

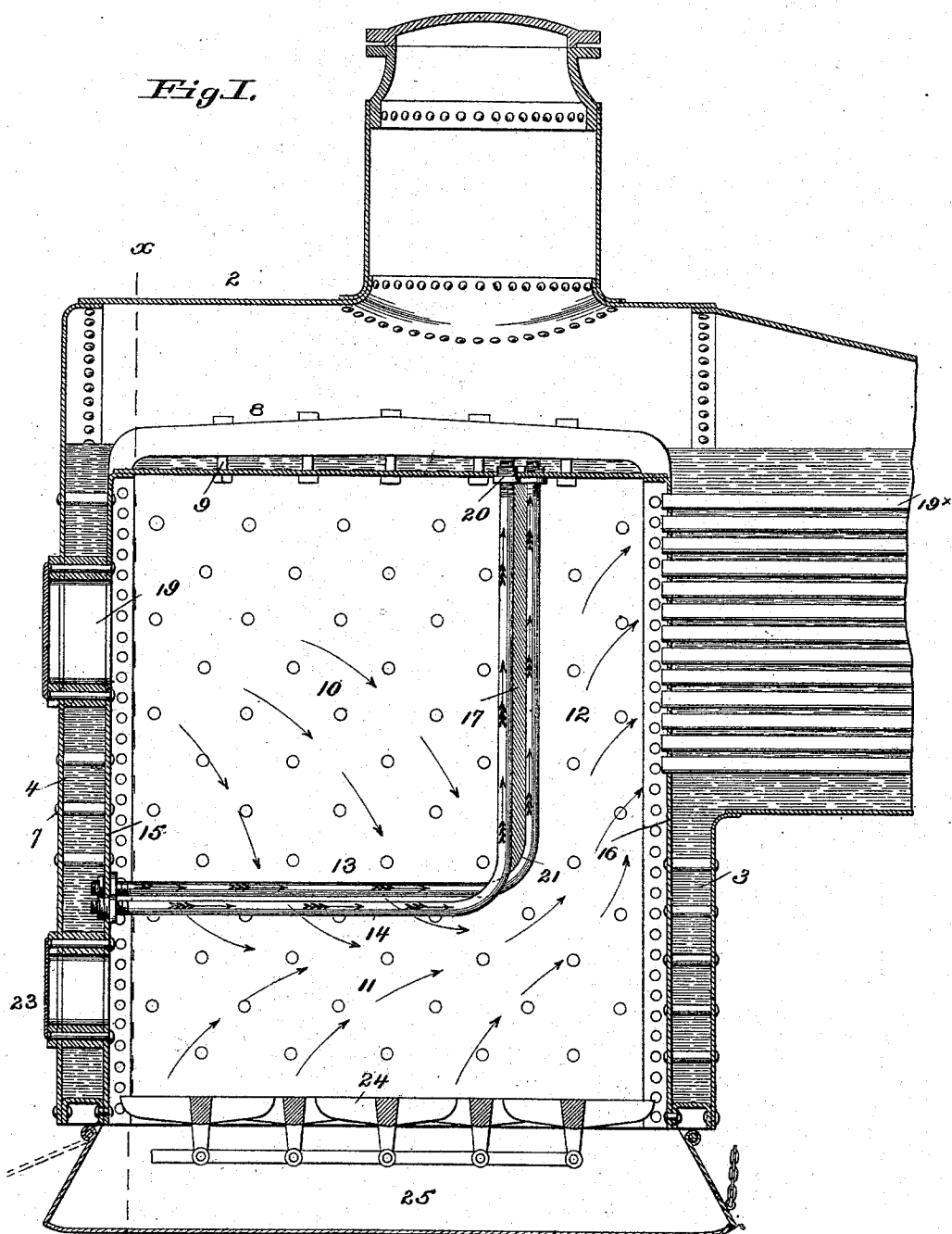
(No Model.)

4 Sheets—Sheet 1.

G. H. WATSON.
LOCOMOTIVE BOILER FURNACE.

No. 530,566.

