

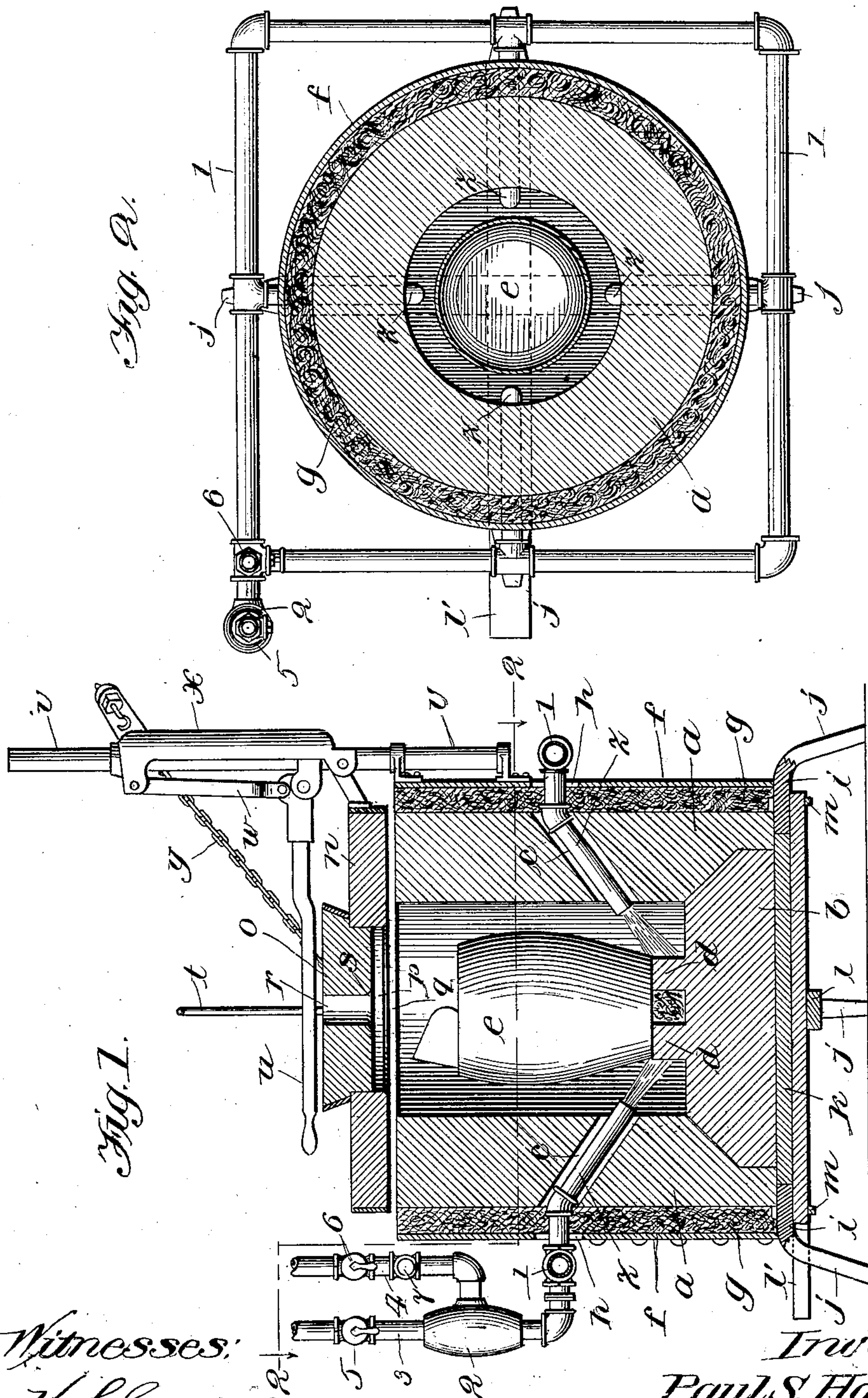
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P. S. HARVEY.  
GAS FURNACE.

APPLICATION FILED JULY 9, 1902.

NO MODEL



Witnesses:

H. S. Gaither.  
J. C. Lee

Inventor:

Paul S. Harvey.

by A. Miller DeField  
his Attorney.



