

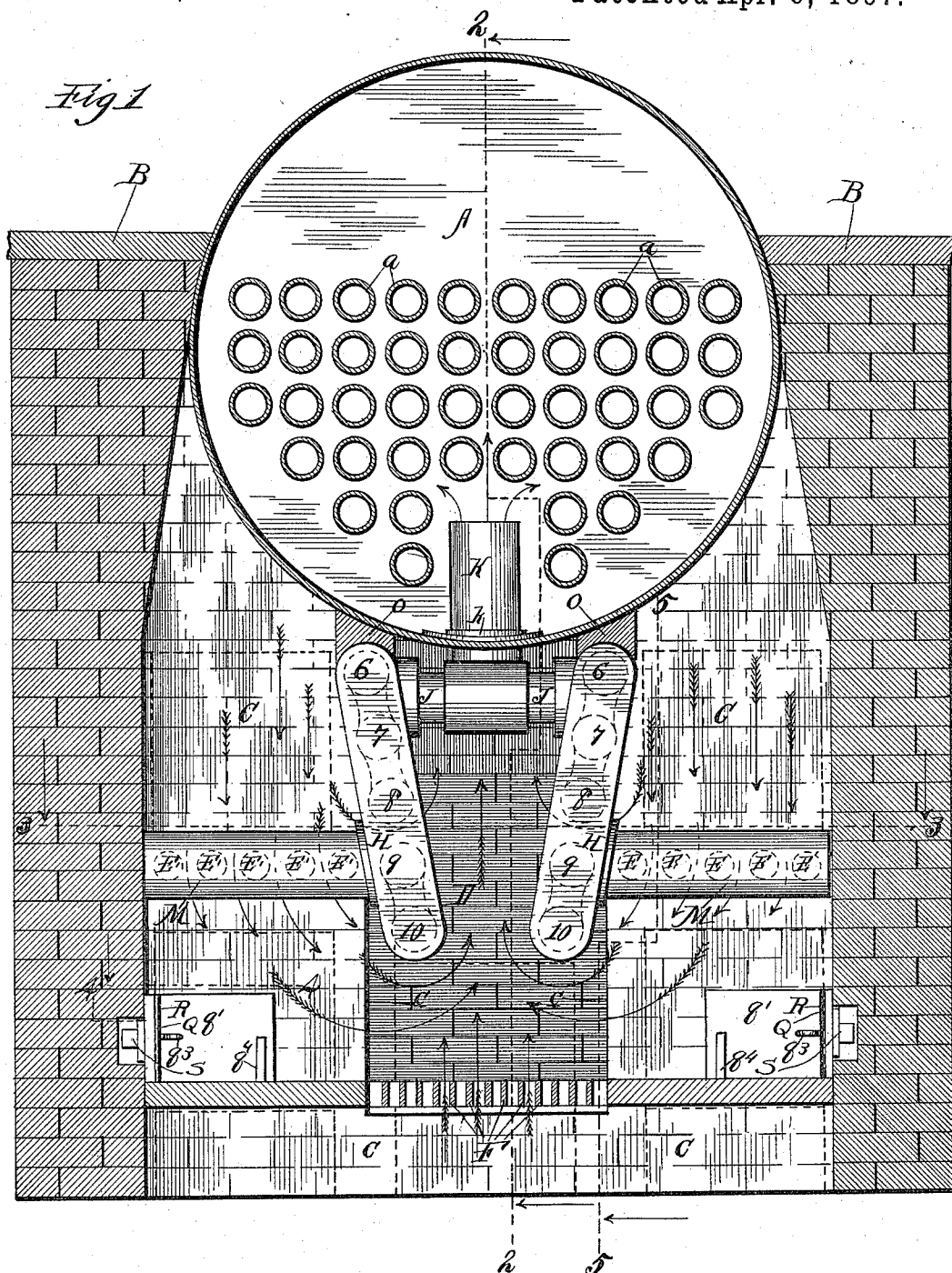
(No Model.)

