

No. 694,241.

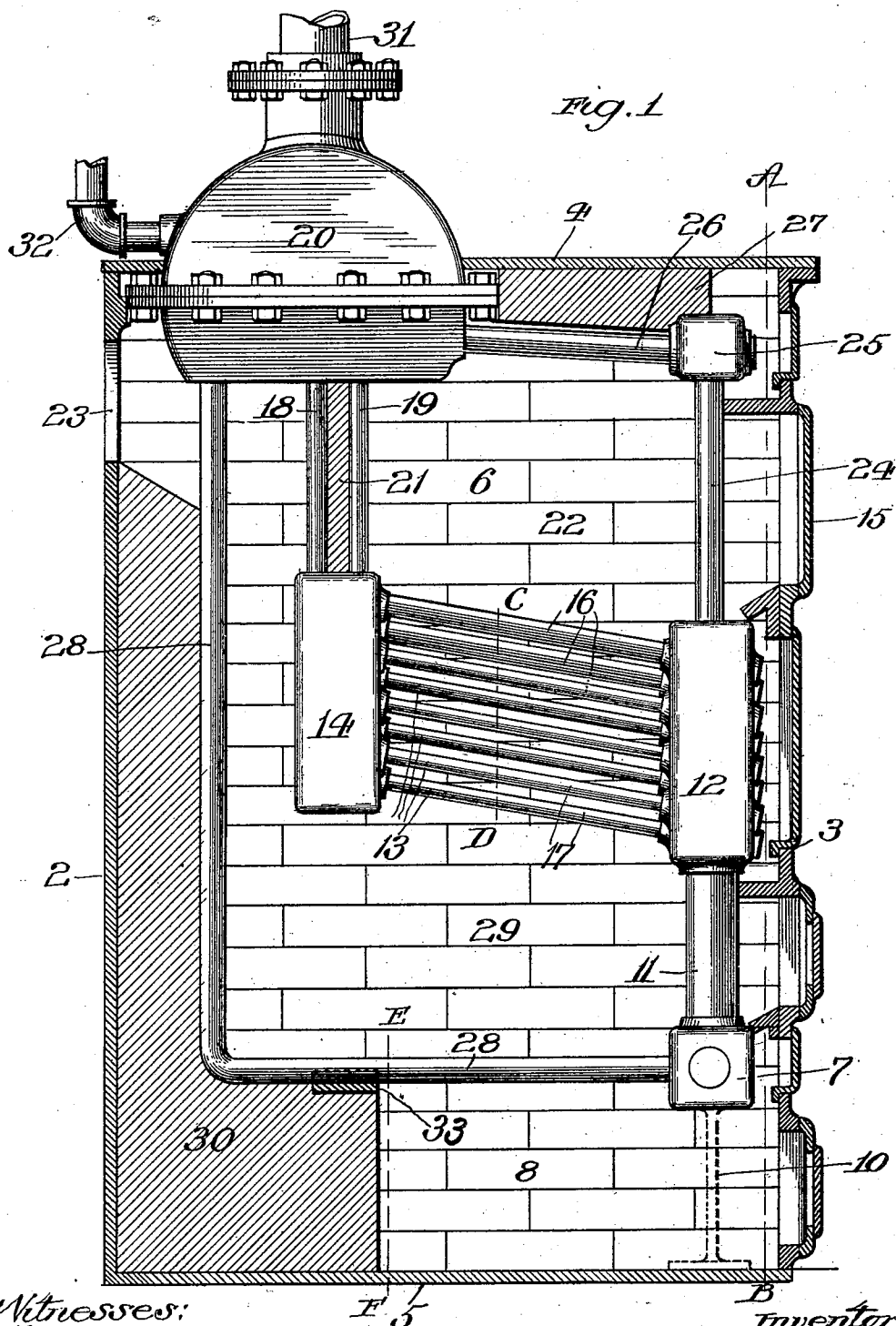
Patented Feb. 25, 1902.

S. T. BLEYER.
FURNACE.

(Application filed May 13, 1901.)

(No Model.)

2 Sheets—Sheet 1.



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2 Sheets—Sheet 2.

