(No Model.) 3 Sheets—Sheet 1.

F. D. SHEPHERD.

STEAM BOILER AND FURNACE.

No. 553,767. Patented Jan. 28, 1896.

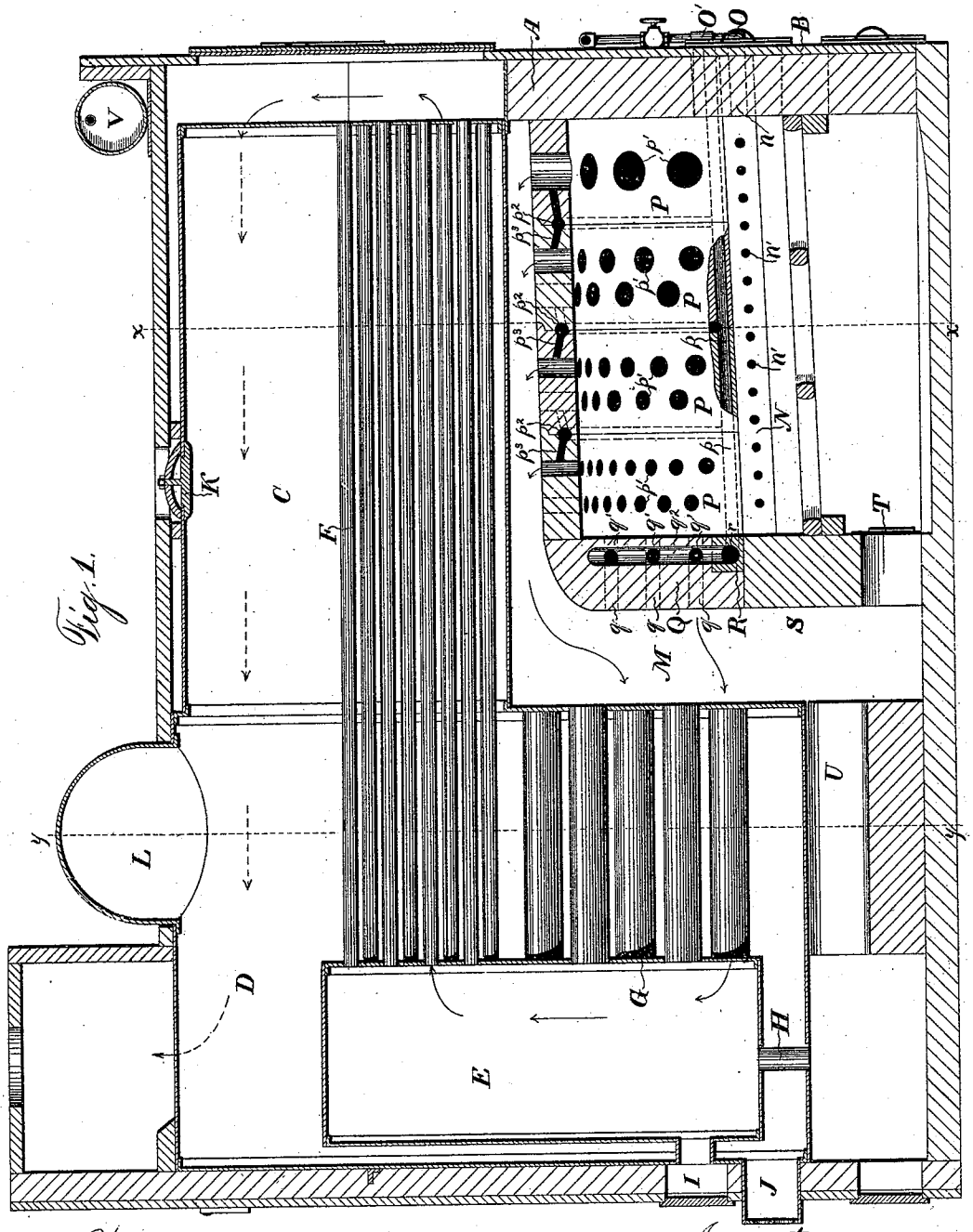

Fig. 1.