# UNITED STATES PATENT OFFICE.

PAUL S. HARVEY, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE ACME GAS CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## GAS-FURNACE.

SPECIFICATION forming part of Letters Patent No. 735,765, dated August 11, 1903.

Application filed July 9, 1902. Serial No. 114,899. (No model.)

*To all whom it may concern:*

Be it known that I, PAUL S. HARVEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Gas-Furnaces, (Case No. 1,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to gas crucible-furnaces for melting metals by the use of gas as a fuel.

Prominent objects of the invention are to provide a simple, practical, durable, and inexpensive construction of gas crucible-furnace, to secure the highest possible economy and effectiveness in the use of the gas, and to provide other novel and desirable results, as will be hereinafter set forth.

In the gas crucible-furnace herein shown for carrying out my invention I provide a hollow cylindrical mold in which the crucible is placed. The crucible is supported slightly above the bottom of the hollow mold and gas-fuel pipes are extended through the said cylindrical walls of the mold and arranged to direct gas into the space below the crucible, and in this space combustion takes place. These several fuel-pipes are connected with a manifold, which in turn is suitably connected with gas and air supply pipes. The mold is made of such height that an ingot can lie upon the crucible when the cover of the mold is in place. The mold is desirably surrounded with a cylindrical-casing somewhat larger than the exterior surface of the mold, and the space between this casing and the mold is desirably filled with mineral wool or similar substance. The top and bottom of the mold are desirably made removable and the top is conveniently constructed of two parts or portions—a smaller one, which is removable relatively to the larger one to permit feeding of the metal to the crucible. Suitable mechanism is desirably provided for readily lifting the entire top. In a gas-furnace so constructed the directing of the gas below the crucible and its combustion there allow the crucible to be heated in the most

desirable manner and with the greatest economy and effectiveness of gas, for obviously the heating occurs at the bottom of the crucible, where it is most desirable that it should occur, and the gas combustion takes place at this locality, where the heat is applied. By the application of heat below the crucible I am enabled to arrange the ingot upon the crucible, and to this end the mold is made sufficiently high to accommodate the ingot, as before stated. Furthermore, oxidation of the metal at the top of the crucible is prevented, as the refuse matter on the metal and the carbon dioxide immediately above the same are not disturbed, but are left there to shield the metal from the oxidizing-gases in the chamber. These fundamental and novel results are of great benefit and advantage. In addition to them there are certain other novel and advantageous features of construction which I will point out in a more detailed description of the invention.

In the accompanying drawings, Figure 1 is a vertical section of a gas crucible-furnace embodying my invention. Fig. 2 is a horizontal section of the same, taken on line 2 2 in Fig. 1.

The furnace shown in the drawings has a cylindrical mold *a*, having a removable bottom *b*, both of which are made of molded fire-brick or other similar material. The walls of the mold *a* are provided with a plurality of downwardly-inclined openings *c c*, arranged opposite one another in the mold. The bottom *b* is provided with a plurality—as, for example, four, as shown—of raised portions or projections *d d*, which are desirably made integral with the bottom. These projections *d d* are to support the crucible *e* and are arranged in quadrilateral form, with the spaces between them in line with the inclined openings *c c*. A cylindrical metallic casing *f* surrounds the mold *a*, and the space between this casing and the mold is desirably filled with mineral wool *g* or like material. The casing *f* is provided with apertures *h h* opposite the outer ends of the apertures *c c* in the mold. A flat ring *i* is arranged below the cylindrical casing *f* and the outer portion of the mold *a* and is provided with legs *j j*, thereby forming



a support for the furnace. A flat circular plate or platform *k* is arranged below the bottom *b* and is supported by suitable supporting mechanism—as, for example, the crosswise  
 5 extending straps *l l*, having their outer ends supported by pivoted cleats *m m*. One of the straps *l* is extended to one side, as at *l'*, whereby a rod or bar can be thrust down alongside  
 10 of the furnace from above to strike the extension *l'* and unlock the platform *k*, so as to throw the same out of adjustment from the floor-level to permit the dumping of molten metal in case of a broken crucible.

