

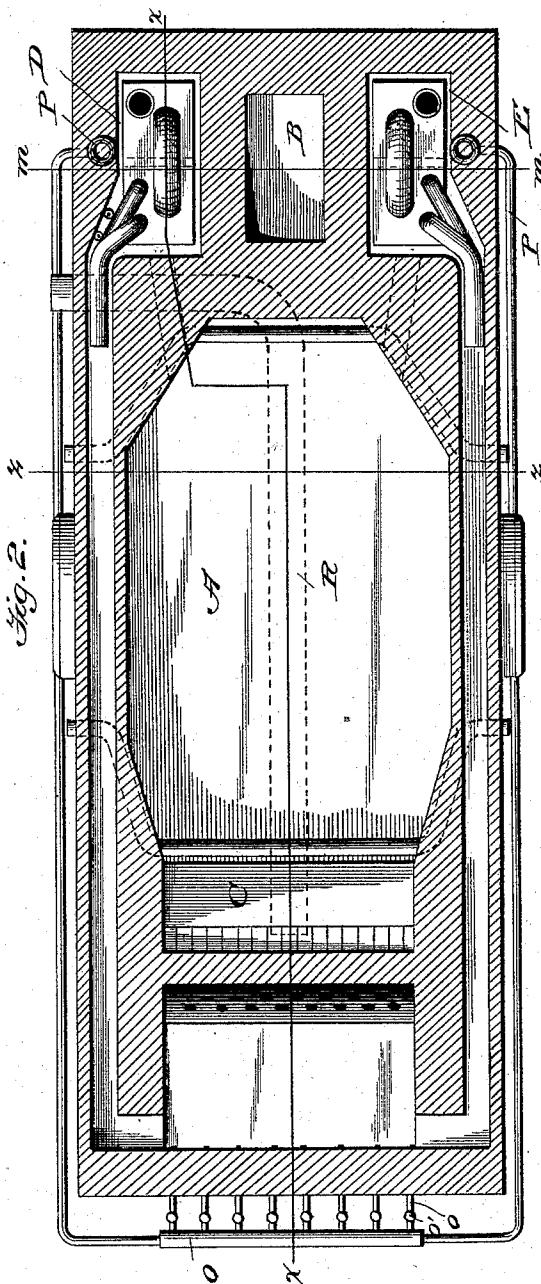
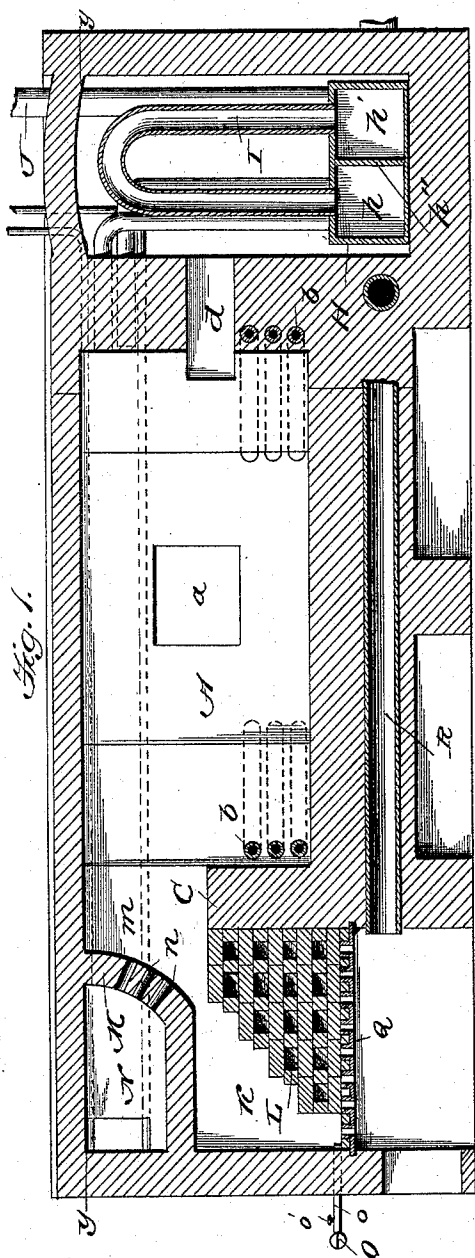
(No Model.)

