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Patented Apr. 29, 1902.

J. H. WALKER.

PROCESS OF PREVENTING OXIDATION OF MOLTEN METALS.

(Application filed July 17, 1899.)

(No Model.)

Fig. 3.

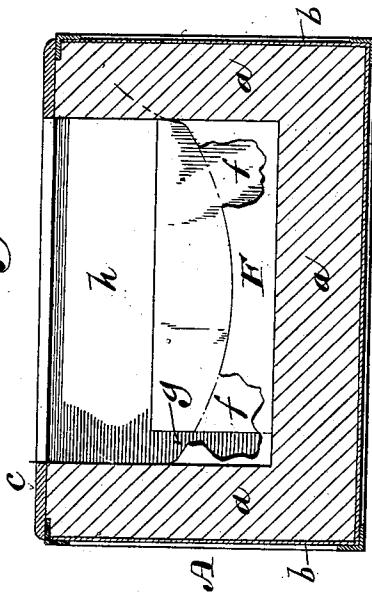


Fig. 4.

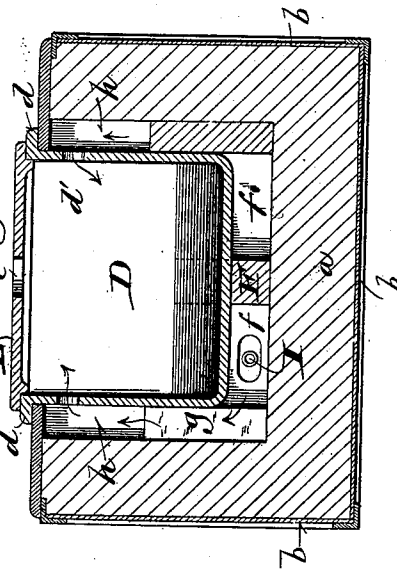
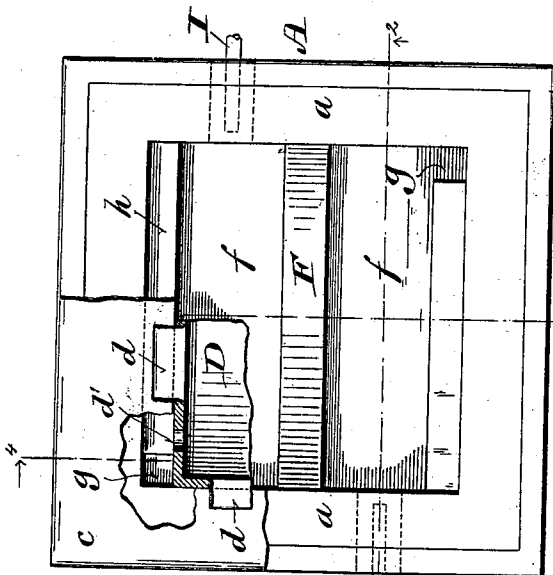
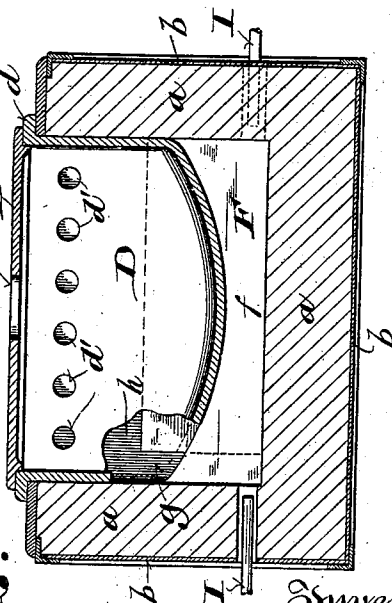


Fig. 1.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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PROCESS OF PREVENTING OXIDATION OF MOLTEN METALS.

SPECIFICATION forming part of Letters Patent No. 698,769, dated April 29, 1902.

Application filed July 17, 1899. Serial No. 724,073. (No specimens.)

To all whom it may concern:

Be it known that I, JAMES H. WALKER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Processes of Preventing Oxidation of Molten Metals, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The main object of my invention is to prevent the oxidation of molten metals, and thus avoid waste of material and loss of time in melting metals and in using the molten metal.

It consists in the process hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings, illustrating suitable apparatus for carrying out the process, like letters designate the same parts in the several figures.

Figure 1 is a plan view of a furnace for melting metals and preventing oxidation thereof according to my process, the greater portion of the melting-pot or crucible being broken away to disclose the arrangement of the furnace-flues. Fig. 2 is a longitudinal section of the furnace on the line 2 2, Fig. 1. Fig. 3 is a similar section showing the furnace without the crucible or melting-pot; and Fig. 4 is a cross-section on the line 4 4, Fig. 1.

For the purpose of illustration I have shown a furnace adapted to use gas as fuel for melting metal; but the process may be practiced with apparatus adapted to use other kinds of fuel.

A designates a furnace, the bottom and side walls *a a* of which are constructed of fire-brick or other suitable refractory material, inclosed and protected on the outside by a sheet-metal casing *b* and provided on the top with a plate *c*, having an opening therein to receive the crucible or melting-pot.

D is the crucible or melting-pot, which may be made of cast-iron and is preferably of quadrangular form in horizontal section. It is made to fit closely inside of the four walls *a* of the furnace, as shown in Figs. 2 and 4, and has around its upper edge an outwardly-projecting flange *d*, which rests upon the top plate *c*. It is provided with a suitable cover

E, which is formed with a central opening *e* for the escape of the products of combustion, as hereinafter explained. Each of the side walls of the crucible is formed near its upper edge or above the level to which the molten metal is intended to rise with a horizontal series of openings *d'*.