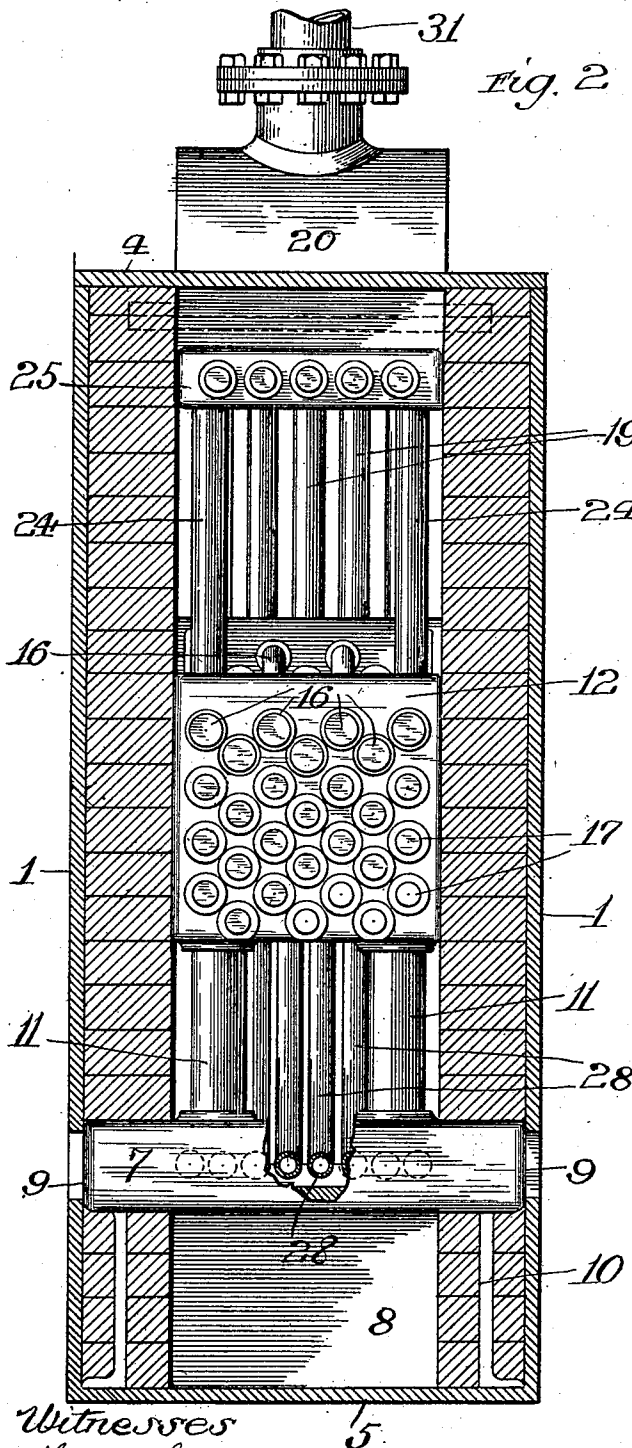


Fig. 3

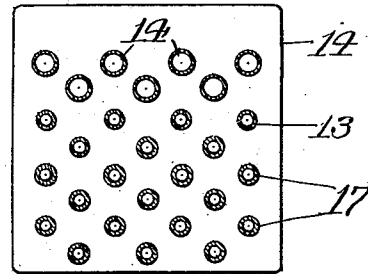
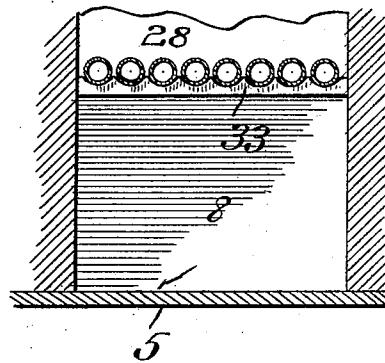


Fig. 4



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UNITED STATES PATENT OFFICE.

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FURNACE.

SPECIFICATION forming part of Letters Patent No. 694,241, dated February 25, 1902.

Application filed May 13, 1901. Serial No. 60,003. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL T. BLEYER, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to a heating-furnace and the like; and its object is to produce an efficient and comparatively inexpensive construction and one which shall be economical in the use of fuel and at the same time possess great efficiency in the utilization of the fuel consumed.

Another object of my invention is to make a furnace which shall be compact and self-contained.

