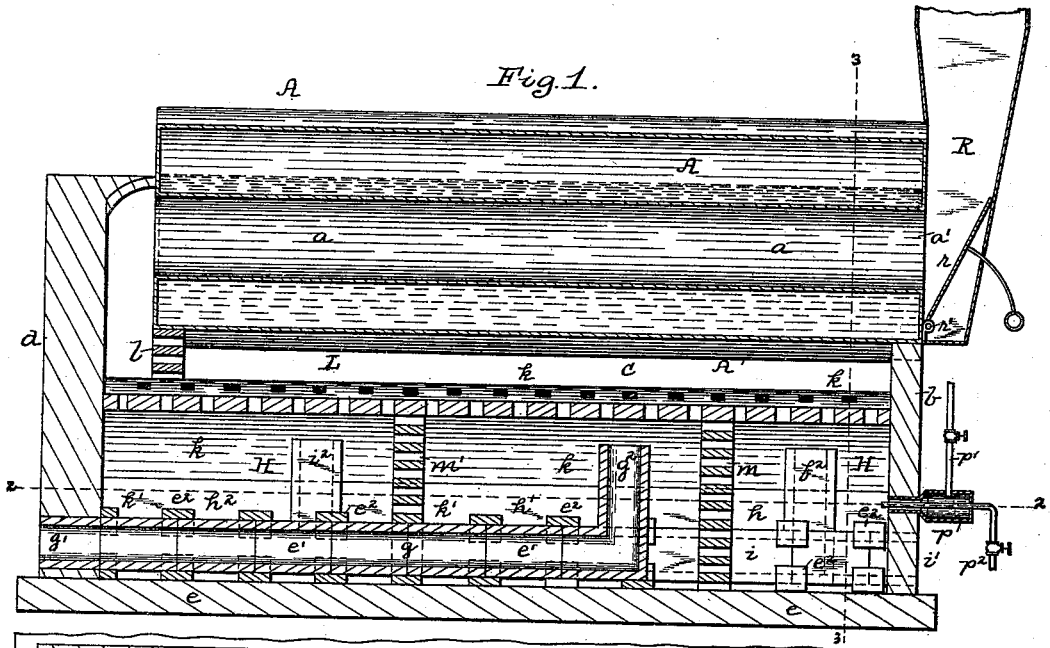
(No Model.)

S. T. OWENS.

BOILER FURNACE.

No. 492,943. Patented Mar. 7, 1893.

Fig. 1.



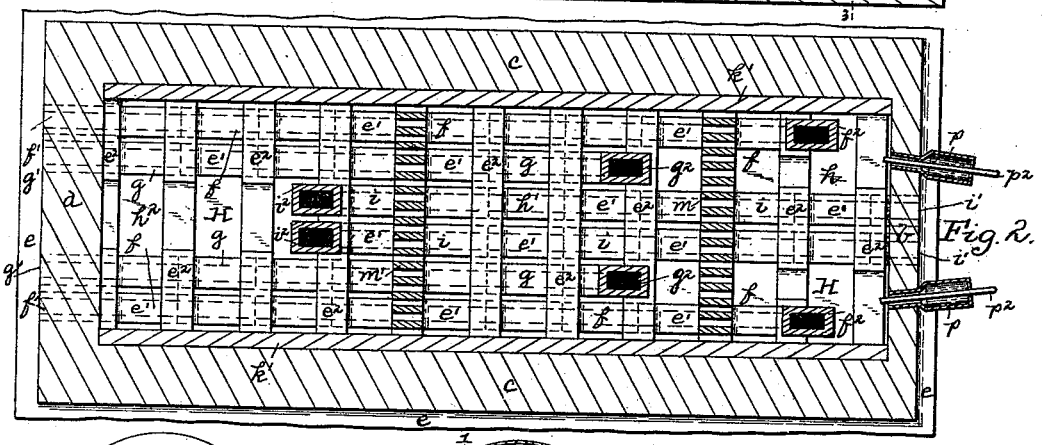


Fig. 2.

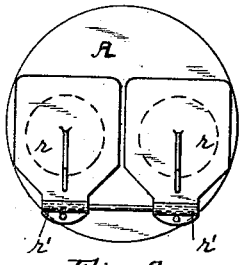


Fig. 4.

Fig. 3.