4 Sheets—Sheet 1.

O. D. ORVIS.
STEAM GENERATOR.

No. 580,348.

Patented Apr. 6, 1897.



Witnesses

W. C. Coelies

C. A. Crawford

Inventor

Orel D. Orvis

By Louis K. Gleson
att.

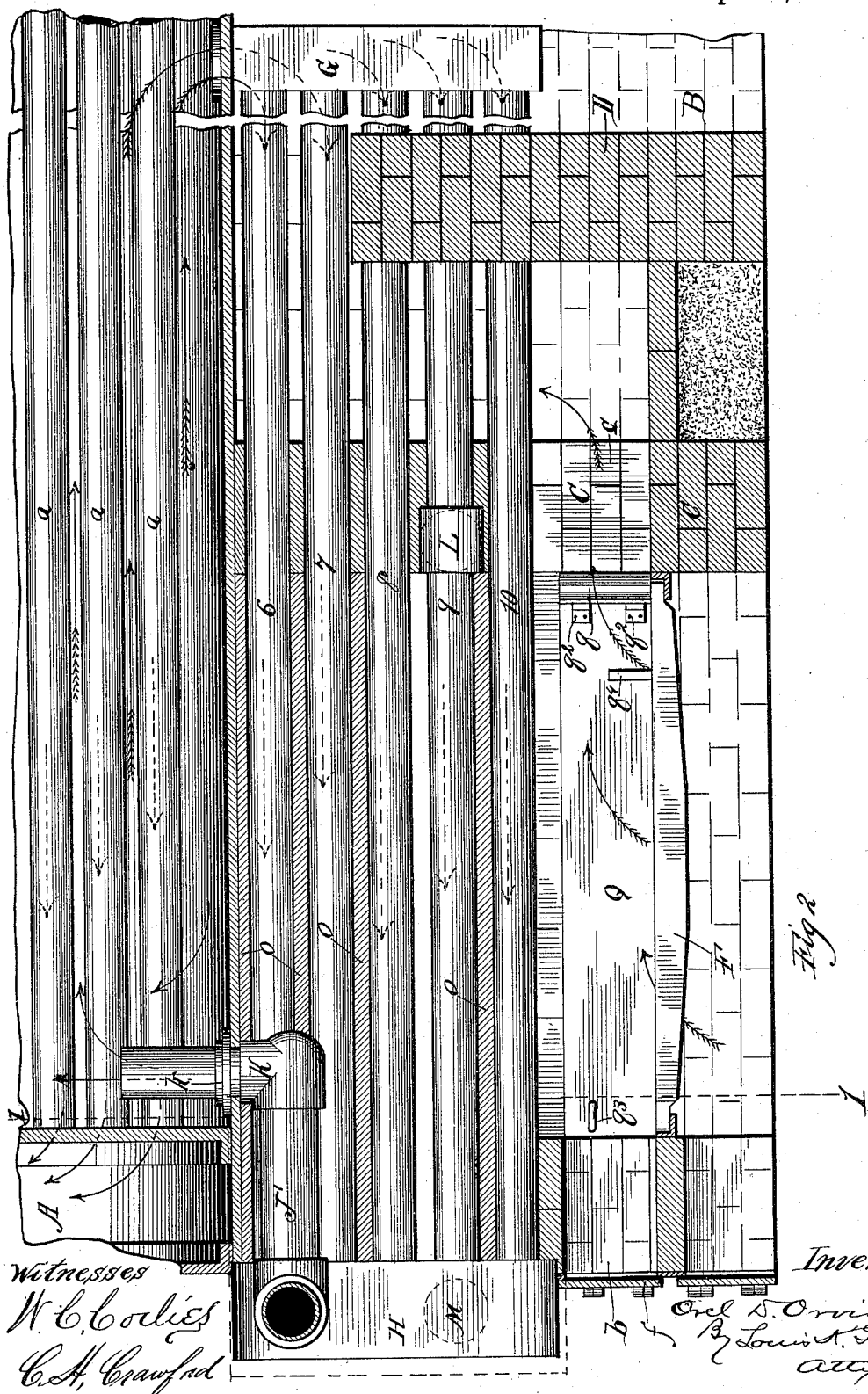
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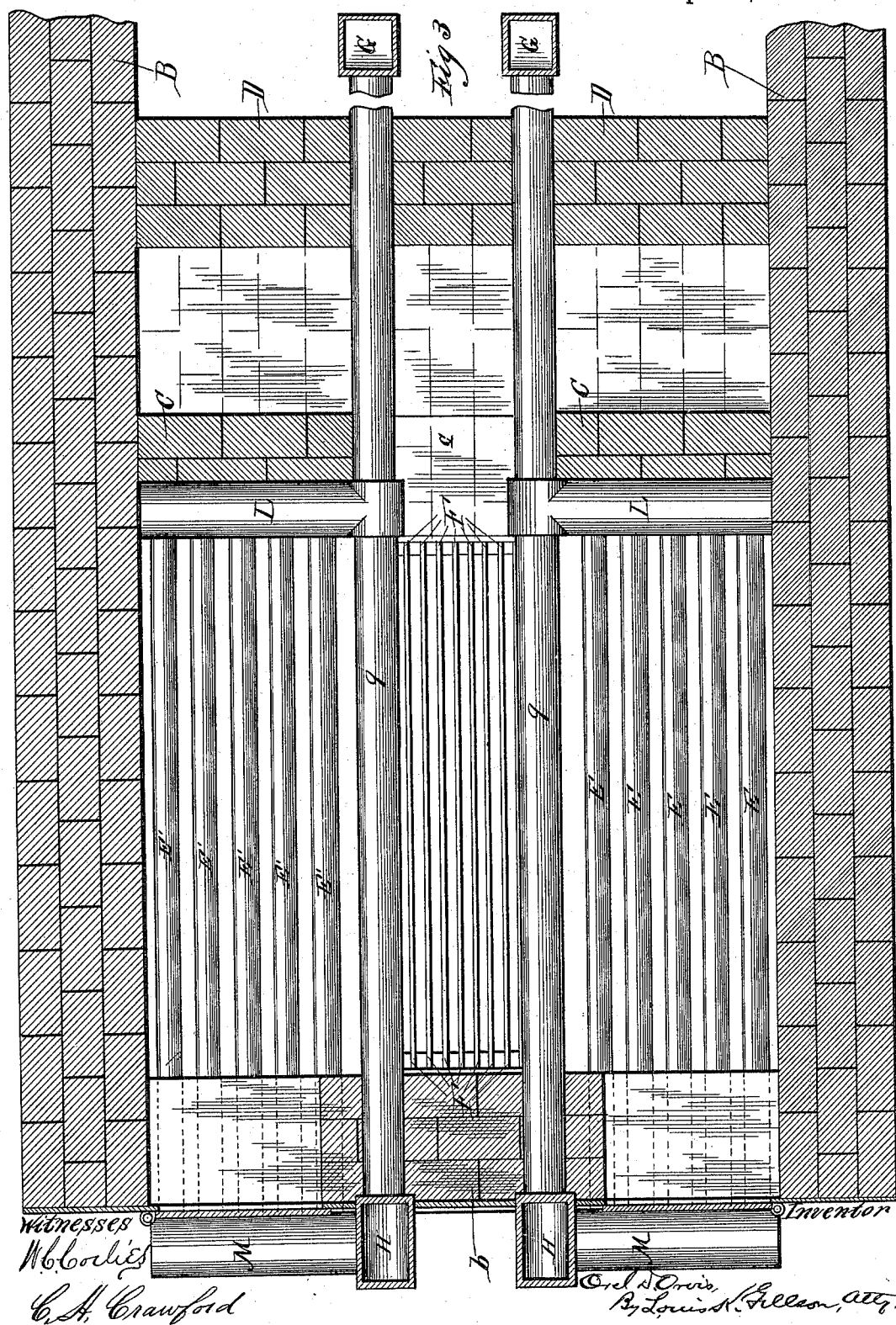
