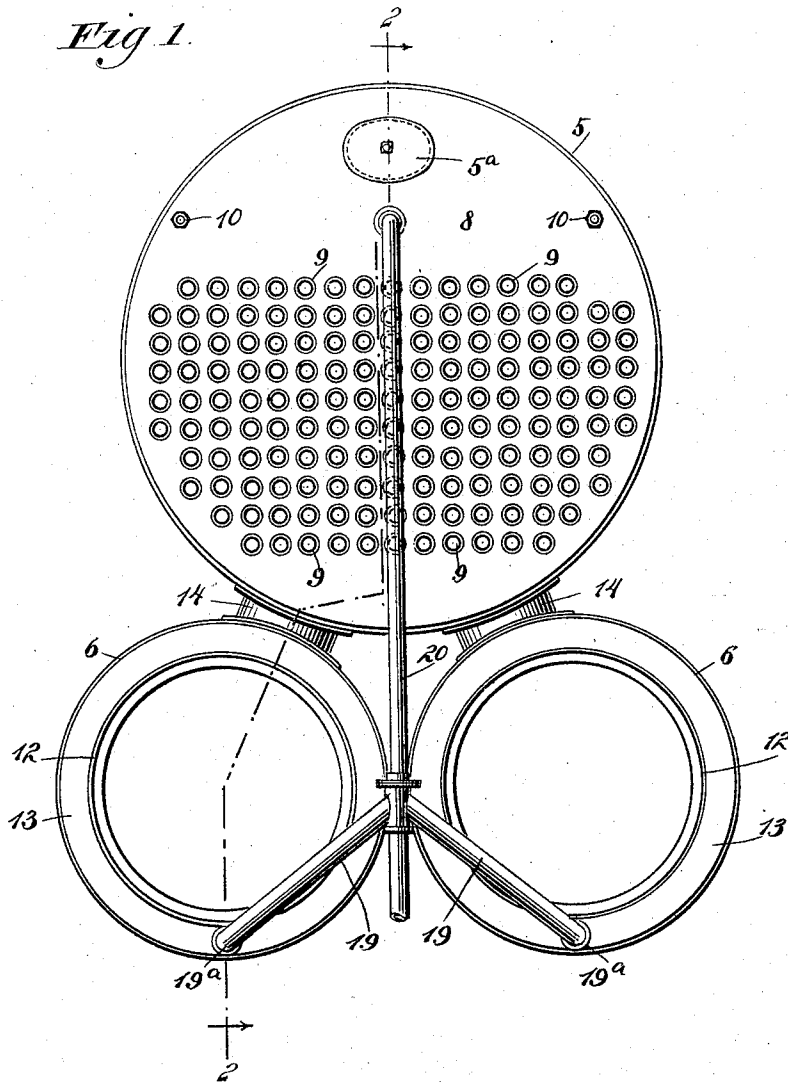


W. HOPKINS.  
STEAM BOILER AND FURNACE THEREFOR.

No. 605,427.

Patented June 7, 1898.

Fig. 1.