Other advantages in construction and operation will be readily apparent from the description hereinafter given.

In the drawings, Figure 1 is a sectional elevation of my furnace. Fig. 2 is a sectional elevation on the line A B of Fig. 1; Fig. 3, a section on the line C D of Fig. 1, and Fig. 4 a section on line E F of Fig. 1.

My furnace, which may be used as a generator for either a steam or hot-water heating plant, is preferably entirely surrounded by a steel shell formed of separate sides 1, back 2, front 3, top 4, and bottom 5, all suitably held together in any desired way, which shell is lined on the interior with brick 6 or other suitable refractory material, as may be found desirable or convenient.

A header 7 is arranged just above or at the top plane of an ash pit or box 8 and transverse of the furnace, with its ends 9 extending through the sides, where they may be connected with suitable pipes, (not shown,) such pipes being return-pipes in case of use with a hot-water heating plant, or inlet or supply pipes in case of use with a steam heating plant. This header 7 may be supported above the floor of the ash-pit in any suitable way, as by means of the legs 10.

From the header 7 rise one or more pipes 11, (preferably a plurality, two being herein shown,) which enter the bottom of another header, or what I shall herein term a "manifold" 12. This manifold may be a single structure, as shown, or be suitably divided in sections corresponding to the number of vertical pipes 11. Hollow grate-bars or water-

tubes 13 join the manifold 12 with a similar manifold 14, positioned in a parallel or somewhat higher plane, as clearly illustrated in Fig. 1, so that the grate-bars will be slightly inclined downward toward the front of the furnace. These bars 13 not only connect and permit communication between the manifolds 12 and 14, but also constitute the fire-grate of the furnace, the fuel being introduced through the door 15 in the furnace-front. As a matter of preferable construction the two upper rows 16 of these grate-bars have a somewhat larger diameter than the lower rows 17, all of which bars are preferably arranged zigzag or staggered. Consequently coal of a size to pass through the upper rows of bars will certainly pass through the necessarily larger openings or spaces between the lower series of grate-bars.

A pipe or series of pipes 18 and 19 lead from the manifold 14 upward into the bottom of a drum 20, which is suitably supported at the top of the furnace. A wall 21, of refractory material, interposed between the manifold 14 and the drum and also preferably interposed between the series of pipes 18 and 19, cuts off the fuel or coal chamber 22 from direct communication with the outlet-flue 23, passing through the back shell 2 of the furnace.

One or more pipes 24 lead up from the manifold 12 and enter an upper header 25, which is in turn connected with the drum 20 by pipes 26, forming the top of the fire-chamber, or at least a portion thereof, just beneath suitable brick setting or other refractory material 27, arranged below the top plate 4 of the shell of the furnace. This pipe or pipes 26 may also be said to constitute a water-arch. The lower header 7 also has preferably a series of pipes 28, which practically divide the main chamber 29 of the furnace from the ash-pit 8. These pipes 28 first lead horizontally and then upwardly into the bottom of the drum 20, being supported at the bend or angle by the L-shaped brick setting 30, and run vertically up the front side thereof and toward the rear portion of the furnace, as clearly shown in Fig. 1.

The drum has a main supply-pipe 31, adapted to communicate with the house circulation, and may also have a special take-off pipe 32, intended to run to the bath or kitchen

for supplying hot water thereto. Of course if my furnace is used as a generator in a hot-water system such system will be filled with water, as is customary, and the return-pipes will communicate with the header 7. If, however, it is used in connection with a steam heating system, the drum 20 will have a steam-space, and steam will be taken off therefrom instead of hot water, the return-pipes being connected with the manifold 7 or with a feed-water heater or, if desired, with some other water-supply.