Witnesses.
Frank P. Prindle.
Henry C. Hazard.

Inventor.
Frank D. Shepherd by
Prindle and Russell, his attys.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

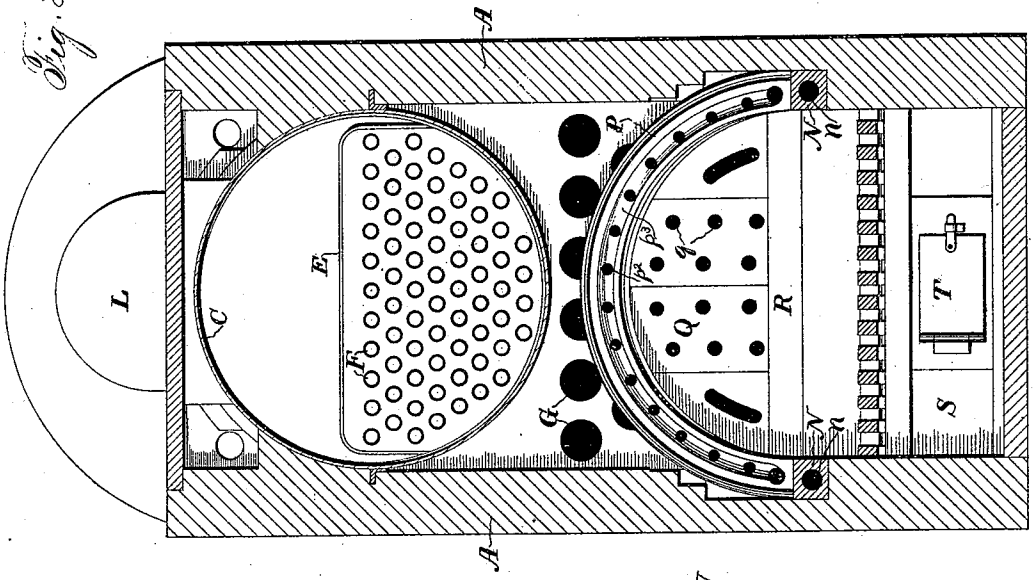

Fig. 2.

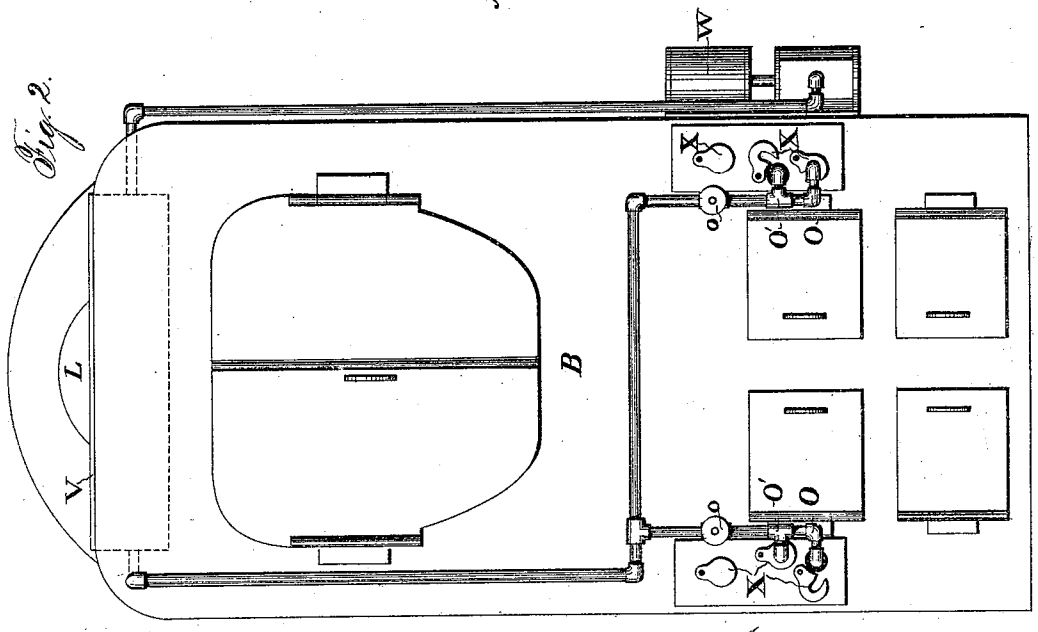

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Fig. 3.

