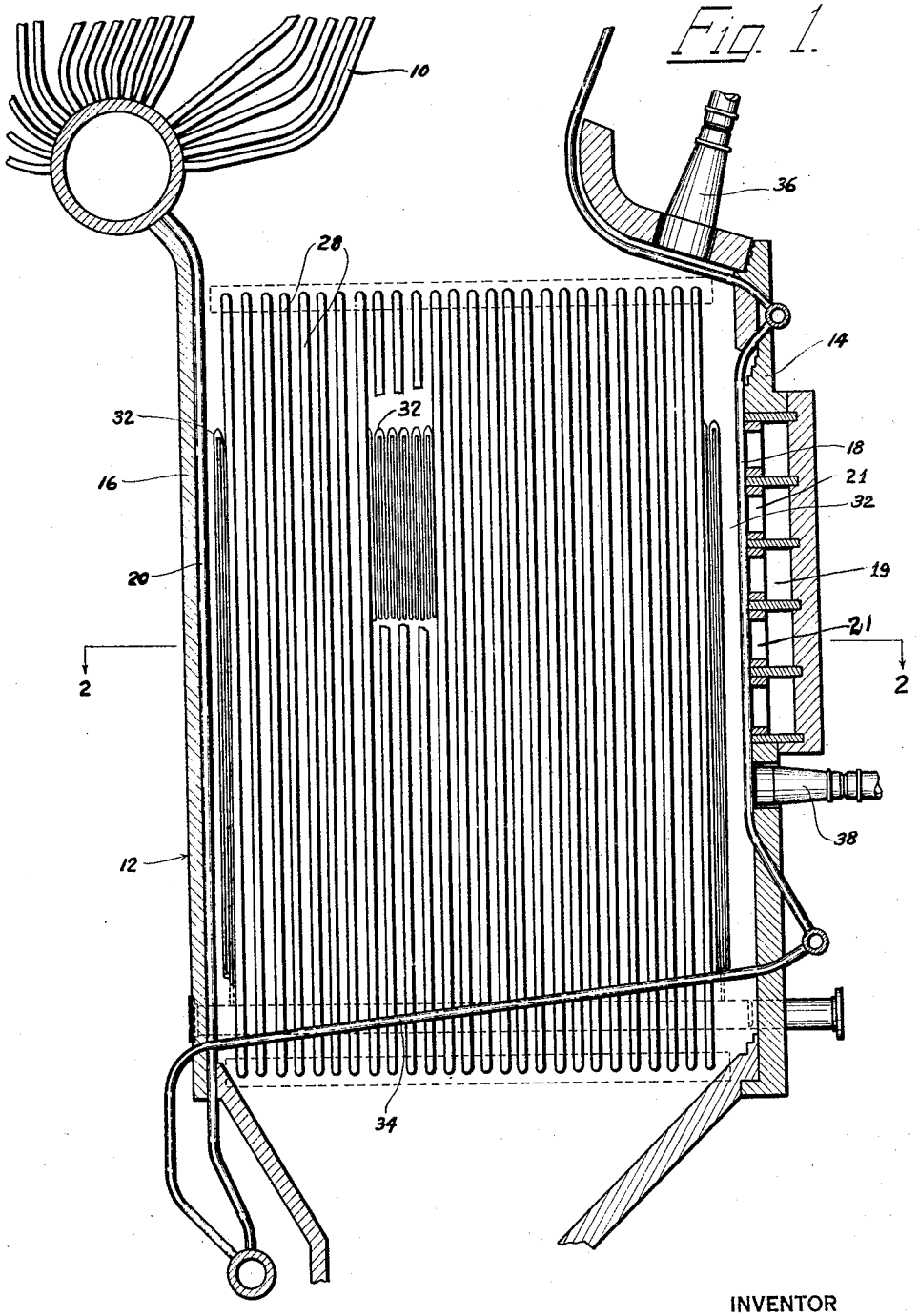
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BOILER FURNACE

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Fig. 1.



