E. T. DAVISON.

FURNACE.

APPLICATION FILED JAN. 8, 1912.

1,027,187.

Patented May 21, 1912.

2 SHEETS—SHEET 1.

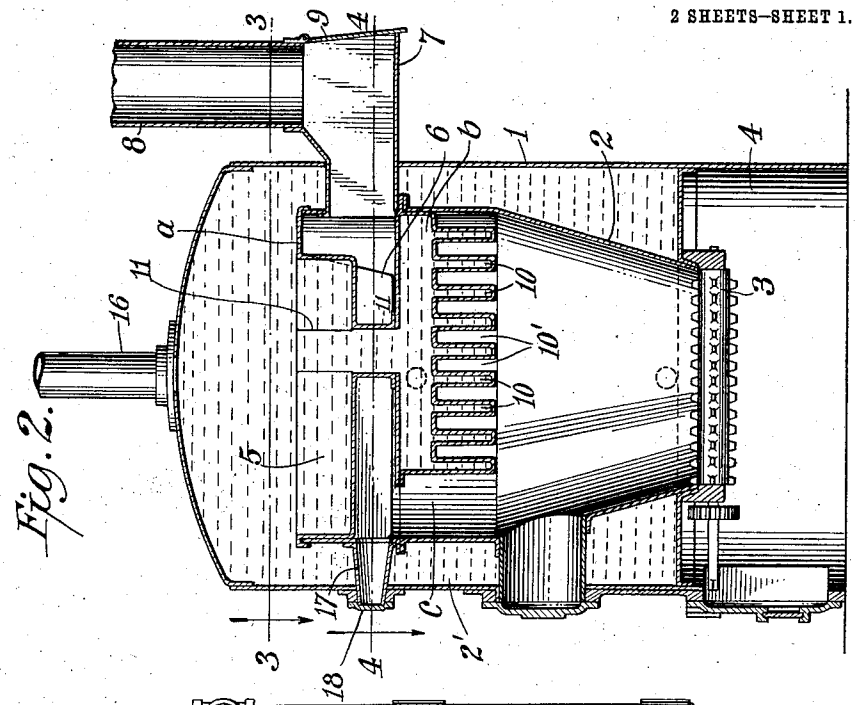

Fig. 2.

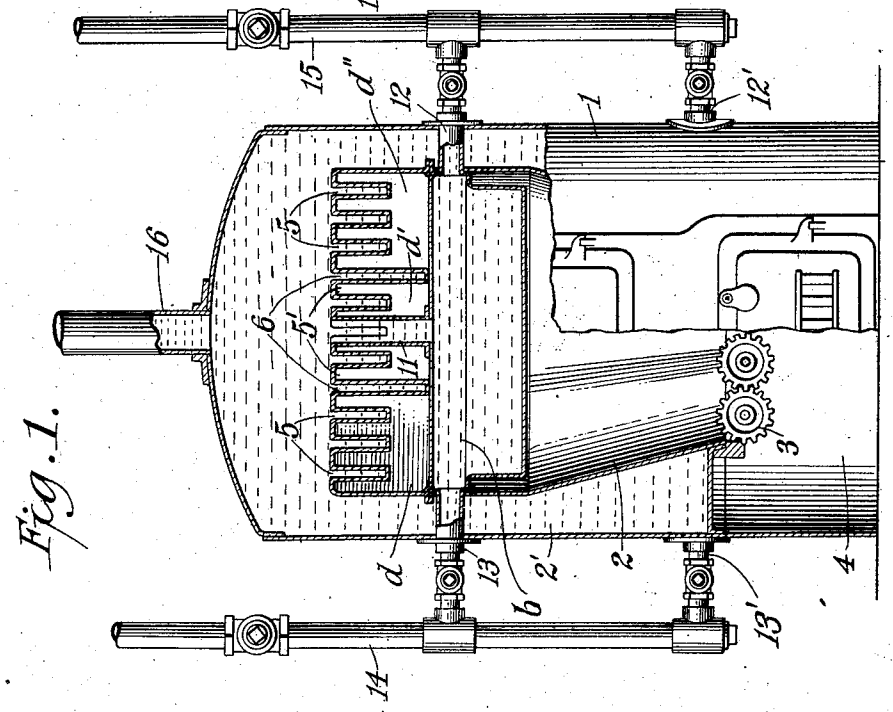

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 4.