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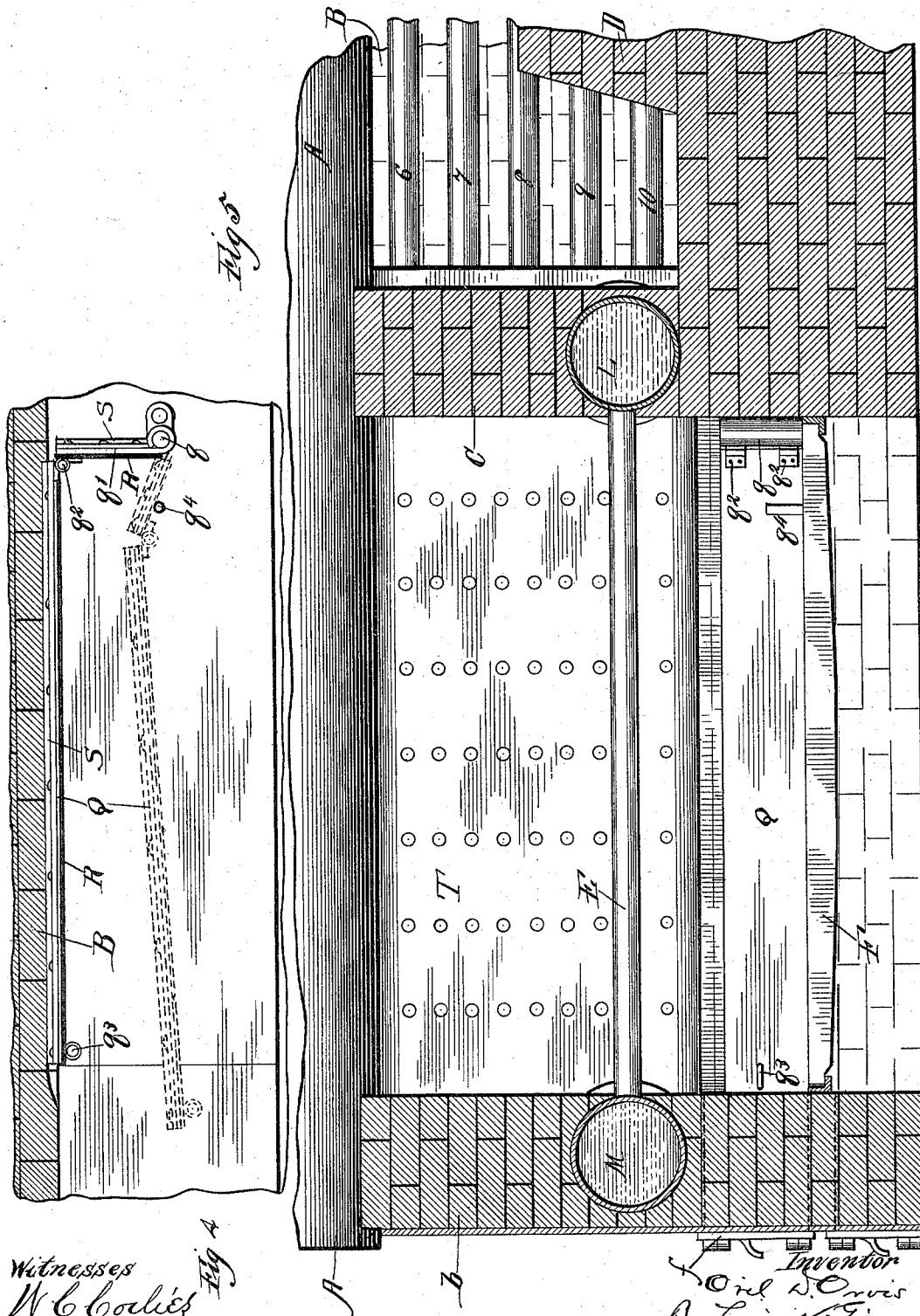
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4 Sheets—Sheet 4.

