H. P. BOBBITT.

FURNACE.

APPLICATION FILED NOV. 20, 1907.

944,591. Patented Dec. 28, 1909.

Fig. 1.

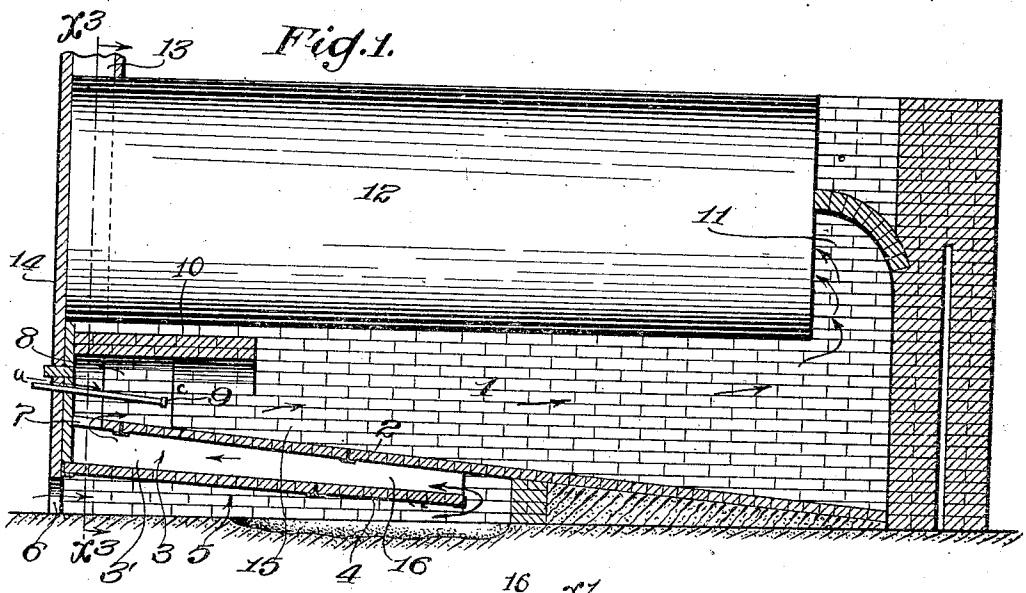



Fig. 2.

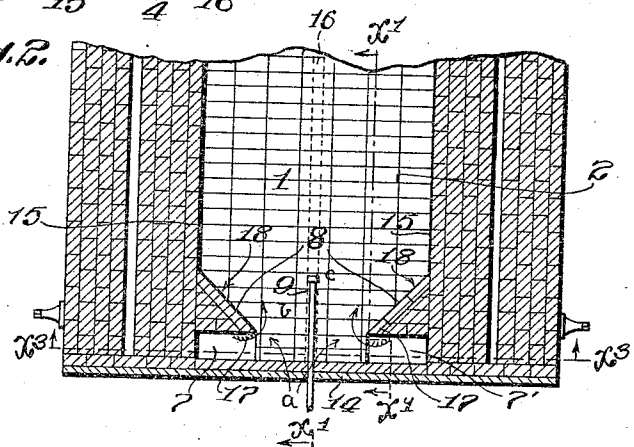
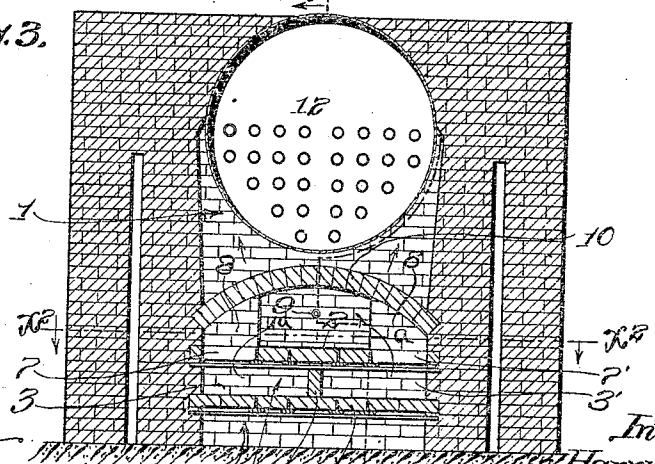



Fig. 3.