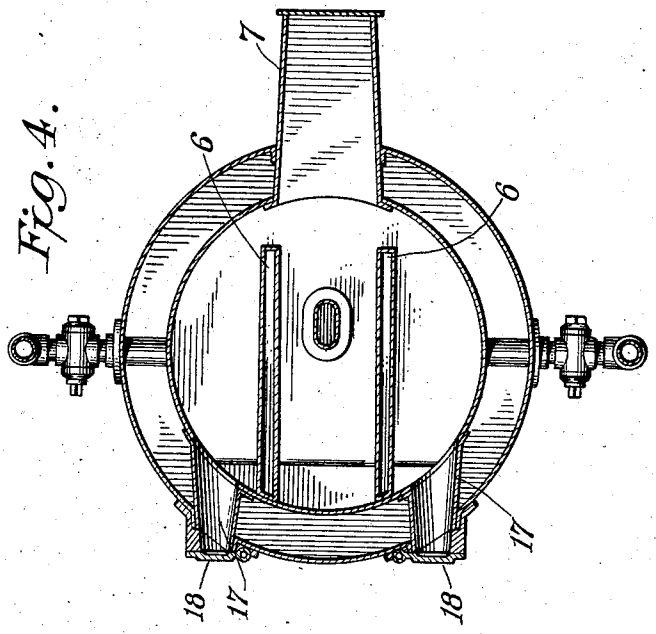
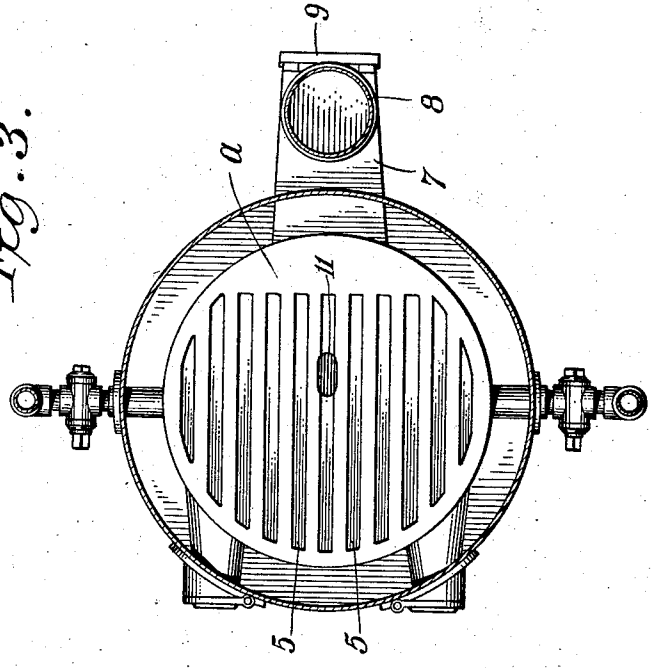


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

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FURNACE.

1,027,187. Specification of Letters Patent. Patented May 21, 1912.

Application filed January 8, 1912. Serial No. 669,969.

To all whom it may concern:

Be it known that I, ELWIN THEODORE DAVISON, a citizen of the United States, residing in Athenia, county of Passaic, and State of New Jersey, have invented new and useful Improvements in Furnaces, of which the following is a specification.

Heretofore various constructions of furnaces have been devised for increasing the fluid heating capacity, as for example, in the Patent No. 448,391 of March 17, 1891, it has been proposed to superimpose in the fire-pot a plurality of sections or fluid heating chambers having corrugated bottoms, in such a manner that the products of combustion are compelled to pass through the peripheral openings in one section, and a central opening in the next succeeding section alternately, thereby resulting in the tortuous passage of the same along to the stack. While the provision of corrugations in the surface of these fluid heating chambers theoretically increases the heating surface area of said chambers some 50 to 90% over and above that of a plane surface, nevertheless, the interposition of such a large number of barriers in the path of the upwardly flowing gaseous products tends to retard the draft to such an extent that for many purposes such a construction cannot be satisfactorily employed. This is particularly true when it is desired to burn soft coal or like grades of fuel. Moreover, the said surfaces, because of the retardation of the draft of the furnace, causes the deposition of the soot which results in effectively insulating the said surfaces against the conduction of heat therethrough with the result that the actual efficiency of the furnace, particularly as stated when employing a low grade of fuel, is not very largely increased either by the provision of these corrugated surfaces or by the great extent of the heating surfaces over which the products of combustion are caused to pass.

The object of this invention is the provision of such a construction of furnace as will afford a maximum of heating surface within the fire-pot without resulting in the excessive retardation of the draft, or the interposition of obstructions which will effect the deposition of large quantities of soot thereon. In fact, the area of the heating surface of the fluid chamber in the construction hereinafter described, is enormously increased over that of a plane surface, corresponding in extent to the horizontal cross sectional area of the fluid compartments and air chambers, the construction is such that the draft is not seriously impaired and there is no material deposition of soot upon the heating surface exposed to the products of combustion. Moreover, what soot, if any, is deposited can be readily removed, because of the novel arrangement of the chambers, which are employed in this construction.

