(No Model.)

2 Sheets—Sheet 1.

J. J. STORER.

BOILER FURNACE.

No. 575,999. Patented Jan. 26, 1897.

Fig. 1.

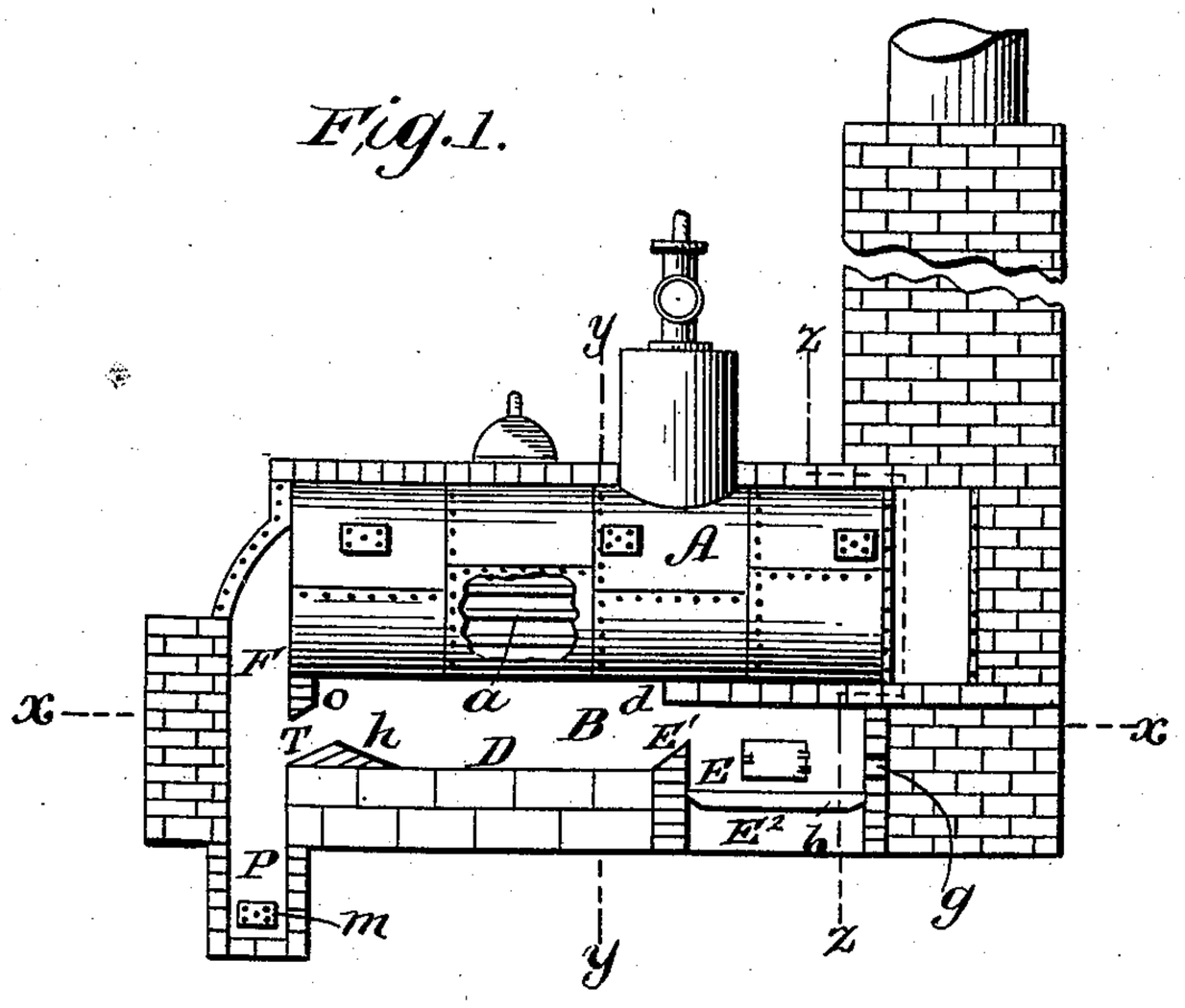
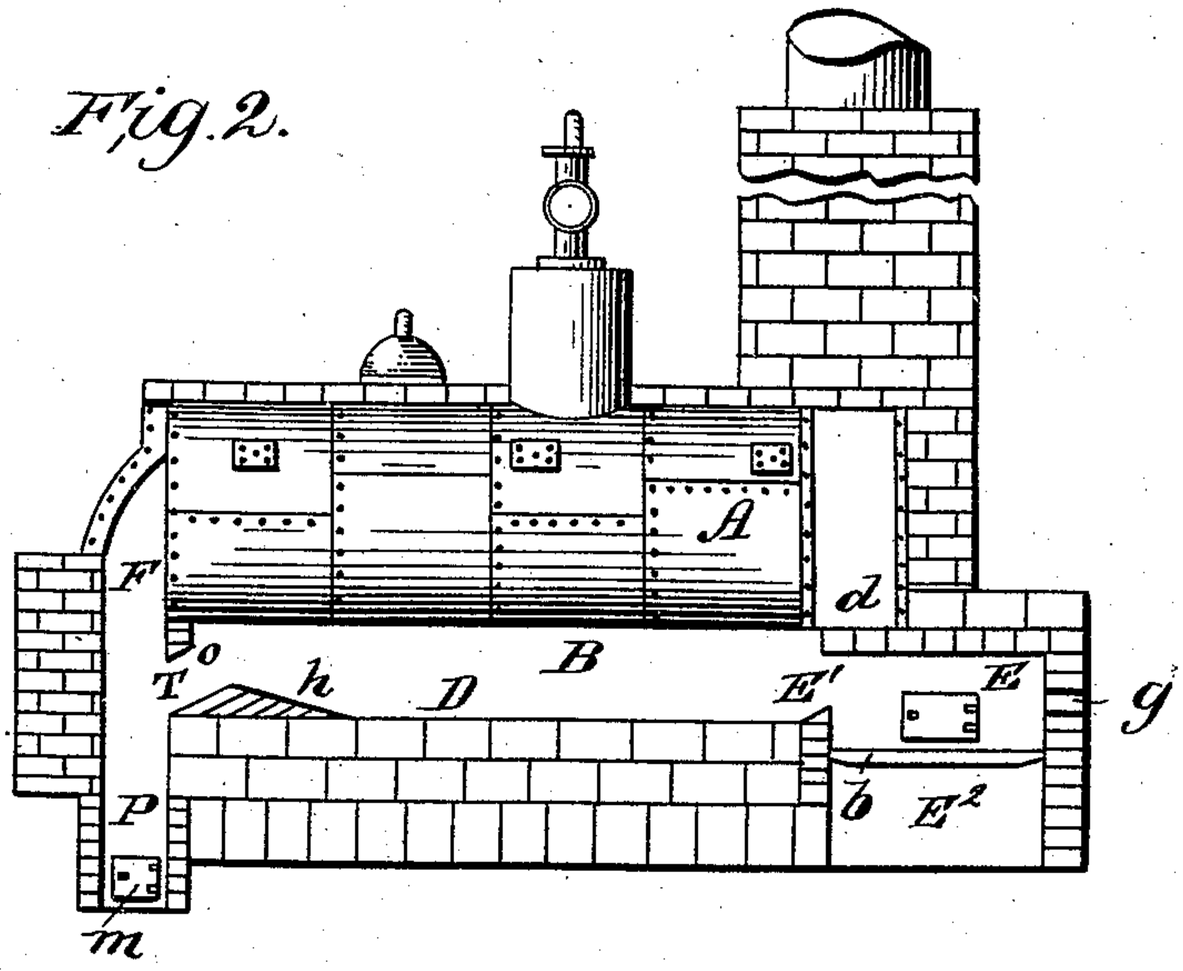