Witnesses:—
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Inventor;
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# UNITED STATES PATENT OFFICE.

HARRY P. BOBBITT, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-THIRD TO JOB HARRIMAN AND ONE-THIRD TO JOHN A. HARRIMAN, OF LOS ANGELES, CALIFORNIA.

## FURNACE.

944,591. Specification of Letters Patent. **Patented Dec. 28, 1909.**

Application filed November 20, 1907. Serial No. 403,069.

*To all whom it may concern:*

Be it known that I, HARRY P. BOBBITT, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Furnaces, of which the following is a specification.

This invention relates more particularly to furnaces provided with injector burners, and is especially designed for a furnace in which crude petroleum is burned for fuel.

It is one of the objects of the invention to provide a furnace of this character by means of which the combustion of all the fuel may be effected, thus securing a maximum liberation of heat units and doing away with the production of smoke and unconsumed gases.

An object of the invention is to so construct the furnace as to supply highly-heated oxygen to the interior of the fire-chamber without any conflicting currents of air, so that the combustion throughout the fire-chamber will be uniform.

A further object is to provide a furnace of this character having a comparatively long life.

The invention may be employed for various purposes as well as with many styles of steam-boilers.

I do not limit the invention to any specific construction or use.

My invention consists of the novel features herein shown, described and claimed.

The accompanying drawings illustrate the invention.

Figure 1 is a longitudinal section of a furnace embodying this invention as applied for heating a tubular steam boiler, the section being taken on line indicated by $x^1$—$x^1$, Fig. 2, cutting through the middle of the arch shown in Fig. 3, leaving the boiler intact. Fig. 2 is a fragmental plan of the furnace, sectioned on line indicated by $x^2$—$x^2$, Fig. 3. Fig. 3 is a sectional elevation taken at the front of the furnace on line indicated by $x^3$—$x^3$, Figs. 1 and 2.

1 designates the combustion chamber having a refractory heat-transmitting floor 2 below which is a tunnel 3 formed between the floor 2 and an apron 4, which may be of any suitable material, and below which is a tunnel 5 opening from the atmosphere at 6 at the front end of the boiler and arranged to deliver air to the tunnel 3 below the refractory heat-transmitting floor 2 of the combustion-chamber. Said tunnel 3 communicates with two air-flues or inlets 7, 7′ behind which, respectively, are two rearwardly-diverging abutments 8 that are spaced apart from the front furnace-wall 14 to form an air-chamber *a* into which the air-flues 7, 7′ open. Said abutments are spaced apart from each other to form a central air-passage *b*, and diverge forwardly from said air-passage to form a burner-chamber *c* between the air-passage *b* and the combustion-chamber proper, 1.

A burner-nozzle 9 which may be of any suitable construction, and in the form shown is adapted to burn crude petroleum, is arranged rearwardly from the center of the air-passage *b* and beneath an arch 10 which extends over the air-chamber, the abutments and also over the burner-chamber *c*, forming the top of such chamber.

11 designates the outlet-flue at the rear end of the combustion-chamber through which the products of combustion escape. Said flue leads, in the construction shown, to the tubes of a boiler 12 and out through the smoke-stack 13.

The front wall 14 of the furnace is practically air-tight so that the air which enters the air-chamber *a* must pass through the tunnel 3 beneath the heat-transferring floor 2 which in practice may become incandescent from the heat of the burner-chamber and the combustion-chamber. Said burner 9 is preferably located centrally below the arch 10, and the burner-chamber is expanded forwardly from the burner, both laterally and vertically; the floor 2 being inclined downward rearwardly, and the arch terminating about as far rearwardly of the burner as the burner is located rearwardly of the front wall 14 of the furnace, so that the burner-chamber suddenly expands upward a short distance rearwardly of the burner.