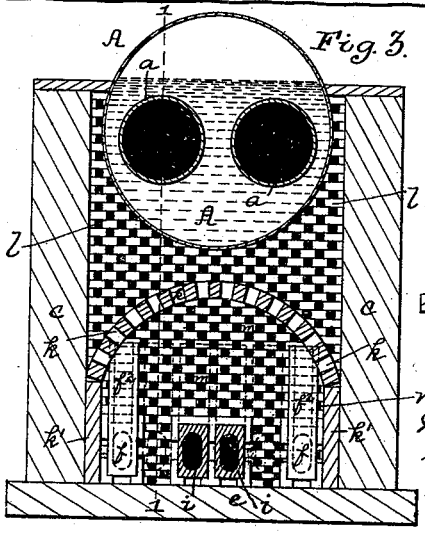
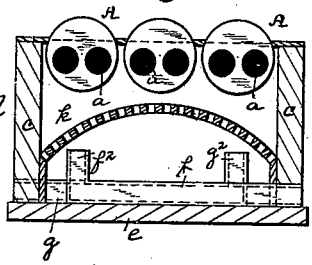


Fig. 5.



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UNITED STATES PATENT OFFICE.

SAMUEL T. OWENS, OF PITTSBURG, PENNSYLVANIA.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 492,943, dated March 7, 1893.

Application filed July 24, 1891. Serial No. 400,566. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL T. OWENS, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Boiler-Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to boiler furnaces, its object being to provide a boiler furnace in which a high heat may be generated throughout the length of the boiler, and in which a large saving of fuel can be effected; practically all the fuel introduced being entirely consumed, and therefore a greater proportion of heat generated than in the ordinary boiler furnace.

My invention relates more particularly to that class of furnaces in which gaseous fuel or vaporized fuel, such as vaporized hydrocarbon is employed, though with some changes in construction it may be employed with the ordinary solid fuel.

It consists, generally stated, in combining with the boiler a perforated arch extending longitudinally under the boiler and above the fire chamber, and one or more transverse perforated walls extending across the same in such way as to divide the space under the arch into compartments each forming a combustion chamber, and so to compel the gases and flame to pass through such perforated walls, the course of the gases being thus retarded in such way that a more perfect commingling of the air therewith is obtained, and the entire combustion of the gases therefore rendered possible.

It also consists in certain improvements in the heating and introduction of the air, and in the dampers for controlling the passage of the heated products through the boiler, as will be hereinafter more particularly set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which

Figure 1 is a longitudinal section through one of the flues of the boiler, the line of such section being shown at 1—1, Fig. 3. Fig. 2 is a horizontal section on the line 2—2, Fig. 1; Fig. 3 is a cross section on the line 3—3, Fig. 1; Fig. 4 is a detail view of the dampers controlling the flues of the boiler; and Fig. 5 is a reduced cross section of a modification.

Like letters of reference indicate like parts in each.

I have illustrated the invention in connection with what is termed a two flue boiler, the boiler A having the flues *a a* extending longitudinally through the same, the boiler being suitably supported within the furnace. The furnace has the front wall *b*, side walls *c* and back wall *d*, the side walls *b* preferably extending up on each side of the boiler, so as to expose the sides thereof to the heat generated.

Extending over the floor *e* of the furnace is a series of longitudinal air heating flues, six such flues being shown in the drawings, and said flues being formed of tubular tile, the tile being preferably rectangular in exterior shape, and being supported on suitable brick work, the bricks e^2 fitting around the meeting edges of the tiles *e'* and closing the joints, but at the same time leaving the bodies of the tile between the joints free for the passage of the heat around the same, so as to cause the heating of the incoming air. By means of these tiles, or similar devices, a series of longitudinal flues is formed, extending along the lower part of the fire chamber and exposed to the heat thereof, and in order to obtain the greatest heating of the air possible, these flues lead either from the ends or the sides of the furnace, according to the distance to be traversed therein. For example; the flues *f* open near the front end of the furnace, and have their entrances *f'* through the rear wall *d* thereof and their discharge openings f^2 near the front end of the furnace, such discharge openings being formed of vertical tile opening from the longitudinal flues *f*, so as to carry the air up toward the upper end of the furnace chamber H. The incoming flues *g* have their vertical openings g^2 back from the front end of the furnace and nearer the front end than the rear end, and therefore they have their entrance ports *g'* in the rear wall *d*. The flues *i* have their ver-