Patented Dec. 11, 1894.



Attest,

Reuben H. Hager,

Inventor,

*George H. Watson
& Paul D. Newby
his atty.*

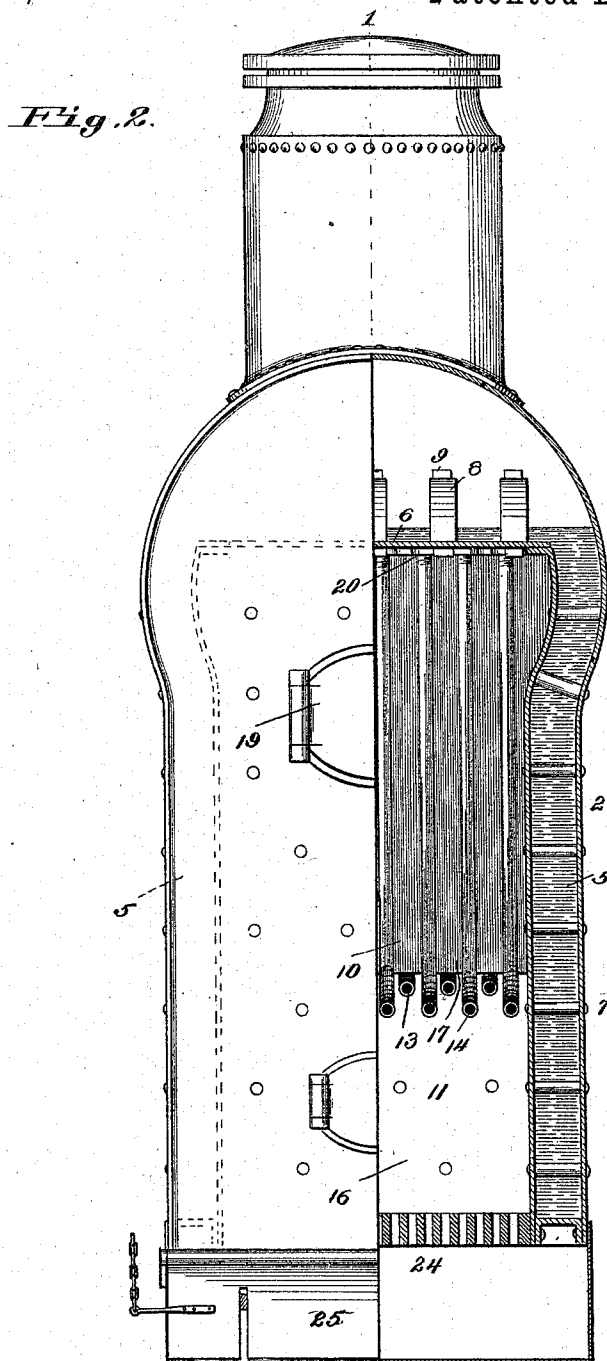
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G. H. WATSON.
LOCOMOTIVE BOILER FURNACE.

No. 530,566.

Patented Dec. 11, 1894.



Attest:

Robert W. A.
Demand Advertiser

Inventory

George H. Watson
Paul & Hawley
his atty

(No Model.)