O. D. ORVIS.
STEAM GENERATOR.

No. 580,348.

Patented Apr. 6, 1897.



Witnesses
W. C. Collier
Chas. Crawford

Inventor
O. D. Orvis
By Louis K. Felson
att.

UNITED STATES PATENT OFFICE.

OREL DIGHTON ORVIS, OF CHICAGO, ILLINOIS, ASSIGNOR TO WILLIAM H. MILLER, OF ST. LOUIS, MISSOURI.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 580,348, dated April 6, 1897.

Application filed August 31, 1896. Serial No. 604,403. (No model.)

To all whom it may concern:

Be it known that I, OREL DIGHTON ORVIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Generators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

In the drawings, Figure 1 is a transverse vertical section, partly in elevation, taken on the line 1 1 of Fig. 2. Fig. 2 is a central longitudinal vertical section taken on the line 2 2 of Fig. 1. Fig. 3 is a plan section on the line 3 3 of Fig. 1. Fig. 4 is a detail plan on the line 4 4 of Fig. 1; and Fig. 5 is a longitudinal vertical section on the line 5 5 of Fig. 1, showing a modified form of construction.

The steam-boiler is shown at A, and has the flue-tubes *a*, of ordinary construction. The boiler-setting is shown at B B, constituting the side walls of the furnace, the front of the furnace being indicated at *b*. A transverse partition C of masonry is thrown across from one side wall to the other, reaching to the bottom of the boiler and forming the rearward wall of the fire-boxes. This partition is provided with a central aperture *c*, reaching to the boiler and forming a flue-opening for the egress of the vapors distilled from the burning fuel. Back of the partition C is located a bridge-wall D of ordinary construction and being spaced apart from the partition C, so as to provide a chamber within which the vapors entering from the flue *c* are retarded somewhat and spread more evenly about the exposed surface of the boiler.

The furnace is of the downdraft type and has two fire-boxes, whose tubular grate-bars are shown at E E'. Circulation through the grate-bars E E' is provided for by means of the following-described system of piping: A pair of water-legs G G depend from the rearward end of the boiler A, one being located upon each side of its longitudinal median line, and from each of these legs a series of pipes 6, 7, 8, 9, and 10 lead forwardly to and

through the front wall *b* of the furnace and enter a head H. The heads H H are provided with discharge-pipes J J near their upper ends, which unite as the cross-arms of a T, the stem of which, J', leads backwardly under the front end of the boiler to a vertical pipe K, which enters the boiler and is prolonged some distance into its interior by means of a nipple *k*, which may be readily detached when it becomes necessary to enter the boiler for cleaning. A horizontal header L leads laterally from each of the pipes 9 9 next to the bottom pipe of each series. These headers L L are located within the masonry of the partition C, and from them lead forwardly the grate-bars E E', which are continued through the front wall *b* of the furnace and enter headers M M, which are in communication with the headers H H. The water-legs G G enter the boiler a sufficient distance to prevent the washing into them of any sediment which may have accumulated upon the floor of the boiler.

The pipes leading through the furnace are so disposed, as will hereinafter appear, that they are exposed to the greatest heat, and by this system of tubing I am able to secure a great velocity of circulation, thereby preventing the accumulation of sediment and the formation of scale within the tubes.

The spaces between the boiler and the upper tubes 6 6 and between the tubes 6 7, 7 8, and 9 10 and between the partition C and the front wall *b* are closed by masonry, as indicated at O O, and thereby I form the inner side walls of the downdraft fire-boxes. These side walls are spaced apart sufficiently to form a combustion-flue leading backwardly to the aperture *c* in the partition C, and I prefer to arrange these walls so as to incline apart from below upwardly, so that a comparatively contracted opening is left between them at the bottom, while a considerable boiler-surface is exposed to the heat developed within the flue.