The space in the furnace below the crucible is divided by a longitudinal partition F into two longitudinal flues *f*, which communicate at opposite ends of the furnace and at one end of each flue through vertical passages *g* with longitudinal side flues *h*, extending from one end of the crucible to the other, in communication with the openings *d'*.

I I are gas-burners, which project into openings in the end walls of the furnace and are constructed and arranged to direct their flames in opposite courses through the flues *ff* underneath and in contact with the melting-pot. The bottom of the melting-pot is preferably curved downward toward the middle from end to end, so as to subject it to the direct action of the flames issuing from the burners and to absorb the greater portion of the heat thus produced where it will be most effective for melting the contents of the melting-pot, as well as to facilitate dipping out the molten metal with a ladle.

In carrying out my process by the apparatus hereinbefore described the metal to be melted is placed in the pot or crucible D and the cover E is placed thereon, as shown in Figs. 2 and 4. The burners I being lighted direct their flames from opposite ends of the furnace through the flues *ff* underneath and against the bottom of the melting-pot. At the ends of the flues *f* opposite the burners I the flames and heated products of combustion pass through the vertical openings or passages *g* into the return side flues *h*, where they act on the sides of the melting-pot and assist in melting the metal contained therein. From the flues *h* the gaseous products of combustion resulting from the complete combustion of the gas or fuel which is employed to melt the metals and from which the greater part of the heat has been absorbed by the walls of the melting-pot pass through the openings *d'* into the upper part of said pot, whence they escape through the opening *e* in its cover. These

gaseous products, which contain little or no free oxygen that will affect the molten metal, being directed by the openings *d'* horizontally toward the longitudinal center of the melting-pot, envelop or cover the contents of the melting-pot, and thus prevent access of air thereto and consequent oxidation. When the metal is melted, the cover E may be removed and the molten metal dipped with ladles from the open pot without exposing such metal to the oxidizing effect of the air, the gases issuing from the openings in the sides of the pot when the cover E is removed maintaining a non-oxidizing envelop and preventing the air from coming in contact with the metal, at the same time affording free access to the contents of the pot for the purpose of dipping it out with a ladle as it is needed.

When a body of metal has once been melted, the melting-pot may be replenished from time to time, so as to furnish a continuous supply of molten metal as often as it may be needed, and the necessity of frequently removing the scum or dross produced by constant exposure to air and the resulting loss of time and waste of heat and metal incident to the employment of the usual methods and apparatus for melting metals are avoided without in any wise obstructing access to the molten metal and its removal from the melting-pot whenever it is required.

The furnace and its flues should be so constructed and arranged with respect to the crucible or melting-pot that the metal will be melted by the direct application of the heat to the walls of the melting-pot, and combustion of the fuel will be practically complete before the resulting gases are allowed to pass into the melting-pot or over the metal contained therein. In this way no free oxygen or air is permitted to come into contact with the melting or molten metal.

The arrangement of the burners I I at opposite ends of the furnace, in connection with the construction and arrangement of the flues, distributes the heat to the best advantage and prevents the unequal expansion and contraction that would otherwise tend to crack or injure the melting-pot and furnace. When ordinary commercial gas is used, the burners may be made of iron or other metals; but when gas (technically known as "producer-gas") distilled from solid fuels is used the burners may be built into and become a part of the fire-brick lining of the furnace containing the melting-pot or crucible, in direct connection with which furnace the gas-generator is placed.

The perforated cover E is for the purpose of retaining the heat in the crucible during the operation of melting and also of holding the gaseous products of combustion in close contact with the surface of the metal during

the melting period, particularly in making alloys of metals having different melting-points, so as to prevent the oxidation of the constituent metal or metals which has a lower melting-point than that of the resulting alloy.

Apparatus of various kinds adapted to use different kinds of fuel and to melt different metals for various purposes may be used in carrying out the process in accordance with my invention and within the scope of the following claims.

I claim—

1. The process of preventing oxidation of molten metal in open crucibles or melting-pots, consisting in directing the non-oxidizing gases which are produced by the complete combustion of the fuel employed to melt the metal and from which heat has been absorbed, over the surface of the molten metal so as to exclude the air therefrom, without interfering with the removal of the molten metal when the crucibles or pots are open, substantially as and for the purposes set forth.

2. The process of melting metal and preventing oxidation thereof, consisting in applying the heat, produced by the combustion of the fuel employed, directly to the bottom and sides of the crucible or pot containing the metal to be melted, and directing the non-oxidizing gaseous products of complete combustion, from which heat has been absorbed to melt the metal, horizontally over the surface of the metal contained in said crucible or pot so as to produce and maintain an air-excluding gaseous covering or envelop over the metal while it is being melted and is in a molten condition, and permit of removing the molten metal when the crucible or pot is open, without allowing access of air to the metal contained in said crucible or pot, substantially as and for the purposes set forth.

3. The process of melting metal and preventing oxidation thereof, consisting in conducting the gaseous products of the fuel, employed to melt the metal, in a sinuous course along and in contact with the walls of the crucible or melting-pot until all or the greater part of the effective heat for melting has been absorbed, and in then directing the incom-bustible gases over the surface of the metal so as to prevent access of air thereto, and permit of removing the molten metal from the crucible or pot without allowing air to come in contact with the metal contained in said crucible or pot, substantially as and for the purposes set forth.

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

JAMES H. WALKER.

Witnesses:

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