The refractory floor 2, the arch 10 and the abutments 8, as well as the side walls 15 of the burner chamber and combustion-chamber, may all be constructed of fire-brick or any other refractory material that may be found desirable.

In practical operation, the air passing through the tunnel 3 from the rear end of the floor 2 to the front end of the furnace, becomes highly heated, and is delivered to the air-chamber through the air-inlets 7 in a highly-heated condition, and is evenly

distributed upon opposite sides of and forwardly from the burner 9, from which the combustion material, as crude petroleum, is injected into the burner-chamber *c* and combustion-chamber 1, where it becomes vaporized and decomposed and the products become intermingled with the highly-heated air, and the combustion-chamber is filled with a flame of intense heat. The rearward expansion of said burner-chamber affords ample room for the expanded products, thereby allowing complete combustion to be effected.

16 designates a partition in the return superheating portion 3 of the tunnel extending from front to rear along the mid-line of the furnace, thereby providing two equal air passages 3 and 3′ from which the air finds egress through the air inlets 7 and 7′, respectively. The abutments 8 rearwardly of the inlets 7 and 7′ are preferably straight on their forward surfaces and terminate at the inner ends of the inlets 7 and 7′ respectively, in a sharp, angular projection, as shown at 17, from which the rear faces 18 of said abutments diverge rearwardly to the side walls 15 of the combustion-chamber. By this construction when the burner 9 is in operation the air will flow through the ways 3, 3′ of the upper return portion of the duplex tunnel and will become highly heated by the incandescent floor 2, and will thence flow to supply oxygen for the combustion at the burner 9.

The partition 16 serves to divide the supply of air into two substantially equal parts so as to prevent a stronger flow of air through one of the inlets 7 7′ than through the other, thereby causing the flame from the burner 9 to spread evenly from the center of the burner-chamber 1 instead of crowding to one side or the other. The inlets 7, 7′ are a considerable distance in front of the discharge end of the burner 9.

The floor 2, the abutments 8, and the arch 10, form an air-mixer in which the air from both sides is crowded toward the burner, the velocity and pressure of the air being considerably increased by the restricted size of the opening, and the discharge end of the burner is in front of the most restricted part of the opening, said opening flaring backwardly along the rear faces 18 of the abutments to the combustion-chamber, to allow expansion as combustion takes place.

In practical effect I have produced a furnace having three floors,—the ground or foundation serving as one floor, the apron 4 serving as the second floor, and the heat-transmitting floor 2 being the third floor, so that the fresh air passes inwardly below the forward end of the apron 4 and backwardly under the apron 4; then upwardly and forwardly between the apron 4 and the floor 2, to the extreme forward end of the floor 2; then upwardly through the floor 2 through the inlets 7, 7′, the stream of air being evenly divided by the partition 16 and one-half passing through the inlet 7 and the other half through the inlet 7′, and by the abutments 8 the two streams of air are forced together around the supply pipe of the burner 9; then through the air-mixer opening between the floor 2, the abutments 8, and the arch 10, and backwardly to the burner 9 and to the combustion-chamber. During this passage of the air which requires considerable time, the air is highly heated before coming in contact with the burner and before reaching the flame in the combustion-chamber.

The fresh air is led from the extreme forward end of the furnace backwardly to the transverse center of the furnace, and then forwardly to the extreme forward end again, and the air-passage is substantially the same size throughout its entire length until the air-mixer is reached, so as to keep all of the air moving at a constant rate of speed.

The widening passage between the symmetrically evenly diverging faces 18 allows the air to expand outwardly away from as well as inwardly toward the tip of the burner 9 to supply a full volume of air of practically equal pressure throughout any cross-sectional plane of the combustion chamber and without any tendency to force the fuel upwardly.