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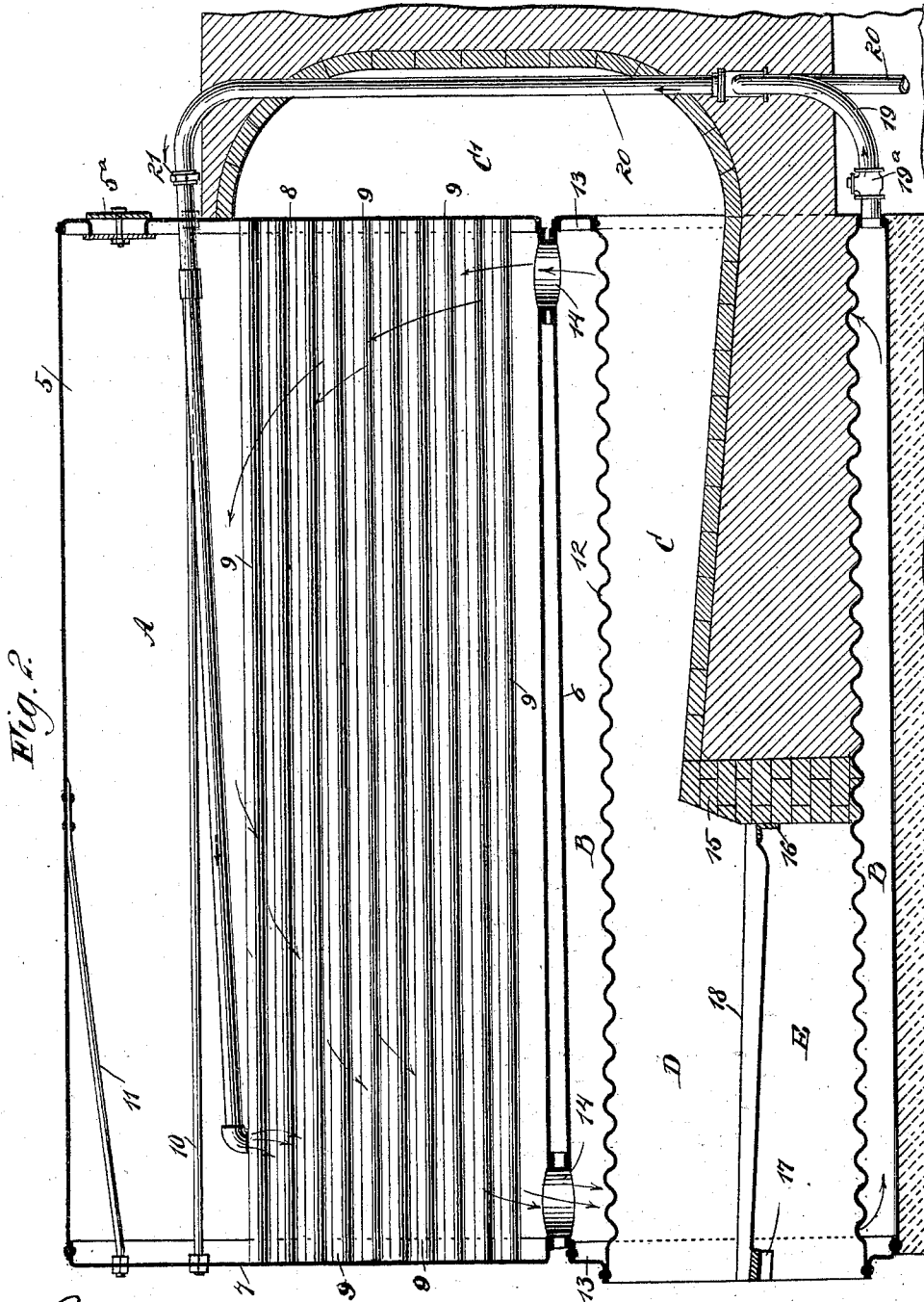


Fig. 2.

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# UNITED STATES PATENT OFFICE.

WILLIAM HOPKINS, OF DUBUQUE, IOWA.

## STEAM-BOILER AND FURNACE THEREFOR.

SPECIFICATION forming part of Letters Patent No. 605,427, dated June 7, 1898.

Application filed September 14, 1897. Serial No. 651,656. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM HOPKINS, of Dubuque, in the county of Dubuque and State of Iowa, have invented a new and Improved Steam-Boiler and Furnace Therefor, of which the following is a full, clear, and exact description.

This invention relates to steam-boilers of the horizontal fire-tube type, having a fire-chamber extending longitudinally below the boiler-shell.

One object of my invention is to provide a steam-boiler of the indicated type with one or more tubular fire-chambers or furnaces, each having an annular water-space extending throughout the length of the furnace and connecting said annular water-space near each end of the furnace and boiler with the shell of the latter in a manner which will insure a rapid continuous water circulation throughout the interior of the steam-boiler, thus assuring its maximum efficiency as a steam-generator and obviating strains due to unequal expansion of material composing the boiler.

A further object is to provide the tubular fire-chamber or furnace for the steam-boiler with a corrugated interior fire-wall that is essentially cylindrical and held concentric within the exterior shell of the furnace, thereby affording an annular water-space around the cylindrical fire-wall, which is to be branch-connected by thimbles or like means with the water-space in the boiler to establish free water circulation between the water-holding compartment of the furnace and the water-space of the boiler.