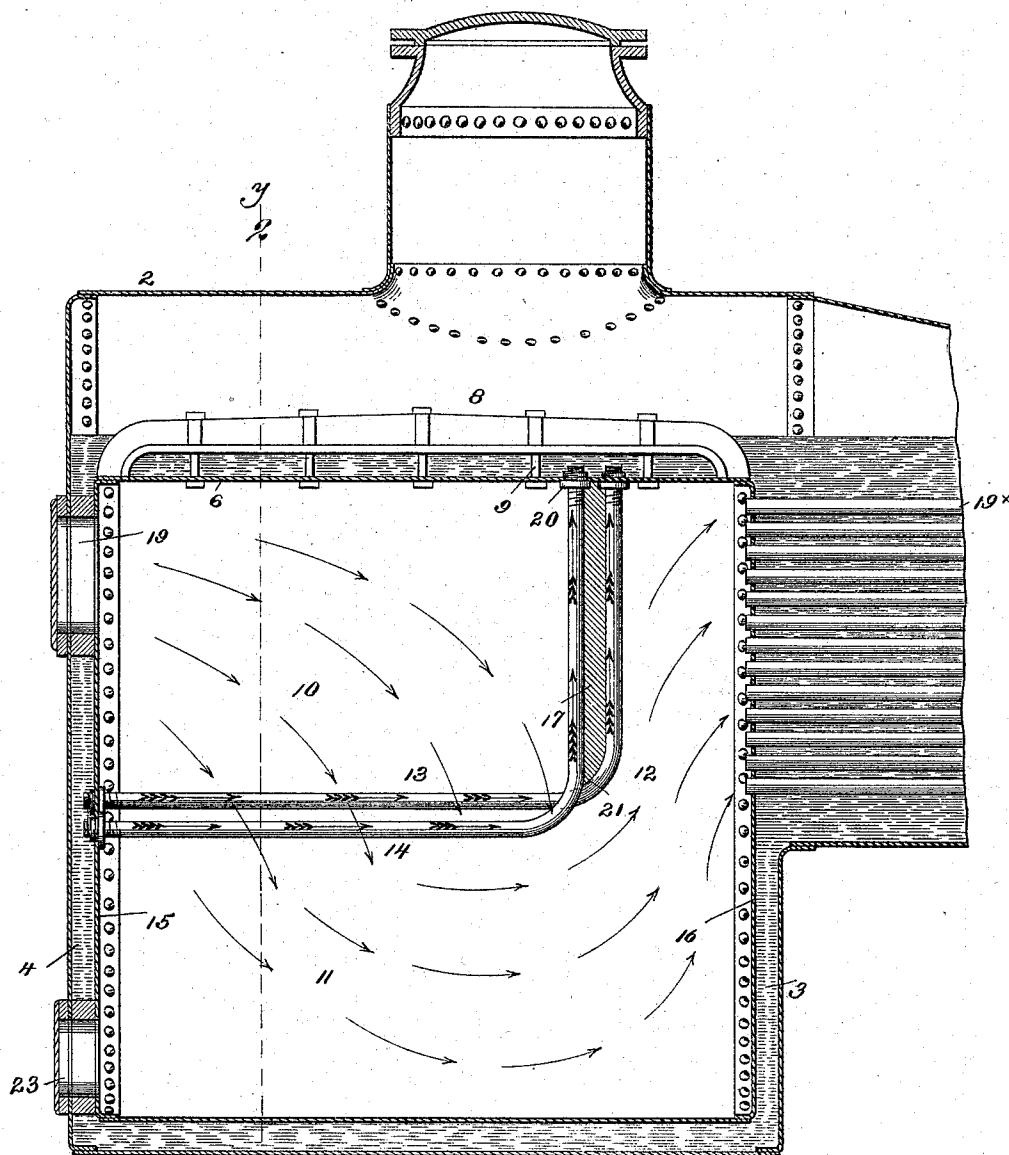
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Fig. 3.



Attest *W. J.*

Robert W. [Signature]
Notary Public.

Inventor,

George H. Watson
E. H. [Signature]
Attorney

(No Model.)