3 Sheets—Sheet 1.

W. STUBBLEBINE.
FURNACE.

No. 487,103.

Patented Nov. 29, 1892.



Witnesses
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H. E. Berah

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By his Attorneys
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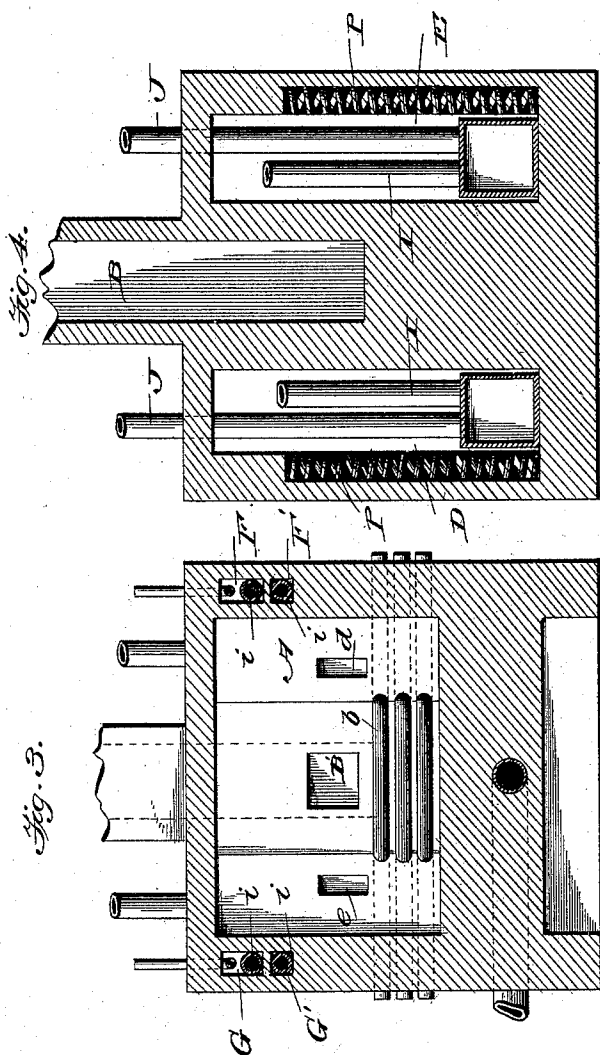
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3 Sheets—Sheet 2.

W. STUBBLEBINE.
FURNACE.

No. 487,103.

Patented Nov. 29, 1892.



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(No Model.)

3 Sheets—Sheet 3.

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Fig. 5.

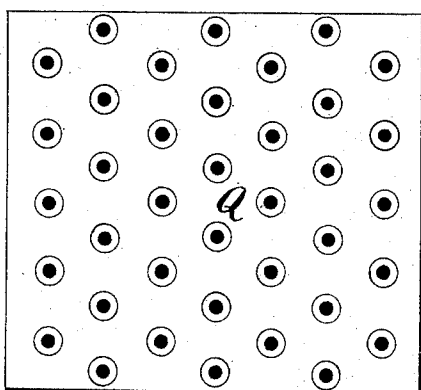
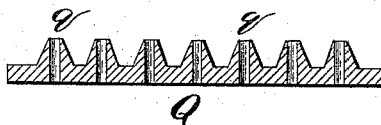


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM STUBBLEBINE, OF BETHLEHEM, ASSIGNOR TO THE STUBBLEBINE FURNACE COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 487,103, dated November 29, 1892.

Application filed December 19, 1891. Serial No. 415,628. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STUBBLEBINE, a citizen of the United States, residing at Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to improvements in furnaces constructed with especial reference for consuming hydrocarbon fuel in liquid or gaseous form, such as oil, oil-gas, coal-gas, natural gas, or other desirable fluids, such improved furnace being capable of use in the puddling of iron, smelting of different kinds of ores, for heating purposes generally, or as a glass-furnace, or an open-hearth furnace, or for any purpose for which furnaces are used.