The invention is fully set forth in the following detailed description and drawings forming a part thereof, in which—

Figure 1 is a front elevation, chiefly in section, of a furnace of the hot-water type; Fig. 2 is a vertical cross-section thereof; Fig. 3 is a cross-section along the line 3—3 of Fig. 2, and Fig. 4 is a cross-section along the line 4—4 of Fig. 2.

Referring to the drawings and the construction shown therein, the reference numeral 1 designates the shell and within this is arranged a fire-pot 2 of the well known construction, the lower portion of the same being preferably of a truncated cone-like configuration, and the upper portion being preferably cylindrical. A fluid-chamber 2′ embraces the said fire-pot, the same being in this instance adapted to receive hot water although obviously, it is suited for the reception of air or other fluid as may be desired. Suitable grate-bars 3 are provided, arranged in the usual manner at the bottom of said fire-pot above the ash-pit 4, and as shown, access may be had both to said fire-pot and said ash-pit by the usual swinging doors. The upper end of said fire-pot as shown, is formed into a series of water and air compartments 5 and 5′ respectively, said water compartments being preferably about one-half the width of said air compartments. In practice I prefer about the proportion of one-half inch for the water compartments and one inch for the air compartments in the furnace, with a fire-pot of 24″x30 inches square and 48 inches high, although these proportions may be obviously somewhat varied as hereinafter set forth. Preferably two compartments of greater depth than the aforesaid compartments 5, as indicated by the reference numeral 6, are provided, and thereby the upper end of said fire-pot is divided into approximately three channels in the manner shown. The smoke-pipe 7, which extends parallel with the axis of said compartments 5 and 6, opens through

the wall of the fire-pot into a chamber *a*, which is intermediate the rear end of said compartments and the wall of the fire-pot. The usual stack 8 of any suitable type, may be provided with a damper 9, connected with said smoke-pipe or outlet pipe.

A fluid heating chamber *b* projects downwardly from a point midway between the top and bottom of the cylindrical portion of said fire-pot. This chamber, which extends almost but not entirely, across the fire-pot, is also provided with fluid compartments 10 which are spaced from each other so as to form air-spaces or culs-de-sac 10′. In order to insure the efficient heating of the fluid in these compartments, each of said air spaces is preferably constructed about twice the width of the corresponding fluid compartment, and thereby the gaseous products of combustion are admitted in relatively large quantities to said culs-de-sac. However, owing to the size of the same and the smooth exterior surfaces possessed thereby there is comparatively little retardation of the flow of the said gaseous products along the entire extent of the surface of these culs-de-sac. The said fluid chamber is supported by means of a water-neck or fluid conduit 11, which is integrally cast with the chambered top of said fire-pot and projects downwardly therefrom to a depth corresponding to that of the compartments 6. In order to prevent the direct passage of the gaseous combustion products to the smoke-pipe, the said fluid chamber *b* is preferably secured directly to the same wall of the fire-pot as that which receives said smoke-pipe. On the other hand a passage *c* is provided intermediate the end of said fluid chamber *b* and the opposite wall of the fire-pot of sufficient size to permit of the free flow of the said gaseous products from the fire-pot after the same have traveled over the exterior surfaces of said fluid compartments 10. The said passage *c* opens into the channels *d*, *d′*, *d″*, which in turn empty into the exit chamber *a*, from which direct communication is afforded with said smoke-pipe.

The reference numeral 16 designates an outflow pipe for conducting the heated water to the radiators in the building, which are connected in the usual manner with the return flow pipes 14 and 15. The bottom of the jacketed portion of the shell being approximately at the lower end of the fire-pot 2, the return pipes 12′, 13′ are tapped through the shell 1 at this point, as shown in Fig. 1. Thus a portion of the return water passes into the interior of the shell 1 and other portions into the heating chamber *b*, which as described, is connected by the pipe 11 with the interior of the shell 1 near the top thereof.

When employing a fire-pot of rectangular configuration, and having dimensions 24″ by 30″, and a heating chamber spaced four inches from the front wall of the fire-pot which fire-pot is 48″ in depth, the whole heating surface area of said fire-pot will be 3672 square inches, when the heating chamber is omitted. When however, as shown herein, a heating chamber is employed, and as stated spaced 4″ from the front wall of the fire-pot, and having fluid-compartments four inches deep and one-half inch in width with intervening culs-de-sac of one inch width, the heating surface area of these projecting compartments is equal to 3744 square inches, or approximately six times that of a plane surface corresponding in area to the cross-sectional area of said fluid compartments and said air chambers combined. As shown, the depending compartments of said fluid-heating chamber are arranged to impede the free escape of the gaseous products of combustion from the fire-pot, and the same must therefore be arranged to intersect the vertical plane including the axis of the outlet conduit from said fire-pot and the center point of said fire-pot. The fluid compartments depending from the top of said fire-pot should on the other hand afford as little resistance as possible to the passage of the gaseous products of combustion to the outlet opening in said fire-pot, and accordingly these are arranged in parallelism to the vertical plane including the axis of the outlet conduit from said fire-pot and the center point of said fire-pot.