tical discharge ports i^2 nearer the rear wall than the front wall, and therefore they have their entrance ports i' in the front wall b. These several ports, f^2 g^2 and i^2 open by means of vertical tubes or tiles extending from the longitudinal flues up into the furnace chamber a sufficient distance to carry or discharge the air at such point therein as to bring the air substantially above the gas, and therefore cause the proper commingling of gas and air. The several longitudinal flues, with their discharge flues, are exposed to the heat generated within the furnace which has free course to pass entirely around the tubes forming the flues except at their joints, and therefore the air is introduced into the furnace at a high heat; examination of the furnace showing that these vertical tubes or risers are held at a red heat, and even the interior walls are not chilled by the incoming air.

In Fig. 5 the air heating flues lead from the side walls, with the same effect. Extending over from the supporting side walls k' which form the base for the arch, is the perforated arch k, which arch preferably extends the entire length of the boiler, though for some purposes it may only extend part way. For example; the rear end of the perforated arch back of the perforated wall m' may be omitted, and the heated products be permitted to strike directly against the boiler at that point. Within said longitudinal perforated arch, and extending across the fire chamber H, are one or more transverse perforated walls m m', two such walls being shown, and the walls dividing the fire chamber into compartments h, h', h^2, each forming a combustion chamber, such construction so dividing the furnace into a series of compartments having perforated arched roofs, and perforated or checker-work cross walls, so that the fuel entering the fire chamber is compelled to pass through these walls in its course toward the rear of the furnace, and is retarded thereby; and each compartment gives a space for the proper mixing or commingling of the air with the gases, so that before they pass through the furnace practically all the gases are completely consumed. According to the construction shown, each one of the longitudinal flues opens in one of these compartments, the flues f opening in the compartment h, the flues g in the compartment h' and the flues i in the compartment h^2; the discharge tubes of these flues opening near the upper ends of the compartments as above stated. The end of the space L between the perforated arch k and the boiler A is closed by the like perforated or checker-work wall l.

The furnace is provided with any suitable fuel entrances, those shown in the drawings being oil injectors p which enter through the front wall b, the oil or other liquid hydrocarbon passing to the injectors through the tubes p', while the steam or air under pressure passes to the injector at p^2. Two of these injectors are shown, and they are preferably placed at an incline to the length of the boiler, so as to inject the hydro-carbon vapor over toward the side walls. Instead of such injectors suitable gas entrances may be employed, or if preferred, a suitable form of grate may be arranged to communicate with, or formed of the front compartment h.

In order to control the draft through the furnace, and to retard the draft as hereinafter described in connection with the operation of the same, I employ at the exit end of the boiler flues a the dampers r, these dampers being placed within the breeching R of the boiler leading to the chimney. The dampers are mounted in any suitable way so as to act to close the exit openings of the flues a, the construction preferred being that shown in the drawings, in which the dampers are hinged or pivoted at their lower ends as at r' to the boilers, or to the breeching, as may be desired, and are adapted to be swung up and close the exit ends a' of the flues in such way as to either retard the flow of the heated products through the flues, or entirely cut off the draft of the same; and as a result of such a construction, I am enabled to entirely close the boiler flues, and so close the draft through the furnace, and maintain the heat within the same for a long period, without consuming any fuel.

In the operation of the boiler furnace where oil is employed, the oil is injected through the injectors p, either air or steam being employed for the purpose, as found most desirable. As so injected it will be vaporized, and as soon as it enters the furnace chamber h it will be raised to a high heat, the oil vapor circulating first within the forward comparment h of the furnace chamber, and a portion of the same uniting with the air entering the furnace through the flues f and discharged into the compartment h through the vertical tile f^2 within the said chamber. The air is introduced in the upper part of said chamber, and as the oil vapor is of lighter specific gravity than the air, and the vapor is introduced under the air, proper conditions for the commingling of the same and combustion of the vapor are obtained. As a result of the combustion in this first compartment a part of the flame and heated products will pass upwardly through the perforated arch forming the upper part thereof, striking against the boiler or circulating within the space L around the boiler. Part of the vapor or the gases formed therefrom, together with the flame and heated products, will strike against the perforated cross wall m which is maintained at practically a white heat, and enter into the second compartment h', into which the highly heated air is fed from the flues g through the vertical tubes g^2, the vapor or gases being commingled with the heated air