My furnace, being constructed as above stated, operates as follows: Coal being supplied on the fire-grate through the door 15 is burned thereon, the draft and combustion generally being downward through the grate-bars. The water in these bars, being thus heated, will circulate upwardly through such bars, and a circulation will also occur upwardly through both manifolds and into the drum 20. Heat radiating from the fire-grate will be absorbed by the pipes 21, 24, and 26, which practically surround the fuel-chamber 22 on four sides. The coal, falling down as it burns, will be entirely consumed, or nearly so, after traversing the grate-bars, and the cinder or ash and any unconsumed fuel will then fall upon the pipes or tubes 28, which may constitute a lower burning-grate if placed close enough together, where unconsumed fuel becomes entirely consumed, the ash falling below into the ash-pit 8. The heat and flame from the combustion in the network of the grate-bars will also serve to heat the pipes or risers 11, header 7, and pipes 28. Before the flame and heated gases can reach the flue they must pass upwardly in contact with the pipes 28 and the rear face of the manifold 14, as well as in contact with the pipes 18. A proper and efficient circulation of the heated water upwardly to the drum is thereby caused, the drum also being directly heated in the present instance.

By the use of my invention provision is made for the complete and economical burning of coal without the production of smoke. The coal may be even a low grade of soft coal instead of expensive hard coal, as now commonly burned in house-heaters, for instance. By the novel arrangement of pipes, headers, and manifolds, as well as the drum itself, practically the full energy of the coal is utilized, these said parts being so located and combined as to bring about this result and at the same time provide for a compact and self-contained arrangement. Complete combustion of fuel and complete absorption of heat, as well as compactness of arrangement, are thus attained in my furnace.

Obviously a single pipe may be used in some instances where I have shown a plurality, and, conversely, a series may be used where I have shown one pipe. Consequently in these instances my invention is not to be limited to any particular number of pipes, the construction herein shown, however, illustrating the

preferable construction. By constructing my furnace self-contained with an outside shell I am enabled to make the furnace complete in the shop and to safely ship it ready to be set down onto its foundations at the place of installation. When the furnace is properly connected up with the heating system, the furnace is ready for use.

It will be apparent from the description hereinbefore given that the furnace may be increased in size by simply adding additional banks of fire-grates and manifolds set side by side and widening the fire box or chamber, or the parts herein shown may thus be enlarged or extended in width to the proper amount.

The manifolds, headers, and the connecting-pipes are positioned and arranged in the best possible manner as to bring the best results as regards both the utilization of the heat and a proper and perfect circulation of water. The chamber 22 is flanked on its four sides with the circulating-pipes, and, in fact, the furnace-chamber as a whole is flanked with pipes, manifolds, and the headers.

As hereinbefore stated, the two upper rows 16 of the water-tube grates are of greater diameter than the lower sets or rows 17, so that the spaces between the upper rows of tubes or grates may be narrower than the spaces between the tubes or grates therebelow. The providing of the narrower spaces at the upper portion of the grate-bars as compared with the spaces between the lower grate-bars is a desirable construction; but it is obvious that this end may be accomplished in other ways than herein shown and described—as, for instance, the upper rows of tubes may be of the same diameter as those below or of less diameter, and the spaces between them may be narrowed by setting them closer together.

As hereinbefore stated, the pipes 28 may be employed as a lower burning-grate by placing them close enough together for this purpose. In order to keep the spacing perfect and prevent the spreading or springing of these pipes, a casting 33, having grooves to receive the pipes, may be arranged upon the foot of the L-shaped lining 30 or arranged in any other suitable or desirable place or manner in order to accomplish the results intended. This construction will be readily understood from an inspection of Fig. 4.

I claim—

1. In a furnace, the combination with a furnace-chamber, of a front and rear manifold therein, pipes or tubes connecting between the manifolds and forming grates, and a firing-chamber thereabove, and connections leading from manifolds along two sides of such firing-chamber.

2. In a furnace, the combination with a furnace-chamber, of a front and rear manifold therein, one of such manifolds being in a slightly-higher plane than the other, inclined pipes or tubes connecting between the mani-

folds and forming grates, a water-arch above the grates and a connection leading from one of such manifolds.

3. In a furnace the combination with a furnace-chamber, of a front and rear manifold therein, one of such manifolds being in a slightly-higher plane than the other, inclined pipes or tubes connecting between the manifolds and forming grates, and a firing-chamber thereabove, a drum exposed to the firing-chamber and a connection between such manifolds and the drum and arranged on opposite sides of said firing-chamber.

4. In a furnace, the combination with a furnace-chamber, of manifolds therein, pipes or tubes connecting said manifolds and forming water-tube grates, the upper pipes having a narrower space between them than the pipes below, and connections leading from the manifolds.