The invention further comprehends the provision of one or more water-circulating pipes extended between the annular water-space of the furnace and the interior of the boiler, said tubular conduit being exposed to the heat of the furnace, whereby the temperature of the water passing upward through the said pipe will be raised before it enters the boiler. Furthermore, the feed-water passing from a cold-water supply is introduced within the lower portion of the upright circulating-pipe, whereby said feed-water is mingled with the water circulating between

the boiler and water-space in the furnace and is thus heated before its introduction within the steam-boiler.

In attaining the indicated objects the invention consists of certain details of construction and combinations of parts, as is hereinafter described, and defined in the appended claim.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in both figures.

Figure 1 is a rear end elevation of the improved steam-generator device, and Fig. 2 is a sectional side view taken substantially on the line 2 2 in Fig. 1.

In the drawings, that illustrate an embodiment of the features of the improvement, 5 indicates the cylindrical shell of the steam-boiler, and 6 the exterior shell of the furnaces, two of which are represented in Fig. 1.

While it is preferred to furnish a steam-boiler of considerable diameter with two of the improved furnaces, it is to be understood that a single furnace may be employed if suitable relative dimensions are afforded to adapt one furnace for sufficient service in connection with said boiler.

The boiler-shell 5 is closed at each end by the flue-sheets 7 8, peripherally flanged in the usual way, and secured in place, respectively, at the front and rear ends of said shell by rivets or equivalent means.

A suitable number of flues 9 is held within the shell 5 and longitudinally extended there-through by a fixed engagement of the ends of said flues within spaced perforations formed in the flue-sheets 7 8. The several series of flues are so disposed within the boiler as to afford an adequate steam-space A above them and also a water-space surrounding the nest of flues to provide for the circulation of water between the outer flues of each row and the inner surface of the boiler-shell, as usual.

In the steam-space A stay-bolts 10 extend longitudinally between the flue-sheets 7 8, and are secured in said flue-sheets by set-nuts or other means. One or more braces 11 may be extended from the front flue-sheet 7 to the crown of the boiler-shell and secured thereto,

as shown in Fig. 2. The two similar furnace-shells 6 are of substantially the same length as the boiler-shell 5 and are of less diameter than said shell. Within each of the furnace-shells 6 a cylindrical plate-metal fire-wall 12 is secured, having such decreased diameter as will produce an annular water-space B between the fire-walls and the shells.

A preferred means for spacing and securing the ends of the fire-wall 12 to the exterior furnace-shell 6 is shown in Fig. 2. Said means consists in the provision of a spacing-ring 13 for each end of the furnace, which rings may be formed of sheet metal, each having a peripheral flange and also a flange formed at the inner edge of the ring, both of said flanges on each spacing-ring being adapted to closely contact, respectively, with an end portion of the shell 6 and of the fire-wall 12 and are secured thereto by rivets or other equivalent means.

Preferably the plate-metal cylindrical fire-wall 12 in each furnace is corrugated, whereby a greatly-increased heating-surface is afforded and the wall is strengthened and stiffened sufficiently to render it unnecessary to employ stay-bolts between the fire-wall and exterior shell 6.

Near each end of the boiler-shell 5 and the corresponding ends of the similar furnace-shell 6 suitable apertures are formed in these shells, and the furnace-shells are joined to the boiler-shell at a proper distance from each other on the lower side of the boiler-shell by rings or thimbles 14, attached to the shells 6 and 12 by any preferred means, the thimbles encircling the apertures in the shells, thus affording free passages for water at each end of each furnace and the boiler.

Preferably the thimble at the rear end of each furnace-shell 6 is made somewhat shorter than the forward thimble, which will cause the upper side of each furnace-shell 6 to incline from front to rear, as indicated in Fig. 2.

In each compartment produced within the cylindrical wall 12 a transverse bridge-wall 15 is located at a proper distance from the front end of the furnace, said wall being constructed of fire-brick or other refractory material, and masonry or other filling material is introduced behind the bridge-wall of a suitable height to form a draft-passage C, which extends from the bridge-wall 15 to the rear end of the fire-wall 12.

Transverse bearing-bars 16 17 are respectively affixed at the front of the bridge-wall 15 and the front end of the fire-wall 12, which bars afford support for a series of grate-bars 18, thus providing a combustion-chamber D above the grates and an ash-pit E below the same.