Fig. 2.



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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

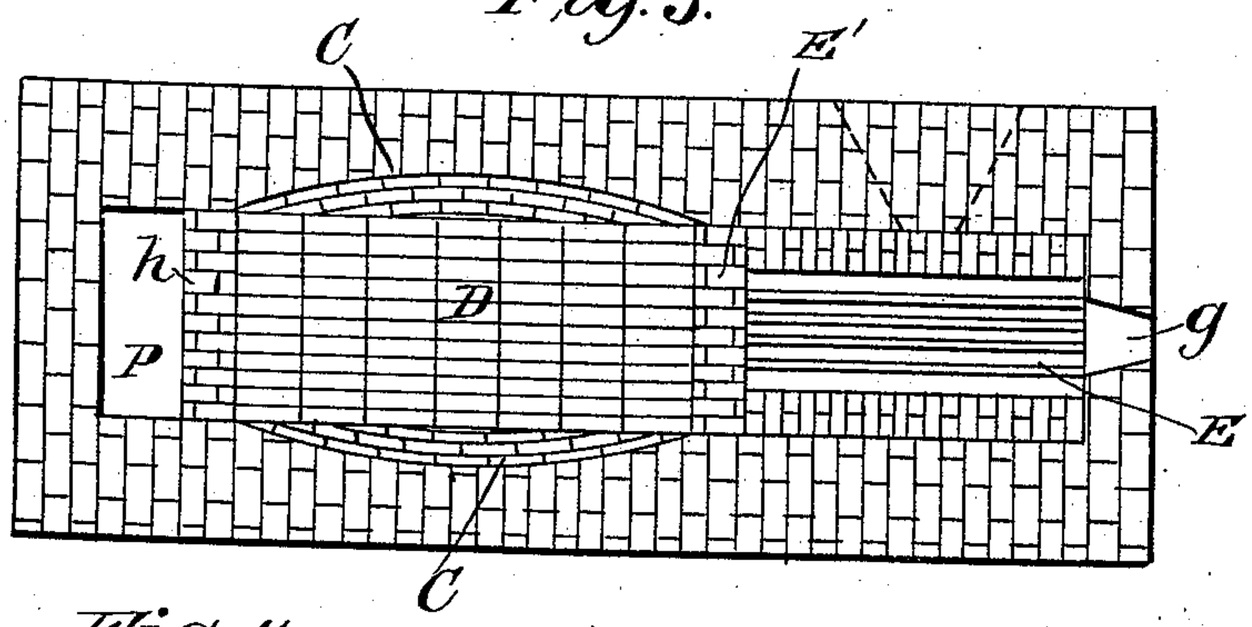
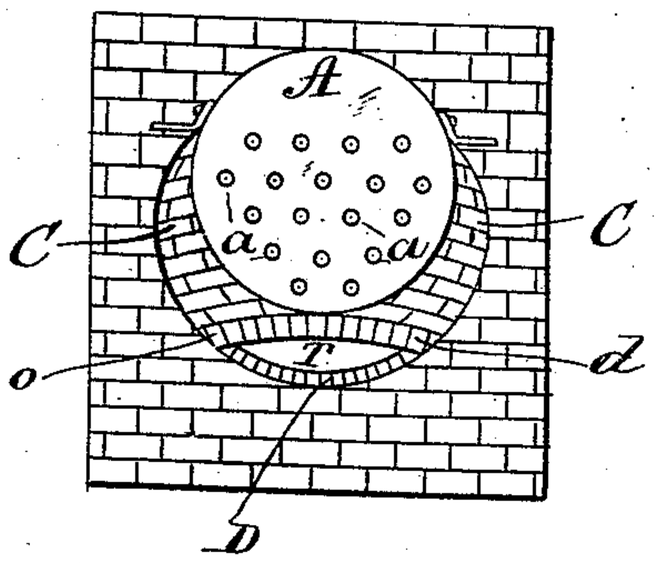


Fig. 4.

Fig. 5.