and still further combustion being formed thereby, part of which escapes through the perforated arch, striking against the boiler and circulating within the space L, while part of the unconsumed gases together with the flame and heated products will strike against and pass through the second perforated cross wall m', which is in like manner maintained at a high heat, and will be commingled with the air entering the compartment h^2 from the flues i through the vertical tubes i^2, and in the course through the furnace chambers and the several compartments thereof a practically perfect combustion of all the gases formed from the oil vapor will be obtained, the perforated cross walls retarding the flow of the same, causing the commingling of the air and gases in such way as to obtain the combustion of the same, while practically all the heat generated in the several compartments will rise through the longitudinal perforated arch k into the space L around the boiler, and in case any of the gases escape into such space L they will intermingle with the heated air which will pass into the said space through the perforated arch, and form combustion above the arch, the perforated arch and the perforated cross walls in this way retarding the draft and the flow of the gas and air, and forcing the gas and air through comparatively small passages so that they will be thoroughly commingled with each other, causing the practically perfect combustion of all the gases formed from the oil vapor. The highly heated products of combustion will flow through the space L to the end of the boiler, and through the perforated wall l, and then pass forward through the flues or tubes of the boiler into the breeching R, and the flow of such highly heated products is controlled by the damper or dampers r, which can be raised so as to reduce the discharge openings at the ends of the flues, and in that way so retard the draft through the same that the larger portion of the heat which is generated in the furnace will be absorbed through the walls of the boiler and utilized for steam generating. The draft can in this way be controlled and retarded, both by the perforated arch and perforated cross walls of the furnace itself, and by the dampers. Practical operation of the furnace has proven that in operating with oil vapor the same heat can be generated with one-third less fuel than in the ordinary furnace heated with the same fuel, while at the same time the steam generating is caused principally by the highly heated products of combustion, and the burning out of the walls of the boiler is prevented. In case it is desired to close down the boiler, such for example as where the works are not running, by closing the dampers r against the flues of the boiler, the draft or current through the boiler furnace and boiler can be entirely checked, and as a result the heat retained within the furnace and boiler, it being found that even where the boiler is shut down for twelve hours, the high heat retained within the walls of the boiler furnace is sufficient to maintain the water within the boiler practically at the steam generating point, so that when the furnace is again started steam will be generated in a few minutes.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A boiler furnace having a cylindrical boiler provided with return flues or passages and having below the same and above the fire chamber a cylindrical perforated arch and one or more transverse perforated walls extending across the fire chamber so dividing the space below the arch into compartments, each forming a combustion chamber substantially as and for the purposes set forth.

2. A boiler or like furnace, having a longitudinal perforated arch extending under the boiler and above the fire chamber, transverse perforated walls extending across the fire chamber and dividing it into compartments, each forming a combustion chamber and air entrances communicating with the said compartments, substantially as and for the purposes set forth.

3. A boiler or like furnace having a longitudinal perforated arch extending under the boiler and above the fire chamber, transverse perforated walls extending across the fire chamber and dividing it into compartments, and having vertical air tubes extending up within said compartments and opening only at points near the top of the compartments, substantially as and for the purposes set forth.

4. A boiler or like furnace having a series of longitudinal air heating flues extending along the base thereof, and exposed to the heat of the fire chamber and having vertical tubes rising therefrom within the fire chamber at different points in the length thereof and opening near the top of the same, substantially as and for the purposes set forth.

5. A boiler or like furnace having longitudinal air heating flues leading from the rear of the furnace to a point near the forward end thereof and opening into the same, and longitudinal flues leading from the forward end of the furnace toward the rear thereof and opening into the same, substantially as and for the purposes set forth.

6. A boiler or like furnace having a fire chamber under the boiler communicating with the entrance end of the boiler flues or tubes, and having a damper at the discharge end of said flues or tubes and adapted to be closed so as to control the flow of the heated products through the same, substantially as and for the purposes set forth.

7. A boiler or like furnace having a fire chamber under the boiler communicating with the entrance end of the boiler flues or tubes,

and having a damper at the discharge end of said flues or tubes controlling the flow of the heated products through the same, said damper being hinged or pivoted below the flue, and adapted to be raised toward or against the same, substantially as and for the purposes set forth.

In testimony whereof I, the said SAMUEL T. OWENS, have hereunto set my hand.

SAMUEL T. OWENS.

Witnesses:
JAMES I. KAY,
J. N. COOKE.