An updraft grate-surface F is located immediately below the flue formed between the downdraft fire-boxes, as described, and a fire is maintained thereupon by hand feeding through the door *f* and by raking thereupon the cinders falling from the downdraft-grates. This updraft-furnace is so located, however, that the droppings from the downdraft-fur-

naces do not fall directly upon it, so as to foul the fire thereupon. In practice the hand feeding into this updraft-furnace should be light, so that the fire burning thereupon may be kept in as nearly an incandescent state continuously as possible.

The line of draft from the downdraft-furnaces is downwardly between the grate-bars E E' and to the center under the tubes 10 10, the gases from these two fire-boxes intermingling as they enter the flue between them. This meeting and intermingling of the vapors from the downdraft-furnaces is directly over the fire upon the grate-surface F, and hence the temperature of these vapors is greatly increased at this point and their complete combustion within the central flue assured. A small lateral draft from each of the downdraft-furnaces is provided between the tubes 8 9, and smoke passing therethrough is discharged directly into the burning gases entering from below and thereby consumed.

The cinders accumulating below the downdraft-grates may at pleasure be raked off upon the grate-surface F by the use of a slice-bar, or a jointed raking-bar Q may be permanently located within these ash-pits, being pivoted, as shown at q , at the rearward end of the floor of the ash-pit and having a short section q' , whose length is equal to the distance from the pivot-point to the side of the furnace and which is jointed to the main section Q, as indicated at q^2 . A ring q^3 is set in the forward end of the bar Q, into which a hook may be caught to swing the bar to the position indicated in dotted lines in Fig. 4, so as to throw any cinders which may have accumulated over toward the center of the furnace. This raking-bar may comprise a plate Q' , resting upon one of its edges and faced with a refractory material, as R, for its better protection from heat and stiffened by a T-bar S along its rearward surface. A recess may be formed along the inner face of the wall B to receive all or a portion of the raking-bar Q when it is thrown back to the position shown in solid lines in Figs. 1 and 4.

While I prefer the construction shown in Figs. 1 and 2 and already described, I may substitute for the forward ends of the pipes 6, 7, 8, 9, and 10 tanks or compartments T, forming the inner walls of the downdraft fire-boxes and into which the pipes 6 to 10 discharge and from which the pipes J J lead.

By continuing the horizontal members of the circulating system of pipes, including the tubular grate-bars, through the front wall of the furnace, and by inclosing the rearward headers L L in the masonry of the partition C, I protect the headers from the excessive heat and better provide for the expansion and contraction of the tubes without danger of disturbing the masonry of the furnace. By locating the tubes 10 10 below the level of the water-grates, so that the draft from the downdraft-furnaces is under and around them, I provide for a rapid circulation of the water

in the lowest part of the system, and consequently the part to which any sediment which may enter the pipes will find its way. These pipes also serve as means for supporting the masonry interposed between them and the pipes 9 9, and which conserves the heat at a point where it is of the utmost importance to maintain a high temperature in order to a perfect combustion.

I secure in this generator three important points of advantage—approximately perfect combustion, by reason of the disposition of the several furnaces and the arrangement of draft and combustion flues; extensive heating surface, by concentrating the maximum temperature upon the water-surfaces; and rapid circulation through not only the pipe system, but the boiler itself, by reason of the concentration of the heat upon the pipes and by reason also of the extension of the return-pipe into the interior of the boiler.

Necessary hand-holes for cleaning the pipe system may of course be provided. The use of such devices is common and as the holes may be located according to the judgment of the builder I have not deemed it necessary to show them.