The mold *a* is provided with a two-part  
 15 cover consisting of the parts or covers *n* and *o*, whereof the cover *n* rests upon the mold and is provided with a central aperture *p*, and the cover *o* rests upon the cover *n* and closes the aperture in the latter. The lower portion  
 20 of the wall forming the aperture *p* is desirably beveled, as at *q*. The small cover *o* is provided with a central vent *r*, whose lower end is desirably rounded, as at *s*. This small cover is conveniently provided with a bail *t*.  
 25 The aperture *p* in the large or main cover *n* is sufficiently large to allow the insertion of an ingot through it. Both covers are desirably made of molded fire-brick. Suitable mechanism is provided for readily lifting the  
 30 large cover *n*, the mechanism shown being a well-known form of cover-lifting mechanism, consisting of a lever *u*, pivotally connected with ears on a standard *v*; a link *w*, having its lower end connected with the lever *u* and  
 35 its upper end pivotally connected with the upper end of a sliding member *x*, arranged to slide up and down on the standard *v* and having its lower end connected with the cover *n*, and a pair of chains *y y*, having their upper  
 40 ends connected with the sliding member *x* and their lower ends connected with the cover *n*.

Gas-pipes *z z* are arranged in the apertures *c c* in the mold *a* and are extended out through  
 45 the cylindric casing *f* and connected with a manifold 1. The latter is connected by means of a suction T 2 with air and gas pipes 3 and 4, respectively. Both these supply-pipes 3 and 4 are provided with straightway cocks 5  
 50 and 6, and the gas-pipe is provided with a check-valve 7.

In using the furnace the crucible *e* is arranged upon the projections *d d* and supplied with a suitable quantity of metal to be melted.  
 55 The gas and air supplies are then turned on in sufficient quantity and proper proportion, and the mixture passes into the manifold 1 and thence into the fuel-pipes *z z*, by which it is directed between the projections  
 60 *d d* and into the space below the crucible. Here it is lighted and combustion takes place so as to heat the crucible and melt the metal therein. The fumes pass out the vent *r*.

It will be seen that the crucible is heated  
 65 from below and that combustion takes place immediately below the locality where the heat is applied, thus securing the most advanta-

geous point for the application of the heat and procuring the highest degree of effectiveness and economy in the use of the gas. It  
 70 will also be seen that the wall of mineral wool surrounding the mold prevents the escape of heat and adds to the efficiency of the furnace; also that the method of applying  
 75 the gas for heating the crucible allows the mold to be made of such height as to permit the ingot to be placed upon the crucible, as shown in the drawings. The whirling motion  
 80 commonly present in furnaces of this kind, by reason of the application of the gas to the crucible in a tangential manner at the sides  
 85 thereof, is avoided in my furnace, and so the heat is not caused to rise so rapidly nor is there a tendency to blow away the charcoal and lighter portions of metal from the sur-  
 90 face thereof. Furthermore, oxidation of the metal at the top of the crucible is prevented.

By having the aperture in the cover *n* large enough for the insertion of an ingot the crucible can be fed as required without removing  
 95 this main cover. The rounding of the lower corners of the vent in the upper or smaller cover *o* prevents the roaring of the outgoing gas.

It will be understood that the construction  
 95 herein shown is capable of modification and change in many particulars without departing from the spirit of my invention and that I do not, therefore, wish to be limited in the  
 100 claims to the precise construction herein set forth.

What I claim is—

1. In a gas crucible-furnace, means for supporting the crucible with a space or chamber immediately below it, and means for directing  
 105 the fuel into such space or chamber from the side, as set forth.

2. In a gas crucible-furnace, the combination of means for supporting the crucible with a space or chamber immediately below it, and  
 110 one or more fuel-pipes having nozzles located at the side of the crucible and pointed inwardly toward said space or chamber, as set forth.

3. In a gas crucible-furnace, the combination of a set of separated supports for the  
 115 crucible, and one or more pipes having nozzles located at one side of said supports and pointed inwardly to direct fuel below the crucible, substantially as set forth. 120

4. In a gas crucible-furnace, the combination with a set of supports for the crucible, separated from one another, of one or more  
 125 pipes inclined downwardly and arranged to direct gas between such supports, substantially as described.