5. In a furnace, the combination with a furnace-chamber of a header arranged therein, a series of pipes 28 leading therefrom and dividing said chamber so as to form an ash-pit in the lower portion thereof, and a casting arranged in the chamber and receiving said pipes so as to space the same.

6. In a furnace, the combination with a furnace-chamber, of a front and rear manifold therein, pipes or tubes connecting said manifolds and forming water-tube grates, the said pipes being arranged zigzag with the upper ones of greater diameter than the lower and connections leading from the manifolds.

7. In a furnace, the combination with a furnace-chamber, of a front and rear manifold therein, pipes or tubes connecting said manifolds and forming water-tube grates downwardly through which the fire burns and also forming a firing or fuel chamber 22, and connections 19 and 24 leading from the manifolds along the walls of such chamber 22.

8. In a furnace, the combination with a furnace-chamber, of a front and rear manifold therein, pipes or tubes connecting said manifolds and forming water-tube grates downwardly through which the fire burns, and also forming a fuel-chamber 22, an elevated drum 20 exposed to the fuel-chamber and connections 19 and 24 leading from the manifolds along the walls of such chamber 22 and into the drum.

9. In a furnace, the combination with a furnace-chamber, of a front and rear manifold therein, connecting water-tubes forming grates between the manifolds, a wall 21 leading upwardly from the rear manifold and forming a fuel-chamber 22 open downwardly through such grates, and pipes or connections 21 and 24 leading from the rear and front manifolds respectively and through chamber 22.

10. In a furnace the combination with a furnace-chamber of a front manifold 12, and rear manifold 14 therein, connecting water-tubes arranged to have greater space between them below than above and forming grates be-

tween the manifolds, an elevated drum, a wall 21 leading upwardly from the rear manifold to the bottom of the drum and forming a fuel-chamber 22, open downwardly through such grates, a pipe or connection 19 from the manifold 14 to the drum and alongside wall 21, and pipes or connections 24 and 26 leading from manifold 12 through chamber 22 and along the top of such latter chamber to the drum.

11. In a furnace, the combination with a furnace-chamber, with flue 23, of manifolds and connecting-tubes forming grate-bars and a series of tubes 28, all said tubes dividing the furnace-chamber into a fuel-chamber 22 flame-chamber 29, communicating with the flue 23, and an ash-pit 8.

12. In a furnace the combination of a furnace-chamber, manifolds 12 and 14 therein, tubes or pipes connecting said manifolds and forming water-tube grates, a wall 21 extending upwardly from the manifold 14, said wall, manifolds and tubes dividing the furnace-chamber into a fuel-chamber 22, a flame-chamber 29 and an outlet-passage leading from said chamber 29 and pipes 18 and 19 leading from manifold 14 and located on either side of the wall 21.

13. In a furnace, the combination with a furnace-chamber of manifolds 12 and 14 located therein, pipes connecting said manifolds and forming grates, a wall 21 leading upwardly from the manifold 14, which together with the manifolds and grates, divides the furnace-chamber into a fuel-chamber 22, a flame-chamber 29 and an outlet-passage leading from chamber 29, an elevated drum, pipes 18 and 19 leading from manifold 14 into said drum and extending along either side of the wall 21, and pipes 24 and 26 leading from manifold 12 through said chamber 22, along the roof or top of said chamber and into the drum.

14. In a furnace, the combination with the furnace-chamber of manifolds 12 and 14 therein, connecting-pipes therebetween forming water-tube grates, an elevated drum in the upper part of said chamber, pipes 18 and 19 leading from manifold 14 into the drum, a wall 21 interposed between the manifold 14 and the drum and also interposed between said pipes 18 and 19, which wall, together with the manifolds and grate, divides the furnace-chamber into a fuel-chamber 22, flame-chamber 29 and an outlet-passage leading upwardly along the rear side of manifold 14 and along pipe 18.

15. In a furnace, the combination with a furnace-chamber having a fuel or firing chamber 22 of a header in the lower portion thereof, front and rear manifolds 12 and 14 located in the furnace above the plane of said header, connection between the header and manifold 12, an elevated drum, pipes connecting said manifolds and forming water-tube grates downwardly through which the fuel burns, and pipes or connections 19, 24 and 26 leading from both the manifolds into

the drum, and surrounding the fuel or firing chamber.