For air heaters, the heating chamber *b* is connected directly with the interior of the shell A, which is provided at the bottom with the usual fresh air inlet duct, and at the top with hot air flues for conducting the heated air to the various rooms to be heated; otherwise the construction is practically the same as above described with reference to the hot water heater shown.

Owing to the vertical arrangement of the fluid compartments, it becomes extremely easy to tap off or break off any soot or other deposit therefrom, and it is evident that access may be had to the compartments depending from the interior fluid heating chamber through the door of the fire-pot and through the chute 17 and door 18. Suitable implements can be introduced to clean off the fluid compartments depending from the top of the fire-pot.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A furnace, comprising a fire-pot and a shell, an exterior fluid heating chamber intermediate the same, an interior fluid heating chamber positioned in the upper portion of said fire-pot and provided with depending fluid compartments, each compartment being separated from an adjacent com-

partment by an air chamber closed at the top and opened at the bottom and said compartments being of sufficient depth to increase the heating-surface area exposed to the products of combustion at least 150% in excess of the total horizontal cross-sectional area of said compartments and said air-chambers separating the same, and means for preventing the unimpeded escape of the products of combustion from said fire-pot prior to the passage of the same over the said chambered inferior surface of said heating chamber and for permitting of the substantially unimpeded escape of said products of combustion after passage over said surface.

2. A furnace, comprising a fire-pot and a shell, an exterior fluid heating chamber intermediate the same, an interior fluid heating chamber positioned in the upper portion of said fire-pot and provided with depending fluid compartments arranged to intersect the vertical plane including the axis of the outlet conduit from said fire-pot and the center point of said fire-pot, each compartment being separated from an adjacent compartment by an air chamber closed at the top and opened at the bottom and said compartments being of sufficient depth to increase the heating-surface area exposed to the products of combustion at least 150% in excess of the total horizontal cross-sectional area of said compartments and said air chambers separating the same, and means for preventing the unimpeded escape of the products of combustion from said fire-pot prior to the passage of the same over said chambered inferior surface of said heating chamber and for permitting of the substantially unimpeded escape of said products of combustion after passage over said surface.

3. A furnace, comprising a fire-pot and a shell, an exterior fluid heating chamber intermediate the same, an interior fluid heating chamber positioned in the upper portion of said fire-pot and provided with depending fluid compartments arranged to intersect the vertical plane including the axis of the outlet conduit from said fire-pot and the center point of said fire-pot, each compartment being separated from an adjacent compartment by an air chamber closed at the top and opened at the bottom and said compartments being of sufficient depth to increase the heating-surface area exposed to the products of combustion at least 150% in excess of the total horizontal cross-sectional area of said compartments and said air chambers separating the same, and depending fluid heating compartments spaced from each other by air chambers arranged above said fluid heating chamber and extending in parallelism with the plane including the axis of the outlet conduit from said fire-pot and the center point of said fire-pot, said compartments being of sufficient depth to increase the heating-surface area exposed to the products of combustion at least 150% in excess of the total horizontal cross-sectional area of said compartments and said air chambers separating the same, and means affording communication between said exterior fluid heating chamber and the fluid compartments positioned within said fire-pot.

4. A furnace, comprising a fire-pot and a shell, an exterior fluid heating chamber intermediate the same, an interior fluid heating chamber positioned in the upper portion of said fire-pot and provided with depending fluid compartments, each compartment being separated from an adjacent compartment by an air chamber closed at the top and opened at the bottom and said compartments being of sufficient depth to increase the heating-surface area exposed to the products of combustion at least 350% in excess of the total horizontal cross-sectional area of said compartments and said air-chambers separating the same, and means for preventing the unimpeded escape of the products of combustion from said fire-pot prior to the passage of the same over the said chambered inferior surface of said heating chamber and for permitting of the substantially unimpeded escape of said products of combustion after passage over said surface.

5. A furnace comprising a fire-pot and a shell, an outlet pipe from said fire-pot, longitudinal hollow vertical compartments extending downwardly from the top of said fire-pot and forming in the upper portion of said fire-pot a plurality of channels adapted to receive a current of gaseous products of combustion flowing to said outlet pipe and sub-dividing said current into a plurality of currents, a horizontal partition adapted to substantially contact with the bottom of said longitudinal vertical compartments to prevent the direct passage of the products of combustion to said outlet pipe without passage through said plurality of channels formed by said longitudinal compartments.

In witness whereof, I have hereunto set my hand at the city of New York, county of New York and State of New York, this thirtieth day of December, 1911.

ELWIN THEODORE DAVISON.

Witnesses:

W. S. SWENARTON,

E. J. ESSELSTYN.