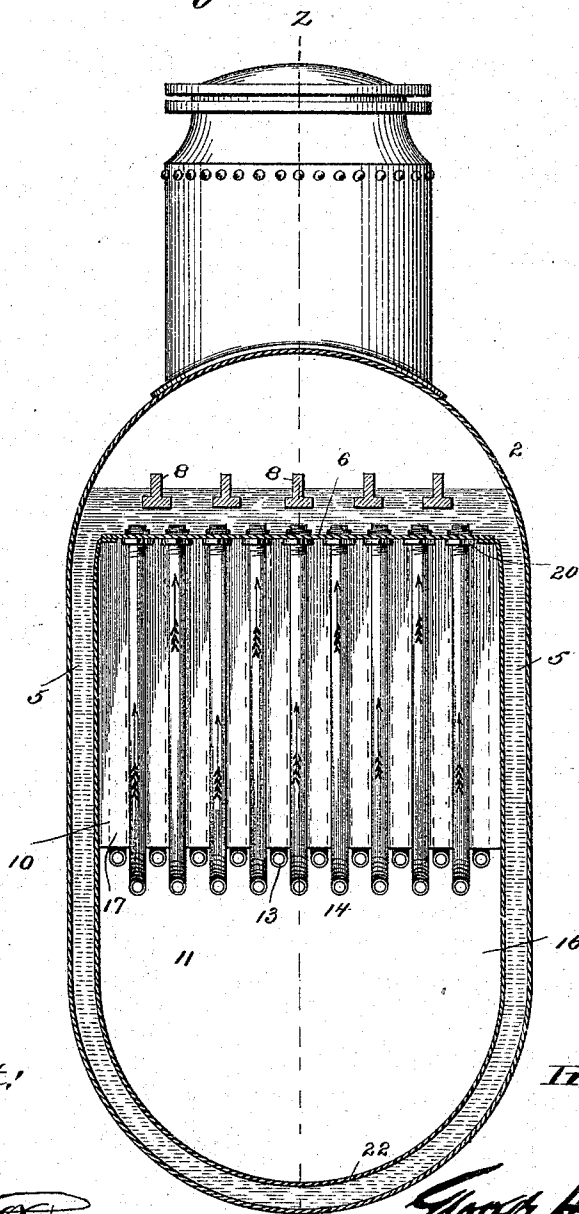
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Fig. 4.



Attest:

Inventor:

Richard H. Hoyer.

*George H. Watson
& Paul & Hawley
his attys.*

UNITED STATES PATENT OFFICE.

GEORGE H. WATSON, OF ST. LOUIS, MISSOURI.

LOCOMOTIVE-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 530,566, dated December 11, 1894.

Original application filed December 30, 1892, Serial No. 456,759. Divided and this application filed June 3, 1893. Renewed October 24, 1894. Serial No. 526,814. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. WATSON, residing in the city of St. Louis, State of Missouri, have invented certain new and useful
5 Improvements in Locomotive-Boiler Furnaces, of which the following is a full, clear, and exact specification.

My invention relates to down draft locomotive boiler furnaces, and has for its object
10 the simplification of the construction of such furnaces; to render them very durable while at the same time greatly reducing the cost thereof; to perfect the water circulation of the boiler, and further to entirely avoid the
15 detrimental results, so often observed heretofore, and caused by the accumulation of scale and boiler settlings.

My invention consists in general in the constructions and combinations all as hereinafter described, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, and
25 in which—

Figure 1 is a vertical, longitudinal elevation on the line 1—1 of Fig. 2. Fig. 2 is an elevation of the front end of the boiler one half thereof being shown in section on the
30 line $x-x$ of Fig. 1. Fig. 3 is a vertical, longitudinal section taken on the line $z-z$ of Fig. 4 and showing a modified form of my boiler furnace. Fig. 4 is a vertical transverse section on the line $y-y$ of Fig. 3.

35 As shown in the drawings 2 represents the boiler casing or shell, within the depending portion of which is arranged the fire box, surrounded upon its four sides by the water legs or sides 3, 4 and 5, 5, and having its top
40 closed by the crown sheet 6. The fire box is held in place by the usual stay bolts 7, and the crown sheet is prevented from collapsing by the usual stays or trusses 8, and their bolts 9.