16. In a furnace, the combination with the furnace-chamber of a header located in the lower part of such chamber, an elevated drum in the upper part of such chamber, a series of pipes 28 leading from said header first horizontally and then upwardly into the drum and forming an ash-pit in the lower part of such chamber, manifolds 12 and 14 in the chamber, connections between the manifold 12 and said header, pipes connecting said manifolds and forming bars, and connections between said manifolds and drum.

17. In a furnace, the combination with a furnace-chamber having in the rear portion a lining 30 substantially L-shaped in cross-section, a header in the front portion of said chamber, a series of pipes 28 leading substantially horizontally from the header and then upwardly to the drum and resting upon the foot of said L-shaped lining, manifolds 12 and 14 in such chamber, a series of pipes forming water-tube grates between said manifolds, a connection 11 between the header and manifold 12 and pipes or connections leading upwardly from said manifolds into the drum.

18. In a furnace, the combination with a furnace-chamber, of a lower header 7, an elevated drum 20, pipes 28, leading from the header first horizontally and then upwardly into the drum, manifolds 12 and 14, having connecting-pipes forming water-tube grates, a connection 11 between the header 7 and manifold 12, pipes 24 and 26 leading from the manifold 12 into the drum, and pipes 18 and 19 leading from the manifold 14 into said drum.

19. In a furnace, the combination with the furnace-chamber, of manifolds 12 and 14 therein, a header 7, connections between said header and manifold 12 and water-tube grates connecting said manifolds, an elevated drum 20, a wall 21, between the drum and manifold 14, said wall and grate-bars dividing the furnace-chamber into a fuel-chamber 22, a flame-chamber 29, and an outlet-passage from said chamber 29, and leading upwardly along the rear side of manifold 14, pipes 28 leading from the header 7 along the bottom of chamber 29, and then upwardly along said outlet-passage, pipes 18 between the manifold 14 and drum 20 and exposed to said outlet-passage, pipes 19 leading from the manifold 14 to the drum and exposed to the fuel-chamber 22, and pipes 24 and 26 leading from the manifold 12 to the drum and exposed to the fuel-chamber 22.

20. In a furnace, the combination with the

furnace-chamber, of manifolds 12 and 14 therein, a header 7, connections between said header and manifold 12, water-tube grates connecting said manifolds, the said grates being arranged zigzag and inclined and with the upper series of greater diameter than the lower series, an elevated drum 20, a wall 21 between the drum and manifold 14, said wall and grate-bars dividing the furnace-chamber into a fuel-chamber 22, a flame-chamber 29 and an outlet-passage from said chamber 29 leading upwardly along the rear side of manifold 14, pipes 28, leading from the header 7 along the bottom of chamber 29 and then upwardly along said outlet-passage, the horizontal portions of the pipes 28 forming the ash-pit 8, pipes 18 between the manifold 14 and drum 20 and exposed to said outlet-passage, pipes 19 leading from the manifold 14 to the drum and exposed to the fuel-chamber 22, and pipes 24 and 26 from the manifold 12 to the drum and exposed to the fuel-chamber 22.

21. In a furnace, the combination with the furnace-chamber, of manifolds 12 and 14 therein, inclined water-tube grates connecting said manifolds, a header 7, a drum 20, pipes 28 from the header to the drum, pipes 11 from the header to manifold 12, pipes 18 and 19 from manifold 14 to the drum, a header 25, pipes 24 between manifold 12 and said header 25, and pipes 26 between header 25 and the drum.

22. In a furnace, the combination with the furnace-chamber, of manifolds 12 and 14 therein, pipes or tubes connecting said manifolds and forming water-tube grates, a wall 21 which together with said grate-bars divide said furnace-chamber into a fuel-chamber 22, a flame-chamber 29, and an outlet-passage leading therefrom, an elevated drum 20 positioned above said wall 21 and exposed both to the chamber 22 and to said outlet-passage and connections between the manifold 14 and the drum.

23. In a furnace, the combination with the furnace-chamber, of manifolds 12 and 14 therein, a series of pipes or tubes connecting between said manifolds and forming water-tube grates, said pipes being arranged zigzag with the two uppermost rows 16 of greater diameter than the lower rows 17 whereby the spaces between the pipes 16 are narrower than those between the pipes 17.

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