In a prior patent issued to me on the 28th day of July, 1891, No. 456,663, I have shown and described a reverberatory furnace with heating-chambers on opposite sides of the uptake and communicating by intermediate passages with the puddling-chamber, combined with mixing-flues which extend longitudinally of the furnace, one end of each mixing-flue connected to its heating-chamber and the other end of said mixing-flue having a discharge port which discharges commingled air and gases above the bridge-wall, and blast-pipes located in said heating-chambers and discharging into the mixing-flues. In the present invention I employ the heating-chambers, mixing-flues, and blast-pipes in somewhat similar form as in my prior patent, and combine with said parts certain elements or devices which adapt the furnace for burning either liquid or gaseous fuel, the object in view being to consume fuel of the character specified in an economic and advantageous manner and to commingle the gases and heat arising from the combustion of said fuel with the current of commingled air and gases from the mixing-flues, said currents from the mixing-flues and the liquid or gaseous fuel meeting over the bridge-wall, being commingled

at this point and entering the working or puddling chamber in their combined form.

With the foregoing ends in view the invention consists in the combination, with the mixing-flues and a bridge-wall, of a perforated arch forming a chamber above the bridge-wall and which chamber receives the commingled air and gas from the mixing-flues, checker-work in front of said bridge-wall and below the perforated arch, a blast-pipe below the working-chamber arranged to discharge into the checker-work, and a fuel-supply pipe having a series of individual outlets or branches which discharge into the checker-work.

The invention further consists in the combination, construction, and arrangement of parts, which will be fully pointed out and described, and particularly specified in the claims hereinafter.

In the accompanying drawings, Figure 1 is a vertical longitudinal sectional view through my furnace on the plane indicated by the dotted line *xx* of Fig. 2. Fig. 2 is a horizontal sectional view on the plane indicated by the dotted line *yy* of Fig. 1, and Fig. 3 is a vertical transverse section through the furnace on the plane indicated by the dotted line *ZZ* of Fig. 2. Fig. 4 is a vertical transverse section on the line *mm* of Fig. 2. Figs. 5 and 6 are detail views in plan and transverse section, respectively, of the metallic diaphragm or drip-plate in the checker-work designed to catch the drippings of oil or liquid from the branches of the fuel-supply pipe. Fig. 7 is a vertical transverse sectional view on the plane indicated by the dotted line *XX* of Fig. 2.

Like letters of reference indicate corresponding parts in all the figures of the drawings.

A indicates the working chamber of the furnace; *a*, the door in one side of the same; *b*, the chills in the bed of the working chamber; B, the uptake; B', the neck leading from the rear end of the working chamber to the uptake; and C, the bridge-wall at the front end of the working chamber.

D E are the heating-chambers formed or built in the masonry of the furnace, and said chambers are located at the rear end of the

working chamber A, and on opposite sides of the uptake B and neck B' of the furnace.

F F' and G G' are the mixing flues or pipes, two of which are on the right-hand side of the furnace and the other two on the left-hand side thereof. These mixing flues or pipes communicate at their rear ends directly with the heating-chambers D E, and the front ends of said mixing flues or pipes discharge into a chamber at the front end of the furnace, which will be presently referred to.

In each of the heating-chambers D E is a blast-box H, preferably located at or near the bottom of said heating-chamber, and each blast-box is divided into two compartments *h* *h'* by an intermediate vertical partition *h''*. The two compartments *h* *h'* of each blast-box H are connected by an elbow-shaped circulating-pipe I, arranged in a vertical position in the heating-chamber and having one end opening into one compartment *h* and the other end opening into the other compartment *h'* of said blast-box. The blast-pipe J enters the heating-chamber and discharges into the compartment *h* of the blast-box H, and from this compartment *h* the current of air or steam passes through the vertical air-pipe I to the other compartment *h'* of said blast-box, and from this latter compartment the air or steam is conducted by jet-pipes *ii* to the mixing flues or pipes. As the heating-chambers D E are in direct communication with the working chamber A by means of the passages *d e*, a portion of the heat and gases from the working chamber passes into said heating-chambers and circulates around the blast-box and the circulating-pipe I, whereby the blast of steam or air passing through the blast-box, the circulating-pipe, and the jet-pipes *ii* is heated before the air or steam is discharged into the mixing-flues. The jet-pipes *ii* terminate in the mixing pipes or flues at points a short distance in advance of the connection between the mixing-flues and heating-chambers, and as the rapidly-moving currents of air or steam from the jet-pipes are injected under pressure into the mixing-flues a part of the gases in the heating-chambers will be drawn into the mixing flues or pipes and thus insure the commingling of said heat and gases from the working and heating chambers with the air or steam blast while said currents are conveyed through the mixing flues or pipes to the front of the furnace.