5. In a gas crucible-furnace, the combination of a hollow structure forming a chamber for the crucible, and having apertures in its  
 130 side walls, a set of upwardly-extending projections formed on the bottom of such hollow structure and separated from one another, a set of fuel-pipes extended through the apertures in the wall of the hollow structure and ar-



ranged to direct the gas between said projections, and connections for supplying such fuel-pipes with fuel, substantially as set forth.

5 6. In a gas crucible-furnace, the combination of a hollow cylindric mold having side openings, a removable bottom provided with a set of integrally-formed supports separated from one another, means for holding the bottom normally in position, a set of fuel-pipes  
10 arranged in said side openings and pointed inwardly to direct fuel to the sides of said supports and means for supplying such pipes with fuel, substantially as described.

15 7. In a gas crucible-furnace, the combination of a hollow cylindric mold having side openings, a removable bottom provided with a set of integrally-formed supports separated from one another, means for holding the bottom normally in position, a set of fuel-pipes  
20 arranged to direct the fuel between the supports on the bottom, means for supplying such pipes with fuel, a cylindric metallic casing surrounding the mold, and mineral wool or the like confined in the space between said casing and the mold, substantially as described.  
25

8. In a crucible-furnace, means for supporting the crucible with a space or chamber below it, one or more pipes arranged in the furnace-walls and pointed inward toward the  
30 space below the crucible, and means whereby said pipe or pipes can be supplied with fuel.

9. In a crucible-furnace, the combination of means for supporting the crucible with a space or chamber below it, and piping having  
35 a set or series of nozzles arranged in annular order around the crucible and pointed inwardly toward the space below the same, substantially as described.

10. A gas crucible-furnace, comprising a  
40 hollow cylindric mold having side openings, a removable bottom provided with a set of upwardly-extending projections separated from one another, means for holding the bottom normally in position, a cylindric metallic casing surrounding the mold, mineral wool or  
45 the like confined in the space between said casing and the mold, a removable cover consisting of upper and lower portions, the former of which is provided with a vent, means  
50 for raising and lowering the cover, a set of fuel-pipes extended through the side openings in the mold and arranged to direct the gaseous fuel between said crucible-supports, a manifold connected with said fuel-pipes, and gas  
55 and air pipes connected with said manifold, substantially as described.

11. A gas crucible-furnace, comprising a fire-brick hollow cylindric mold having downwardly-inclined side openings, a removable bottom for said mold, provided with a set of  
60 upwardly-extending projections separated from one another, means for supporting the bottom normally in position, a cylindric casing surrounding the mold and having openings opposite the outer ends of the openings  
65 in the mold, mineral wool or the like confined between said cylindric casing and the mold, a removable top consisting of large and small covers, whereof the large cover rests upon the mold and has a central opening, and the small  
70 cover rests upon the large cover and covers said opening, the small cover being also provided with a central aperture, means for raising and lowering the large cover, a set of fuel-pipes confined within said downwardly-extending  
75 side openings in the mold and arranged to direct the gaseous fuel between said projections on the bottom, a manifold connected with said fuel-pipes, a suction T connected to the manifold, and valved air and gas pipes  
80 connected with the suction T, substantially as described.

12. In a crucible-furnace, the combination with means for supporting the crucible with a space or chamber below it, and means for directing the fuel from opposite sides into such  
85 space or chamber, whereby opposing jets of fuel meet below the crucible where combustion takes place, and also whereby the nozzles are out of the way of matter dripping from  
90 the crucible, substantially as described.

13. In a crucible-furnace, the combination of a removable bottom, means for supporting the same normally in position, and means for engaging said supporting means and holding  
95 the same in supporting position, said means being provided with an extension projecting beyond the side of the furnace, substantially as described.

14. In a gas crucible-furnace, the combination with the bottom, of straps extending transversely of the bottom, and means for engaging said straps to support the same in the bottom, one of the straps being extended  
100 beyond one side of the furnace, substantially  
105 as described.

In witness whereof I hereunto subscribe my name this 19th day of June, A. D. 1902.

PAUL S. HARVEY.

Witnesses:

A. MILLER BELFIELD,  
I. C. LEE.