When the complete steam-generator is erected at any locality for service, the boiler and furnaces are inclosed with masonry walls to provide a draft-flue at the front of the boiler, or this draft-conduit, which must be in connection with an upright stack or chimney

of any available construction, may be of metal, if preferred, and as this is an ordinary provision of well-known form it is not considered necessary to illustrate it in connection with the improvements.

At the rear end of the boiler and near the crown of the shell 5 a manhole is formed, which is normally closed by a bonnet 5<sup>a</sup>, of usual construction, which when removed will allow an inspector to have access to the steam-space A of the boiler.

The rear ends of the boiler-flues 9 are connected with the rear end of the draft flue or passage C by a flue extension C', which may be formed of masonry or other material, and it will be seen that the products of combustion which pass over the bridge-wall 15 will be drawn rearwardly and upwardly through the passage C C' and thence forwardly through the flues 9 to heat the water in the shell 5 and evolve steam therefrom.

In the lowermost portion of the annular water-space in each furnace, at the rear end of the same, one end of an upwardly-bent branch water-pipe 19 is secured, these pipes being joined at their upper ends to the body of the upright water-feed pipe 20, which is shown broken at its lower end, but which is designed in service to be extended to a source of water-supply under pressure.

Above the point where the branch pipes 19 join the feed-pipe 20 the latter is upwardly projected through the draft-flue extension C', as shown in Fig. 2. Above said upright flue C' the water-supply pipe 20 is bent at a right angle to extend it forwardly through the rear flue-sheet 8 of the boiler, wherein it is rendered steam-tight by any preferred means, and said pipe is projected toward the front flue-sheet 7, terminating near the latter in an L, that discharges downwardly. Preferably the water-feed pipe 20 is constructed of two sections, which are joined together by the "union-fitting" 21.

In each branch water-pipe 19 a check-valve 19<sup>a</sup> of ordinary construction is introduced, as shown in Fig. 2, these valves being provided to prevent a current of cold water from passing through the branch pipes into the rear ends of the annular water-spaces B when feed-water is periodically passing through the pipe 20, as may be necessary to keep a proper quantity of water in the boiler.

Assuming that the improved steam-generating apparatus is erected as specified and is in operative condition, it will be seen that when a proper quantity of water is introduced within the boiler-shell 5 and the water-spaces B in the furnaces the products of combustion evolved from the fire in the chambers D will pass rearwardly in contact with all the interior surface of the fire-walls 12 above the grate-bars and the lower surface of the draft-passages C and pass thence forwardly through the tubular flues 9, as before mentioned. The heat applied to the upper portion of each fire-wall 12 will quickly raise the tempera-

ture of the water held in the annular spaces B, and as the crowns of the shells 6 incline from front to rear it will be evident that water immediately over the fires in the chambers D and that is most quickly heated there-  
 5 by will be rarefied and pass rearward and then upward through the rear thimbles 14. After entering the boiler-shell 5 through the rear thimbles 14 the intensely-heated water  
 10 passes upwardly and forwardly between the flues 9, from which it receives additional heat, and steam generated thereby occupies the space A. The current of water from the rear end of the boiler is measurably cooled  
 15 by water that passes up through the branch pipes 19 and feed-pipe 20 from the lower part of the annular chambers B. Now as the partly-cooled water becomes heavier it descends through the forward thimbles 14 into  
 20 the spaces B to again become highly heated from contact with the crowns of the fire-walls 12 and thence passes rearwardly, thus establishing a continuous uniform circulation in the furnace and boiler-shell for the copious  
 25 generation of high-pressure steam, the direc-

tion of water circulation being clearly indicated by arrows in Fig. 2.

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

A boiler having a cylindrical boiler-shell, a series of fire-tubes run through said shell, two exterior furnace-shells located beneath the boiler-shell and running parallel therewith and communicating therewith at each  
 30 end, a fire-wall within each furnace-shell, the spaces inclosed by the front portions of the fire-walls serving as fire-boxes, means engaging said shells and forming a passage establishing communication between the fire-  
 35 walls and the fire-tubes of the boiler-shell, and pipes passing respectively from the rear bottom portion of each furnace-shell upward to the upper portion of the boiler-shell where-  
 40 by to lead the water from said lower rear portions back to the boiler-shell. 45

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Witnesses:

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