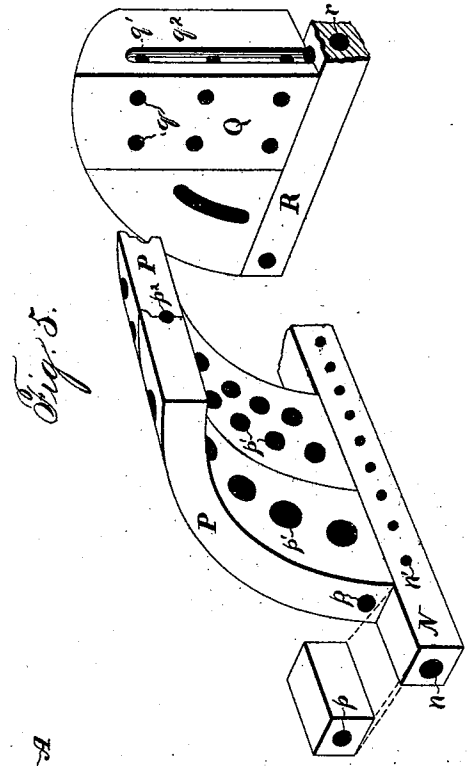
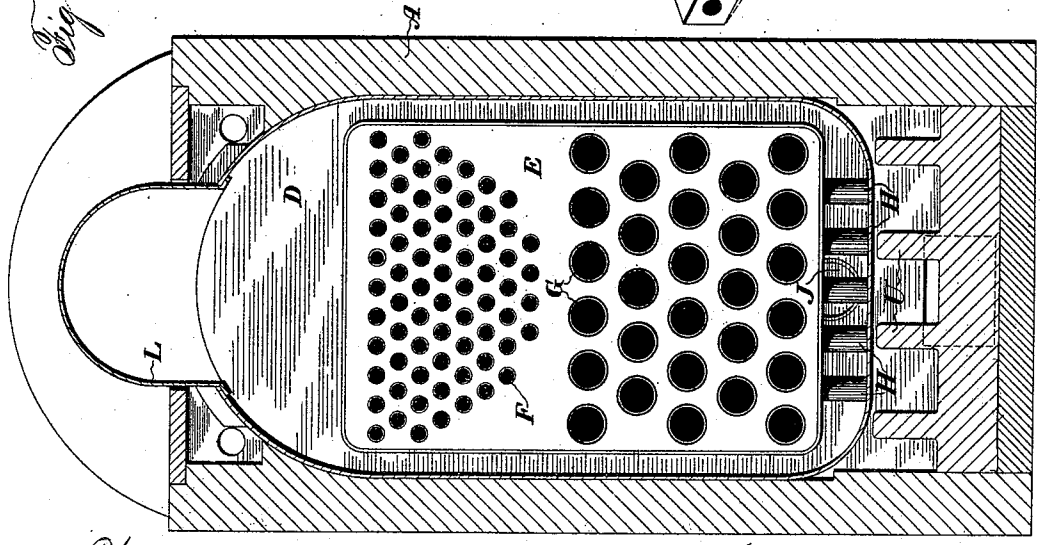


Fig. 4.



Witnesses.
Frank P. Prindle.
Henry C. Hazard.

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Prindle and Russell, his attys

UNITED STATES PATENT OFFICE.

FRANK D. SHEPHERD, OF AURORA, ILLINOIS.

STEAM-BOILER AND FURNACE.

SPECIFICATION forming part of Letters Patent No. 553,767, dated January 28, 1896.

Application filed October 4, 1895. Serial No. 564,595. (No model.)

To all whom it may concern:

Be it known that I, FRANK D. SHEPHERD, of Aurora, in the county of Kane, and in the State of Illinois, have invented certain new and useful Improvements in Steam-Boilers and Furnaces Therefor; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a steam-boiler and furnace embodying my invention. Fig. 2 is a front elevation thereof. Figs. 3 and 4 are respectively cross-sections on the lines *x x* and *y y* of Fig. 1, and Fig. 5 is a detail perspective view of a portion of the furnace-arch.