I claim:—

1. A furnace comprising a combustion-chamber, an outlet-flue at the back end of the combustion-chamber, an arch at the forward end of the combustion-chamber, abutments beneath the arch and intermediate the ends thereof to form a burner-chamber at the forward end of the combustion-chamber and an air-chamber forwardly of the burner-chamber, air-flues opening upwardly through the floor of said air-chamber in front of the abutments respectively, means underneath the combustion-chamber to supply air to said air-flues, an air-passage being provided from the air-chamber between the abutments to the burner-chamber, and a burner located in the burner-chamber between said air-passage and the combustion-chamber to discharge flame through the burner-chamber into the combustion-chamber.

2. A furnace comprising a combustion-chamber, an outlet-flue at the back end of the combustion-chamber, an arch at the forward end of the combustion-chamber, rearwardly-diverging abutments beneath the arch and intermediate the ends thereof to form a rearwardly-flaring burner-chamber at the forward end of the combustion-chamber and also forming an air-chamber forwardly of the burner-chamber, said abutments being spaced apart at their forward

ends to form an air-passage between the abutments, flues opening into said air-chamber in front of the abutments respectively and at the sides of said air-passage, means to supply air to said flues, and a burner located in the burner-chamber between said air-passage and the combustion-chamber to discharge flame through the backwardly-expanding burner-chamber into the combustion-chamber.

3. A furnace comprising a combustion-chamber, an outlet-flue at the back end of the combustion-chamber, an arch at the forward end of the combustion-chamber, rearwardly-diverging abutments beneath the arch and intermediate the ends thereof to form a rearwardly-flaring burner-chamber at the forward end of the combustion-chamber and also forming an air-chamber forwardly of the burner-chamber, said abutments being spaced apart at their forward ends to form an air-passage between the abutments, flues opening into said air-chamber in front of the abutments respectively and at the sides of said air-passage, means to supply hot air to said flues, and a burner located in the burner-chamber between said air-passage and the combustion-chamber to discharge flame through the rearwardly-flaring burner-chamber into the combustion-chamber.

4. A furnace comprising side walls, an apron between the forward halves of the side walls, a heat-conducting floor above the apron, there being air-passages extending from the forward end of the furnace backwardly under the apron and upwardly and forwardly between the apron and the heat-conducting floor and to the extreme forward end of the furnace; a combustion-chamber above the heat-conducting floor, an outlet-flue at the back end of the combustion-chamber, an arch at the forward end of the combustion-chamber, abutments beneath the arch intermediate the ends thereof to form a burner-chamber at the forward end of the combustion-chamber and an air-chamber forwardly of and communicating with the burner-chamber; air-flues opening upwardly from said air-passages through the floor of said air-chamber in front of the abutments respectively, and a burner located in the burner-chamber to receive air from the air-chamber and to discharge flame through the burner-chamber into the combustion-chamber.

5. A furnace comprising a combustion-chamber, an outlet-flue at the back end of the combustion-chamber, an arch at the forward end of the combustion-chamber, abutments beneath the arch and intermediate the ends thereof to form a burner-chamber at the forward end of the combustion-chamber and an air-chamber forwardly of the burner-chamber; air-flues opening upwardly through the floor of said air-chamber in front of the abutments respectively, and two air-passages underneath the combustion-chamber to supply air respectively to said air-flues, and air-passage being provided from the air-chamber between the abutments to the burner-chamber, and a burner located in the burner-chamber between the last-mentioned air-passage and the combustion-chamber to discharge flame into the combustion-chamber.

6. A furnace comprising a fire-chamber having rearwardly-diverging abutments at the front end and air-inlets forwardly of said abutments, and a burner between and rearwardly of said abutments so that the air from the inlets is distributed to the burner around the ends of the abutments.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 13th day of November, 1907.

HARRY P. BOBBITT.

In presence of—
JAMES R. TOWNSEND,
JULIA TOWNSEND.