Referring to Figs. 1 and 2 it will be seen
45 that the fire box is divided into three main parts, namely, the fuel chamber 10, the combustion chamber 11 immediately beneath the same, and the escape chamber or duct 12; the division being made by the basket grate
50 shown. This grate is formed of the two sets of, upper and lower, hollow grate bars or

tubes 13 and 14, respectively. These tubes have their forward ends fastened by suitable means in the front plate 15 and extend therefrom horizontally through the fire box, being
55 bent or curved upwardly at some distance from the flue sheet. The ends are from thence carried directly up and through the crown sheet 6, wherein they are suitably secured. The space 12, between the tubes and
60 the flue sheet 16, is wide and large. Communication between the same and the chamber 10, is entirely cut off and prevented by a filling 17 of a suitable material, arranged between the upright parts of the water tubes.
65 Therefore products of combustion issuing from fuel burning upon the horizontal parts of the grate bars and supplied with air entering through the door 19 can only escape
70 by passing downward between said horizontal parts and into the combustion chamber, passing thence into the escape space or duct 12 communicating with the boiler flues 19.

Each hollow grate bar is formed of a single
75 piece of pipe, the lower end of which pierces the front sheet 15 and communicates with the water leg 4, while the upper end of the tube pierces through the crown sheet 6. Any suitable means may be employed for fastening
80 the tubes in the front and crown sheets, but I much prefer the use of the water-tight, all threaded connections shown plainly in Figs. 1 and 4. As shown the ends of the tubes are threaded back for quite a distance, and the
85 bushings 20, have interior threads to fit the same, while the outside threads of the bushings fit the large threaded openings in the front and crown sheets 15, 6. In building a furnace the bushings are first screwed down
90 over the ends of the pipes, then the bare ends are inserted in the large holes, after which the bushings are screwed out over the ends of the tubes to fill the large holes. The tubes are thus firmly, tightly and non-expansively fastened in the front and crown sheets, the
95 bend of the pipes being alone relied upon to accommodate expansion and contraction.

A further and most important feature of the construction, consists in the arrangement of the up-turned ends of the upper and lower
100 sets of grate bars or tubes, so as to hold the refractory filling between said up-turned ends

firmly in place and prevent dislodgment of the filling by the violent vibration to which a locomotive boiler, particularly, is subjected. For this purpose I carry the bend of the upper set of bars or tubes farther back than that of the lower set so that the upper ends of the upper set of bars stand back of the ends of the lower set, thus forming a crotch or seat 21, to support the filling 17.

In my furnace the construction of those parts which lie above the chamber 11, is in all cases substantially the same, but below that point the construction may vary. For instance the combustion chamber 11 may terminate in the closed bottom 22, having beneath it the water bottom, as shown in Figs. 3 and 4. The ashes from the down draft grate fall upon the bottom 22 and are removed from thence through the normally closed ash-pit door 23. The construction which I prefer, however, is shown in Figs. 1 and 2, an upward draft grate 24, thus forming the bottom of the combustion chamber. A portion of the fuel placed upon the down draft grate falls through upon the grate 24, and there continues to burn, adding greatly to the extent of the combustion of the gases in the combustion chamber and hence to the general efficiency of the boiler. Beneath the grate 24, I provide the ash pan 25, which is normally tightly closed to the entrance of air, but which has one or more doors 25, through which the ashes may be removed and which doors may be opened whenever an upward draft through the lower grate is deemed necessary.

The advantages of a furnace constructed as described, are: first, the uninterrupted circulation of water from the front water leg, through the water bars directly into the top of the boiler; second, the total absence of sediment pockets in the path of active circulation; third, the entire freedom from detrimental results of contraction and expansion in the water grate bars or tubes; fourth, the complete stoppage of all draft across the top of the fuel upon the down draft grate, and due to the employment of the filling 17; fifth, the added heating surface resulting from the exposure of the outer surfaces of the upturned parts of the water bars 13, 14, the inner parts only of said bars being embedded in the refractory material forming the filling 17; and lastly, and arising from the use of both up draft and down draft grates, the thorough combustion of all gases and carbon while within the combustion chamber 11, which results in an almost complete abatement of the dense black smoke which ordinarily arises from the boiler furnaces particularly where bituminous coal is used.

This application is filed as a division of my application filed December 30, 1892, Serial No. 456,759, the subject matter contained herein having been withdrawn from the prior application.