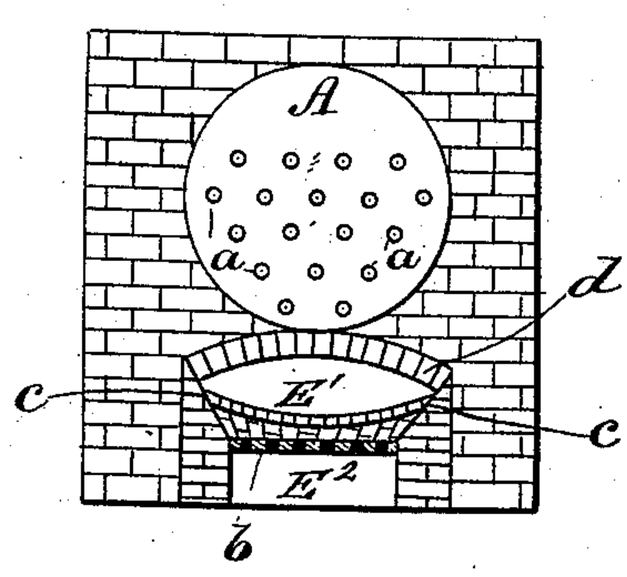
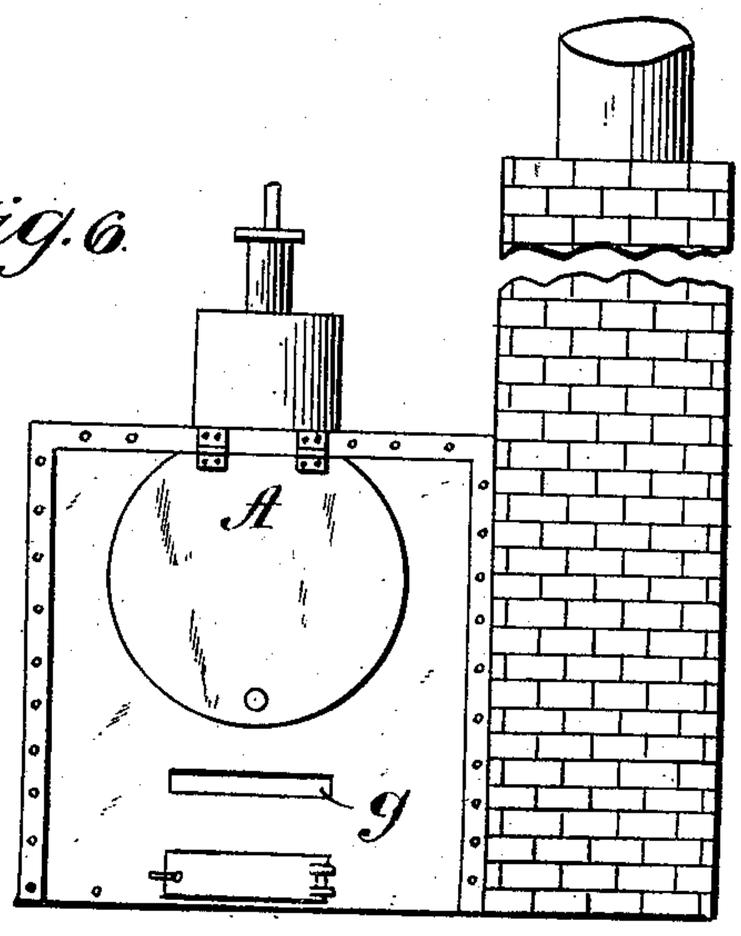


Fig. 6.



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UNITED STATES PATENT OFFICE.

JACOB J. STORER, OF NEW YORK, N. Y., ASSIGNOR OF TWO-THIRDS TO EMMA C. EATON, OF SAME PLACE, AND FRANK MARTIN, OF TOWNSEND, MONTANA.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 575,999, dated January 26, 1897.

Application filed March 12, 1896. Serial No. 582,905. (No model.)

To all whom it may concern:

Be it known that I, JACOB J. STORER, a citizen of the United States, residing at New York, county and State of New York, have invented a new and useful Improvement in Boiler-Furnaces, of which the following is a specification.

This invention is designed as an improvement on the usual method of setting horizontal cylindrical boilers; and its objects are to secure and apply, for the generation of steam, more of the thermal value of the fuel than is commonly done, and also, by causing complete combustion, to prevent the escape of smoke, which results are effected by means of certain simple changes in the inner lines or contours of the usual side walls and hearth inclosing the boiler and, in combination with these, by means of certain other useful and novel features in the construction and arrangement of the boiler fire-chamber and related parts, all of which will be hereinafter fully set forth.

The improvement is especially applicable to boilers designed to be fired with liquid, gaseous, or pulverized fuels, and will be found also of great advantage in many of its features for boilers fired with coal or wood in the usual way.

Reference is to be had to the accompanying drawings, in which similar letters of reference indicate corresponding parts.