I claim as my invention—

1. In a steam-generator, the combination with a boiler, and with side and front walls for supporting the boiler, of a pair of front and a pair of rear water-legs depending from the boiler, the members of each pair being on opposite sides of the median line thereof, tubes uniting corresponding members of each pair of legs, a partition extending between the side walls and to the boiler and having an aperture between the two sets of tubes, filling material closing the spaces between adjacent tubes, a pair of fire-boxes of one of which each of the two sets of tubes forms the inner wall, and a draft-flue from each fire-box to the flue-space between the two sets of tubes.

2. In a steam-generator, the combination with a boiler, and with side and front walls for supporting the boiler, of a pair of front and a pair of rear water-legs depending from the boiler, the members of each pair being on opposite sides of the median line thereof and the front pair being outside of the front wall, tubes uniting corresponding members of each pair of legs, a partition extending between the side walls and to the boiler and having an aperture between the two sets of tubes, filling material closing the spaces between adjacent tubes, a pair of fire-boxes of one of which each of the two sets of tubes forms the inner wall, and a draft-flue from each fire-box to the flue-space between the two sets of tubes.

3. In a steam-generator, the combination with a boiler, and with side and front walls for supporting the boiler, of a pair of front and a pair of rear water-legs depending from the boiler, the members of each pair being on opposite sides of the median line thereof,

tubes uniting corresponding members of each pair of legs, a partition extending between the side walls and to the boiler and having an aperture between the two sets of tubes, filling material closing the spaces between adjacent tubes, a pair of fire-boxes of one of which each of the two sets of tubes forms the inner wall, a draft-flue from each fire-box to the flue-space between the two sets of tubes, a horizontal header projecting outwardly from one of the tubes in each series back of the fire-box, a head extending horizontally from each front water-leg across the fire-box, and water-tube grate-bars leading from the rearward to the forward header.

4. In a steam-generator, the combination with a pair of downdraft-furnaces, spaced apart and having a combustion-flue therebetween, of an updraft-furnace located directly below such combustion-flue and opening directly thereto.

5. In a steam-generator, the combination with a pair of downdraft-furnaces, spaced apart and having a combustion-flue therebetween, of an updraft-furnace located directly below such combustion-flue and opening directly thereto, and a scraping-bar pivoted at the rear end of the floor of the ash-pit of the downdraft-furnace and extending to the forward end thereof whereby the accumulations of cinders upon the floor may be thrown toward the updraft-furnace.

6. In a steam-generator, the combination with a pair of downdraft-furnaces, spaced apart and having a combustion-flue therebetween, of an updraft-furnace located directly below such combustion-flue and opening directly thereto, and a jointed scraping-bar pivoted at the rearward end of the floor of the ash-pit of the downdraft-furnace, one section

thereof being adapted to lie along the rear wall of the ash-pit and one member thereof to lie along its side wall, whereby the surface of the floor may be cleaned by drawing the bar forward and swinging it toward the center of the furnace.

7. In a steam-generator, the combination with a boiler, with side and end walls for supporting the boiler and forming a furnace-inclosure, and a transverse centrally-apertured partition dividing such inclosure transversely, a pair of fire-boxes forward of the partition the inner walls of which inclose between them a combustion-flue and the aperture of the partition, draft-flues leading from each fire-box to the combustion-flue, and a bridge-wall back of the partition and spaced apart therefrom.

8. In a steam-generator, the combination with a boiler, of a pair of downdraft-furnaces whose inner walls are water-chambers and are spaced apart to form a combustion-flue, draft-flues leading from the furnaces to such combustion-flue, and connection between the boiler and the chambers of the walls.

9. In a steam-generator, the combination with a boiler, of a pair of downdraft-furnaces whose inner walls are water-chambers and are spaced apart to form a combustion-flue, draft-flues leading from the furnaces to such combustion-flue, connection between the boiler and the chambers of the walls, and an updraft-furnace directly below such combustion-flue and open thereto.

In testimony whereof I affix my signature in presence of two witnesses.

OREL DIGHTON ORVIS.

Witnesses:

GEORGE F. KIMBALL,
EDWARD B. TYLER.