Having thus described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

1. The combination with the front and crown sheets of a locomotive boiler, or like furnace, and the water spaces surrounding the same, water grate bars having their rear ends bent or curved upwardly, the opposite ends of said bars being extended through and secured in said front and crown sheets respectively, and the spaces between the upturned ends or parts of the water bars being closed by a suitable filling, substantially as and for the purpose specified.

2. The combination with the boiler shell, of the fire box arranged therein and surrounded by the water spaces or legs, the front crown and flue sheets respectively, of said box, a door 19 leading into the upper part thereof and the basket grate formed by a series of tubes or pipes, extending part way through the fire box and bent or carried upward in the rear part thereof, the lower ends of said pipes being extended through and secured in the front sheet to communicate with the front water leg, the upper ends of the pipes being carried upward through, and secured in the crown sheet, and a refractory filling provided between the up-turned ends of said pipe or tube, said fire box being divided by said grate into three parts or chambers 10, 11 and 12, for fuel, combustion, and, escape, respectively, all substantially as described.

3. The combination with the boiler shell, of the fire box arranged therein and surrounded by the water spaces or legs, the bent water tubes or bars forming the grate within said fire box, the rear ends of said bars being carried upwardly in front of the flue sheet and extended through the crown sheet, the lower and forward ends of the bars passing through the front sheet and thus communicating with the front water leg and the spaces between the up-turned parts of the water tubes being filled with refractory material, while the outside surfaces of said up-turned parts are exposed, substantially as and for the purpose specified.

4. The combination with the boiler shell, of the fire box arranged therein and having the front, crown, and, flue, sheets respectively, the water tubes or bars forming the grate within said box, and having their rear ends extending upwardly in front of said flue sheet, the opposite ends of said pipes being connected with the water spaces surrounding the fire box and the spaces between the upright parts of said tubes or bars being closed by a suitable filling to compel a down draft through the spaces between the lower parts of the tubes, substantially as described.

5. The combination with the boiler shell, of the fire box arranged therein, the upper and lower sets of water grate bars or tubes 13, 14, the rear ends of said tubes being bent or curved and extended upwardly in the rear part of said box, the up-turned ends of the

upper set of bars being extended through the spaces between the like ends of the lower bars and standing back of the same to form a crotch or seat 21, a refractory filling arranged between the up-turned ends of the two sets of bars and resting in said seat, and the ends of said grate bars being connected with the water spaces of the boiler, substantially as described.

6. The combination with the boiler shell, of the fire box arranged therein, the upper and lower sets of water grate bars or tubes, 13, 14, the rear ends of said tubes being bent or curved and extended upwardly in the rear parts of the box, the up-turned ends of the upper set of bars being extended through the spaces between the ends of the lower bars and standing back of the same to form a crotch or seat 21, a refractory filling arranged between the up-turned ends of the two sets of bars, and resting in said seat, and the opposite ends of said bars being extended through and secured in the front sheet and the crown sheet of the fire box, respectively, and communicating directly with the surrounding water spaces, substantially as described.

7. The combination with the boiler shell, of the fire box arranged therein, and sur-

rounded by the water spaces, the bent tubes having the horizontal and upright parts, the ends of said tubes being secured in the front and crown sheets of the fire box, respectively, by all threaded connections and the spaces between the upright parts of the tubes being closed by a refractory filling, substantially as described.

8. The combination with the boiler casing, of the fire box arranged therein, the water tubes extending horizontally and vertically in said fire box and connected with the surrounding water spaces, the spaces between the vertical parts of said tubes being closed by a suitable filling, said fire box being divided by the grate so formed into the three chambers 10, 11 and 12, respectively, and an up draft grate provided in the lower part of the fire box and a normally closed ash receptacle or space provided beneath the same, substantially as described.

In testimony whereof I have hereunder set my hand this 3d day of June, 1893.

GEORGE H. WATSON.

Witnesses:

C. G. HAWLEY,

LEONARD H. DYER.