In the front of the furnace is the combustion-chamber K between the bridge-wall and the front wall of the furnace, and in this chamber is the checker-work L, built of brick in the usual form.

Above the checker-work L in the top of the furnace and in front of the bridge-wall is an overhanging arch M, which is so arranged and constructed that it forms between the roof and front of the furnace a chamber N, which chamber extends transversely across the furnace in the upper front part thereof, so that the four mixing flues or pipes F F' G

G' will open and discharge into said chamber the currents of commingled air or steam and gases. The rear wall of this chamber N is inclined or curved, as at *m*, so that it faces the heat passage or way over the bridge-wall, and this inclined or curved wall of said chamber N is perforated at *n* to permit the currents of commingled air or steam and gases to pass from said chamber into the working chamber A.

O is the fuel-supply pipe, arranged horizontally on the front wall of the furnace, said supply-pipe being supported either a short distance from the face of the front wall, as shown, or embedded in said front wall, as most desired. This pipe O is supplied with either liquid or gaseous fuel from any convenient source; but I prefer to first raise the temperature of said liquid or gaseous fuel by passing said fuel through heating-coils P P, located in the heating-chambers D E, said heating-coils connected by pipes *p p* to the supply-pipe O. From this supply-pipe extends a series of branch or outlet pipes *o*, which lead through the front wall of the furnace, so as to discharge the fuel into the checker-work L, and said branches or outlets *o* are provided with regulating cocks or valves *o'*. The said branches or outlets are of less diameter than the supply-pipe to cause the liquid or gaseous fuel to enter the checker-work slowly and regularly and thus insure the proper combustion of the fuel. The branch or outlet pipes from the supply-pipe are all arranged in substantially the same horizontal plane, and below this plane of said branches or outlets is a horizontal diaphragm or drip-plate Q, which is arranged in the checker-work L and is designed to catch the drippings of oil or liquid fuel from the branches of the supply-pipe, whereby the liquid is prevented from dripping through the checker-work into the ash-pit. This diaphragm or drip-plate is provided with a multiplicity of nipples *q*, each having a transverse passage *q'* for the heat and blast, and these nipples extend above the level of the diaphragm or drip-plate and are so spaced or arranged that the liquid fuel will be retained on the diaphragm or plate. As the nipples extend above the plate and as they are perforated, the heat and blast can pass freely through the diaphragm, while the liquid fuel cannot escape through said perforated nipples, and as the diaphragm is heated to about the same temperature as the checker-work the liquid on the diaphragm is vaporized and the heat and gas thereby generated are utilized in the working chamber.

R is the blast pipe or flue to the combustion-chamber, which extends through or underneath the bed of the furnace, and this blast-pipe discharges into the checker-work below the horizontal diaphragm or drip-plate.

The operation of my furnace may be briefly summarized, as follows: The checker-work is heated in any convenient way, and the heat and gases from the working chamber pass

through the passages *de* to heat the chambers D E, the coils, and pipes therein. The blasts having been started in the pipes J R, the gases in the heating-chambers are drawn into the mixing flues or pipes by the jets of steam or air, and said steam or air and gases pass through the mixing-flues into the chamber N. The fuel fed to the checker-work by the supply-pipe is vaporized and commingled with the blast from the pipe R, and the two currents of gases and air—the one from the chamber N and the other current from the checker-work—are commingled as they pass over the bridge-wall into the working chamber A, as will be readily understood.

I am aware that changes in the form and proportion of parts and details of construction may be made without departing from the spirit or sacrificing the advantages of my invention, and I therefore reserve the right to make such changes as fairly fall within the scope of my invention.

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

1. In a furnace substantially as described, the combination, with a working chamber, a combustion-chamber, a bridge-wall, and heating-chambers arranged to receive from the rear part of said working chamber, of a chamber N, arranged above the combustion-chamber and having outlets to discharge its contents over the bridge-wall, and the longitudinal flues adapted to convey heat, &c., from the heating-chambers to said elevated chamber N, as and for the purpose described.