Letters of like name and kind refer to like parts in the several figures.

The design of my invention is to provide a steam-boiler and furnace that will enable the most economical production of steam by largely increasing the heating-surface of the boiler and causing the most thorough combustion of the fuel by the judicious supply and mixing of air with the gases of combustion, and to these ends said invention consists in the steam-boiler and the furnace therefor constructed and combined substantially as hereinafter specified.

In the carrying of my invention into practice I employ suitable brickwork A for the support of the boiler and the fire-brick of the furnace, and having, as usual, a metal front B, provided with doors at the proper places.

The boiler-shell comprises the horizontal cylindrical part C and the straight-sided vertical part D, to the upper part of the front wall or sheet of which the rear end of the cylindrical part is riveted.

Within the part D, and occupying the rear half thereof, is a chamber E, with the interior of which fire-tubes F communicate, said tubes being secured to its front wall and extending horizontally forward through the shell part C, and passed through the front wall or sheet thereof. Larger fire-tubes G, secured at their ends to said front wall and to the front wall of the shell part D, establish communication between said chamber and the space in front of the part D below the cylindrical part C, in which the combustion-chamber to be described is located. Products of combustion thus pass through the large tubes G, heating the water surrounding the same, thence into the chamber E, which is a supplemental combustion-chamber, where more heat is imparted to the water around the same, next through the small fire-tubes F and, emerging at the front end of the boiler, pass back over the top of the latter to the uptake or chimney connection located at the rear of the furnace, and in both their forward passage through and the backward passage over the boiler imparting heat to the contained water.

All six walls of the chamber E are away from the walls of the boiler-shell, so that the water is in contact with all of the outer surface of said chamber. A number of vertical tubes H and H extend from the bottom wall of said chamber through the bottom wall of the boiler part D to permit the easy removal of ashes or other deposit in the chamber E. A manhole I affords access to the interior of the latter for cleaning or repair, and just below the manhole is provided a mud-drum J that communicates with the lower rear portion of the boiler part D to enable the removal of mud, &c. The feed-water connection is preferably made with the drum, and it is also furnished with a blow-off valve.

The cylindrical part of the shell is provided with a manhole K to afford access to the interior of the boiler, and a steam-dome L is placed upon the top of the shell part D.

Supported on a ledge or projection on the inner side of each side wall of the brickwork, within the combustion-chamber M, is a long section of fire-brick N that is square in cross-section and provided with a longitudinal opening or passage *n* that at its front end is connected with a pipe O at the front of the furnace, which is in communication with a supply of compressed air. A number of small horizontal openings *n'* and *n'* pass from the longitudinal opening through the inner side of said section N to discharge the air into the combustion-chamber.

Resting at their lower ends upon the brick-sections N and N are a number of arches P formed of fire-brick and placed with their sides abutting and interlocking for mutual support by means of corresponding ribs and grooves. Each arch P is semicircular in shape

and is formed by two sections having an angular length each of ninety degrees and which abut at their ends.

Passing horizontally through each arch P at each of its ends is a horizontal opening p that with those of the other arches forms a straight continuous passage, which at its front end is connected, by means of a pipe O′ on the front of the furnace, with a source of supply of compressed air.

Each arch is perforated with one or two rows of radial openings p' and p', into which air from the openings p and p is adapted to be passed, by means of passages formed by grooves p^2 and p^2 in the abutting sides of the arches, that are connected by small upwardly and rearwardly inclined perforations p^3 with said radial openings p'. The inclination of the perforations p^3 assists the draft of the furnace materially.

The radial openings through the arches are largest in size in the front arch and are smaller in each succeeding arch, being smallest in the rear one.