Figure 1 is a partly-sectional longitudinal elevation of a cylindrical tubular boiler and improved setting, with parts broken away to exhibit other parts. Fig. 2 represents a modification of the same. Fig. 3 is a plan view on line *x x*, Fig. 1. Fig. 4 is a vertical sectional elevation on line *y y*, Fig. 1. Fig. 5 is a vertical sectional elevation on line *z z*, Fig. 1. Fig. 6 is a front elevation.

When by and with steam and air, or either of them, liquid, gaseous, or pulverized fuels are under pressure injected into a suitable and sufficiently hot furnace, the injected column, becoming heated, ignites and radially expands, thereby occupying a wider space and presenting more surface for quick oxygenation and combustion, the highest degree of which—the zone of most active combustion—is clearly indicated by the point of the greatest width or diameter of the flame column, and as the combustion progresses to completion the volume of flame gradually diminishes to a point or thin edge, ceasing simultaneously with the complete oxygenation of all its oxidizable elements.

When in a boiler fire-chamber constructed in the usual manner with parallel side walls and flat hearth sufficient air or steam borne fuel for best evaporating effects is applied, the natural lateral or radial expansion of the flame column is thereby by the parallel walls and flat hearth in great measure prevented and its longitudinal extension increased, and its onward movement toward the stack consequently much accelerated, so that its combustion cannot, as it should, be completed beneath and about the boiler-shell; but when the side walls and hearth are constructed to conform in their inner lines with the natural outlines of the projected flame column the latter will not be compressed out of shape nor be drawn from beneath the boiler before its combustion is completed and its full and proper work done.

When liquid, gaseous, or pulverized fuels are injected beneath a cylindrical flue or tubular boiler set in the usual manner with straight parallel side, walls which prevent proper lateral expansion of the flame column, the latter consequently, becoming unduly elongated and made to move faster, will extend beyond the length of the shell and turn upward and into the boiler flues or tubes, and there, becoming quickly deprived of a large portion of its heat by the surrounding heat-absorbing surfaces, its combustion will cease and a portion of its smoke or unconsumed carbon will deposit in said flues or tubes, making a non-conducting lining therein, while the rest will escape up the smoke-stack as visible smoke.

By my method of boiler-furnace construction the flame column is afforded ample room beneath and about the boiler-shell for natural lateral expansion and also for the thorough intermixture of the oxidizing and oxidizable elements and consequent complete combustion with resultant intense heat at the desired

point and absence of smoke, so that the flame column moves onward with comparative slowness and is comparatively short (does not extend beyond the boiler length) and only the hot gaseous products of complete combustion enter the flues or tubes or pass up the stack, the escape of smoke (unconsumed carbon) from beneath the boiler being thus prevented.

The above are some of the advantages of this improved method of boiler-setting. Another is that the hearth being laid on a curve concentric, or nearly so, with the boiler-shell and the inner side walls being made concave and ovoidal, as shown, the lines of heat radiation from them concentrate or focus directly upon the boiler and the flame column itself, and thus perform most effective work in the generation of steam and in rendering most active the chemical reactions in the flame column. And yet another important feature of this new boiler-furnace is the contracted throat of the flame-chamber, whereby the flame and hot gaseous products of combustion are retarded in their onward movement and made to reverberate (to borrow a word technically expressing the movement of the flame in a reverberatory furnace) about and against the boiler-shell, thus assuring the most effective work in the shortest space and measurably preventing loss of heat up the stack. It will be seen, then, that the boiler fire-chamber is essentially a reverberatory furnace with the fire-surface of the boiler-shell projecting down through the roof in the longitudinal axis thereof.

In the drawings, A represents the boiler, in this instance a cylindrical tubular boiler, as shown by tubes *a*, Figs. 1, 4, and 5.

B represents the flame or combustion chamber, with concave ovoidal side walls C C and concave hearth D, the latter, however, being an old device.

The fireplace shown at E is separated from the hearth D by fire-bridge E′.

In Fig. 1 the fireplace is located beneath the boiler, and its arched roof *d* is nearly in contact with the boiler crown-sheet, while in the modification shown in Fig. 2 the fireplace is constructed entirely outside of the boiler-front and made to communicate with the boiler-chamber through an opening in said front.