2. In a furnace substantially as described, the combination, with a working chamber, a combustion-chamber, and a bridge-wall, of a transverse elevated chamber N, arranged over the combustion-chamber and having the outlets *n*, arranged to discharge the contents over said bridge-wall, the checker-work situated in said combustion-chamber below the elevated chamber, a fuel-supply pipe O, having outlets discharging into said checker-work, and means for supplying heat to said elevated chamber, whereby the currents from the checker-work and the elevated chamber are combined at or over the bridge-wall, as and for the purpose described.

3. In a furnace substantially as herein shown and described, the combination, with a working chamber, a combustion-chamber, a bridge-wall, and the heating-chambers arranged to receive from the rear part of said working chamber, of the transverse elevated chamber N, situated over the combustion-chamber and having at its rear end the outlet-ports *n*, which discharge over the bridge-wall, the mixing-flues arranged longitudinally of the furnace and connected to said heating and elevated chambers, the checker-work in said combustion-chamber below the elevated chamber N, and the fuel-supply pipe O, discharging into the checker-work, as and for the purpose described.

4. In a furnace substantially as described, the combination, with a working chamber, the bridge-wall, heating-chambers, and flues, of an arch forming a chamber in the upper front part of the furnace which receives from the flues, said arch having the rear part thereof perforated for the escape of the currents over the bridge-wall, the checker-work, a supply-pipe, and a blast-pipe, as and for the purpose described.

5. In a furnace substantially as described, the combination, with a working chamber, the bridge-wall, heating-chambers, and flues, of the arch arranged to form the receiving-chamber N in the upper front part of the furnace, having the perforated inclined or curved rear wall overhanging the bridge-wall, the checker-work, the supply-pipe, and the blast-pipe, as and for the purpose specified.

6. In a furnace, the combination, with a working chamber, a combustion-chamber, and a bridge-wall, of the checker-work L, situated in said combustion-chamber, the supply-pipe O, having a series of branches which discharge into said checker-work, and a blast-pipe R, discharging into said combustion-chamber below the checker-work therein, whereby the blast is commingled with the fuel as the currents pass through the checker-work, as and for the purpose described.

7. In a furnace substantially as described, the combination, with a working chamber and the bridge-wall thereto, of the checker-work, the supply-pipe which discharges into said checker-work, a perforated diaphragm or drip-plate in the checker-work, and a blast-pipe arranged below the working chamber and having its discharge end below the diaphragm or drip-plate, as and for the purpose described.

8. In a furnace substantially as described, the combination, with a working chamber and a bridge-wall, of the checker-work, a supply-pipe arranged to discharge fuel into said checker-work, a diaphragm or drip-plate in the checker-work below the discharge-openings of the supply-pipe and having the perforated raised nipples on its upper side, and a blast-pipe arranged below the working chamber and having its discharge end below the diaphragm or drip-plate, as and for the purpose described.

9. In a furnace substantially as described, the combination, with a working chamber, combustion-chamber, bridge-wall, and heating-chambers, of the checker-work in said combustion-chamber, a fuel-supply pipe O, located outside of the furnace and having branches which discharge into the checker-work, the heating-coils P, situated in the heating-chambers, and the connecting-pipes extending longitudinally of the furnace and connecting the heating-coils and supply-pipe, as and for the purpose described.

10. In a furnace substantially as described, the combination, with a working chamber, the heating-chambers, and longitudinal flues or pipes, of a divided blast-box in each heating-

chamber having its compartments connected by a circulating-pipe, a blast-pipe connected to one of said compartments, and a jet-pipe leading from the other compartment to the
5 longitudinal flues or pipes, as and for the purpose described.

11. In a furnace substantially as described, the combination, with a working chamber and the heating-chambers, of a single receiving-
10 chamber N at the front of the furnace, the longitudinal flues or pipes extending from the heating-chambers to said chamber N, the di-

vided blast-boxes each having its compartments connected by circulating-pipes, the blast-pipes connected to the blast-boxes, and an individual jet-pipe leading from the blast-box to each longitudinal flue or pipe, as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM STUBBLEBINE.

Witnesses:

JACOB W. LUCKENBACH,
HORTENSIA V. KRAUSE.