At the rear end of the space over which the arches P and P extend is a vertical wall Q, made of several abutting vertical sections, and each of the latter is pierced by horizontal openings q and q, that by small perforations q' and q' are connected to vertical passages q^2 and q^2 formed between the abutting sides of the sections, and which extend from the lower side thereof upward, but not entirely to the top of said wall. Each passage q^2 communicates with the longitudinal opening r in a transversely-arranged brick-section R that, with the wall Q, rests upon a transverse partition S. The opening p in the rear section P communicates with the opening r, and thus air is supplied to and through the latter and to the horizontal wall-openings q.

By the construction shown and described the gaseous products of combustion, as they pass through the radial openings p' in the several arches to the bottom and sides of the boiler part C and through the horizontal openings q in the vertical wall Q, are abundantly and most advantageously supplied with air, with the result that a perfect combustion and complete utilization of the fuel are secured.

To permit easy access to the ash-pit, to clean the same, and to the large fire-tubes, to calk or repair them, an opening, closed ordinarily by a door T, is provided through the partition S at the rear of the ash-pit.

In rear of the partition S, beneath the boiler part D, there are several longitudinally-extending parallel brickwork-ribs U that serve to catch or cause the deposit of sulphur that may result from the use of inferior coal.

For the removal of fine ashes that may accumulate within the furnace, blow-holes are provided at advantageous points for the introduction of a hose, through which compressed air or steam under pressure can be passed for blowing away such accumulations.

Compressed air may be conveniently supplied from a tank or reservoir V placed on the top of the furnace, a suitable air-compressor W being connected therewith.

A valve o is provided in each air-supply pipe of the pipes O and O′ to control the supply of air therethrough.

As under some conditions it may be desirable to employ air not under pressure, I provide for this by making the openings through which the air-supply pipes O and O′ communicate with the brick-sections N and N larger than said pipes, and pivot or hinge over the openings plates or covers X and X, that are adapted to be swung to one side thereof to freely admit air through the openings around the pipes. The air will thus be drawn into the furnace and discharged through the perforations in the arches or walls thereof.

Having thus described my invention, what I claim is—

1. The combination of the boiler-shell having a downward extension at its rear end, a chamber within such extension, fire-tubes extending from such chamber through the upper part of the shell, fire-tubes extending from the chamber to and through the front wall of the extension, and vertical tubes between the bottom of such chamber and the bottom of the extension, substantially as and for the purpose described.

2. The combination of the boiler-shell having a downward extension at its rear end, a chamber within such extension, fire-tubes extending from such chamber through the upper part of the shell, fire-tubes extending from the chamber to and through the front wall of the extension, suitable brickwork, and a combustion-chamber in front of said extension, substantially as and for the purpose set forth.

3. In a steam-boiler furnace, the combination of the perforated arches arranged side by side, the perforated wall at the rear end thereof, and connections between the perforations and a source of supply of air, substantially as and for the purpose shown.

4. In a steam-boiler furnace, the combination of the longitudinally and horizontally perforated sections, the perforated arches resting upon said sections at their ends, having horizontal openings in line with each other forming a continuous passage, and means of communication between the latter and a source of supply of air, and between the openings of the supporting-sections and the air supply, substantially as and for the purpose specified.

5. In a steam-boiler furnace, the combination of the perforated arches having horizontal openings in line with each other forming a continuous passage, a longitudinally-perforated section extending crosswise of the furnace, and the perforated wall over such section whose openings communicate with that of said section, substantially as and for the purpose described.

6. In a steam-boiler furnace, the combina-

tion of the two longitudinally and horizontally perforated sections at the furnace sides, the perforated arches resting upon said sections having radial and rearwardly and upwardly inclined openings that communicate, and having horizontal openings in line that form a continuous passage and are connected with said inclined openings, the longitudinally-perforated section extending crosswise of the furnace having communication with said passage, and the perforated wall over such section whose openings communicate with that of said crosswise section, substantially as and for the purpose set forth.

7. The combination of the furnace, the boiler having a downward extension in rear of the furnace, and a series of projections beneath such extension to catch deposits from the products of combustion, substantially as and for the purpose shown.

In testimony that I claim the foregoing I have hereunto set my hand this 30th day of September, 1895.

FRANK D. SHEPHERD.

Witnesses:
SAMUEL ALSCHULER,
E. T. PRINDLE.