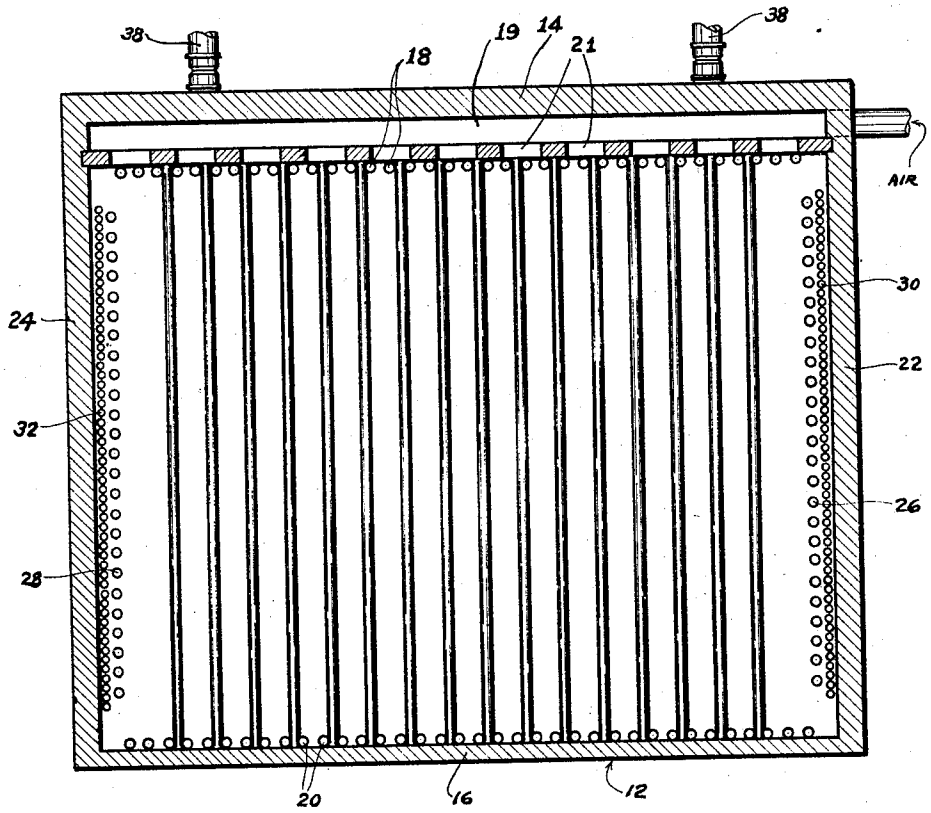
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Fig. 2.



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UNITED STATES PATENT OFFICE

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BOILER FURNACE

Application filed February 17, 1931. Serial No. 516,365.

The present invention relates to combustion chambers having fluid cooled walls and aims to provide an arrangement whereby such walls may operate at high capacity.

A common form of combustion chamber at present is one having fluid cooled walls and a row of burners set along one upper corner of the combustion chamber and directed to discharge downwardly into such chamber, and having air inlets in the upwardly extending wall whose top is near the burners. I have found, however, that in such an arrangement there is a cold segment in the combustion chamber extending along the wall through which the air enters and having a triangular cross-section in the plane perpendicular to such wall, the air for combustion not only cooling such segment by its relatively low temperature but by blowing the flames of the burners away from the points of entrance of the air to the chamber. The heat absorbing elements of the fluid cooled walls bounding such cold segment therefore are worked much below their rated capacities.

It is the object of my invention to provide an arrangement adapted to avoid the above mentioned difficulties.

In applying my invention to a furnace chamber having water cooled walls, I employ, in addition to the usual main row of burners set along one upper corner of the furnace, two auxiliary burners set beneath the main burners and discharging adjacent the side walls of the chamber. In my preferred arrangement, substantially the entire surface of the side walls is exposed to direct radiation from the flame in the furnace.

The novel features of the invention are pointed out in the appended claims. In order that my invention may be fully and clearly understood, however, I will now describe in detail, in connection with the accompanying drawings, a furnace chamber having fluid cooled walls and forming an illustrative embodiment of my invention. In said drawings,

Fig. 1 is a vertical sectional view through a furnace chamber looking at one of the side walls, parts being broken away for purposes of illustration; and

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

Referring to the drawings more in detail, the installation illustrated therein comprises a boiler 10 having a furnace chamber indicated generally by reference character 12. The front and rear walls 14 and 16 of chamber 12 are shown as having on their inner faces heat absorbing groups of water tubes 18 and 20 respectively, and wall 14 has an air chamber 19 along its face from which air for combustion is supplied to chamber 12 through apertures 21, 21. The side walls 22 and 24 of chamber 12 also have on their inner sides groups of water tubes 26 and 28 respectively, between which and the inner face of the walls proper are groups of superheater tubes 30 and 32 respectively.

The tubes in groups 26 and 28 are spaced apart sufficiently so that heat radiation perpendicular to the face of walls 22 and 24 freely strikes tubes in the superheater groups although the superheater tubes are shielded somewhat from the non-perpendicular radiation of the furnace by the water tubes 26 and 28 to prevent overheating of the superheater tubes. The tubes in groups 18, 20, 26 and 28 are connected into the circulation of the boiler 10 in the usual manner. Preferably also the bottom of the furnace chamber 12 is cooled by a horizontally inclined group of tubes 34 which is shown as connected to the tubes 18. The tubes of the superheater groups 30 and 32 are connected to receive steam from boiler 10 in the usual manner. In Fig. 1, suitable headers for the several groups of tubes 18, 20, 28 and 34 are indicated. The use of such headers is well

understood and they have not been shown in Fig. 2.