Preferably the fireplace is constructed and located as shown in Fig. 1 when applied to a long boiler, as it leaves an ample length of combustion-chamber, while in the case of a short boiler the modification shown in Fig. 2 is preferably adopted, so that the boiler fire-chamber shall not be shortened by its encroachment.

The several members of the fireplace E, beneath which is the ash-pit E^2, are the grate *b*, the inclined jambs *c*, and the arched roof *d*, all of which have been subjects of former patents of mine and hence require no special description herein.

When pulverized, gaseous, or liquid fuels are injected beneath a boiler, their instant and continuous ignition is assured by a very small fire on the grate, enough to keep the grate covered and heat the jambs and roof. Hence the grate is made much narrower than if solid fuel alone were to be applied. These jambs, arch, and fire-surface, when the boiler is in operation, constitute radiating-surfaces to concentrate heat upon the entering column of injected fuel as it is introduced through the twyer *g*.

Sometimes the grate is altogether dispensed with, a flat or preferably a concave brick hearth being substituted therefor, on which a fire is made for igniting the injected fuel, which fire will not require replenishing after the said hearth, jambs, and arch have become red-hot; yet the grate is at times desirable, inasmuch as it affords a convenient way of introducing air upward against the under surface of the injected column of fuel. What auxiliary air may be required for complete combustion in excess of that introduced with the fuel may be supplied through openings in the walls of the fireplace or flame-chamber or through the fire-bridge, but as all these methods and devices are old and well understood I do not show or claim them herein.

In order to insure as nearly as possible the best duty from the injected fuel, it is necessary to keep its gaseous products and floating incandescent particles of carbon from contact with the cooler boiler-surface until their combustion is nearly completed; otherwise a considerable proportion of them would be cooled below the point of combustion and chemical combination, and hence fail of producing their proper effect. To this end the arched roof *d* is constructed.

The hearth D is, as best shown in Fig. 4, laid concentric with the boiler, so that the lines of heat radiation from it may concentrate upon the bottom of the latter, and in order to better cause the hot gaseous products of the completed combustion of the injected fuel to make contact with the boiler a deflecting wall or bridge *h* is fixed transversely across the rear of the hearth D at the point where the column of flame should, if the flame-chamber be well heated, indicate almost or quite complete combustion, and at this point, too, and partially for the same purpose, the concave ovoidal side walls C C are drawn in to their nearest approach to each other, as best seen in Fig. 3, and a brick arch-supported wall *o* is sprung from the sides of the hearth D, with its top nearly or quite touching the bottom of the boiler at its rear end. This wall *o* serves a double purpose, that of deflecting the floating ashes of the pulverized fuel, when used, down into the pit P, whence they may be removed through door *m*, while in combination with the bridge *h* and the indrawn side walls C C it forms or outlines the contracted furnace-throat T and locates it well below the plane of the bottom of the boiler, features that are of especial value when pulverized fuel is used, as can

readily be understood from what has been said above.

The eminent advantages in constructing a boiler flame-chamber with concave ovoidal inner side walls and with a contracted throat, as shown, are apparent without argument, for it is clearly evident that in such a furnace the combustion of the injected fuel and their gases may be made complete and absolute, the heat radiated from said walls be assuredly utilized for work, and the hot products of combustion be most effectively retarded beneath the boiler to do work there.

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

1. A boiler-furnace constructed substantially as herein shown and described, comprising a fireplace with inclined jambs and arched roof, a fire-bridge, a concave hearth beneath the boiler, ovoidal side walls to the flame or combustion chamber, a deflecting-wall fixed transversely across the hearth, near the rear end thereof, and an arch-supported wall sprung from the sides of said chamber with its crown nearly or quite touching the boiler at its rear end, all combined and arranged as and for the purposes set forth.

2. In a boiler-furnace, the combination with the arched fireplace-roof, fire-bridge and concave combustion-chamber hearth, of ovoidal side walls in said chamber, a deflecting-wall fixed across the hearth near its rear end and an arch-supported wall with crown nearly or quite touching the boiler at its rear end, all combined and arranged substantially as herein shown and described.

JACOB J. STORER.

Witnesses:
H. M. JOHNSTON,
GEO. O. EATON.