Along the corner of the chamber 12 at the upper end of the front wall 14 is a row of burner nozzles 36 arranged to discharge downwardly and rearwardly into chamber 12 in a known manner. The flames from the row of burners 36 extend downward substantially the whole depth of the chamber 12 and also extend laterally substantially the entire width of the furnace chamber so that the tubes in groups 18 and 20 on the inner faces of the front and rear walls of the chamber receive radiation almost perpendicularly from the flames over substantially the entire area of the front and rear walls 14 and 16. As the flames from burners 36, however, flow somewhat diagonally of chamber 12, portions of the side walls 22 and 24 are not covered by the sheet of flame from furnace 36 and receive radiation therefrom not only from a greater distance, but at such an angle that a good deal of the radiation is reflected instead of absorbed. Also the flames are at a considerable average distance from wall 14. The heat absorbing groups of tubes 18, 26 and 28 of the chamber 12 therefore have not been worked under optimum conditions. In accordance with my invention, I overcome this difficulty by using auxiliary burners 38, 38 arranged to discharge approximately horizontally through the front wall 14 at a level below the center of air chamber 19. Preferably the burners 38 discharge parallel and adjacent to walls 22 and 24, but I do not limit myself to either of these features as I consider that any arrangement of auxiliary burners with downwardly discharging main burners and in which the discharge of the auxiliary burners is substantially parallel to the central thread of the ingoing air stream and substantially fills with flame the portion of the lower corner of the combustion chamber adjacent the air admission wall which is alongside the side walls falls within my invention. The flames from burners 38 spread over substantially the entire area of the side walls 22 and 24 and thereby greatly increase the radiant heat absorbed by the groups of tubes on such walls, as well as the portion group 18 adjacent burners 38. The turbulence resulting from the auxiliary burners 38 also improves the combustion efficiency of the furnace 12. While burners 38 are shown as below air chamber 19, it is sufficient to obtain the desired results in the arrangement illustrated if they are not above the level of the center of the stream of ingoing air.

The improved heat absorption due to the burners 38 is noticeable not only with respect to the water wall groups of tubes 18, 26 and 28, but also with respect to the superheater groups of tubes 30 and 32, since the tubes in these groups are similarly placed with relation to the flames in the furnace as tubes 26 and 28. The arrangement in accordance with my invention therefore not only improves the heat absorption of the furnace as a whole and of the end walls in particular, but increases the proportion of the heat absorbed by partially screened superheater tubes on the side walls of the furnace.

The burner arrangement herein disclosed has, moreover, the great advantage as to radiant superheaters of spreading the combustion over a greater area and thereby decreasing the unit intensity of radiation falling on the superheater units for a given rate of fuel consumption, whereby the maximum metal temperatures are reduced. The arrangement in question has also the important advantage as regards superheaters in that it creates sufficient turbulence to cause the combustion to be completed much closer to the burners. As the flame always tends to spread as it leaves the burner, completing the combustion closer to the burners greatly lessens the direct impingement of the flame on the superheater and thereby protects pro tanto the metal of the superheater from overheating.

I claim:

1. In combination, a furnace chamber having heat absorbing side walls, main burners set along the upper part of one of the other walls of said chamber and discharging downward into the chamber, means for introducing air into said chamber through a vertical wall thereof transverse to said side walls and beneath said main burners, and auxiliary burners set beneath the discharge from said main burners and to discharge into said chamber through said vertical transverse wall, at a level near the lower edge of the stream of air from said means.

2. The combination of a furnace chamber having heat absorbing front, rear and side walls, main burners set along one of said walls other than the side walls and discharging diagonally downward into the chamber, means for discharging a stream of air into said chamber below said main burners, and auxiliary burners set to discharge into said chamber below said air stream and in the direction of said air stream and adapted and arranged to cover with flames, in conjunction with said main burners, substantially the entire area of said side walls.

3. The combination as set forth in claim 2 and in which the heat absorbing side walls have means for superheating steam.

4. In combination, a furnace chamber having heat absorbing side walls, main burners set along the upper part of one of the other walls of said chamber and discharging downwardly into the chamber, means for introducing air into said chamber through a vertical wall thereof transverse to said side walls and beneath said main burners, and auxiliary

burners set beneath the discharge from said main burners and to discharge into said chamber thru said transverse wall at a level lower than the air stream from said means.

5. In combination, a furnace chamber having front, rear and side walls, a radiant type superheater along one of said side walls, main burners set along one of said walls other than said side walls and arranged to discharge downwardly into the chamber, means for discharging a stream of air into said chamber below said main burners, and an auxiliary burner set to discharge into said chamber in the same direction as said air stream and near the lower edge thereof and also adjacent the one of said side walls having said superheater therealong.

CHARLES W. GORDON.