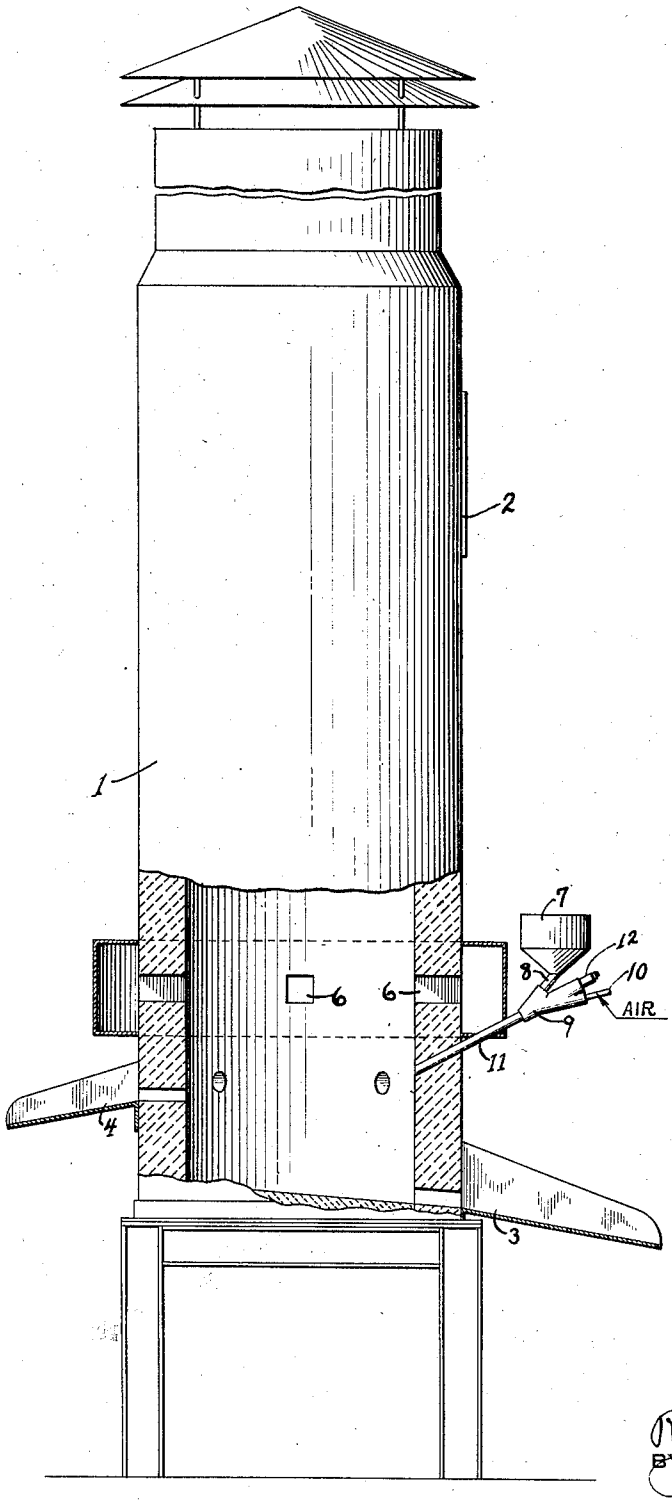
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CUPOLA

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CUPOLA

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The present invention relates to cupolas and more particularly to a novel and improved cupola for producing alloys as well as to a novel and improved method of alloying metals in a cupola.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, construction, arrangements, combinations and improvements herein shown and described.

The accompanying drawing, referred to herein and constituting a part hereof, illustrates one embodiment of the invention, and together with the description, serves to explain the principles of the invention.

The single figure of the drawing is a side elevation partly in section and largely diagrammatic of a cupola constructed in accordance with the present invention.

The present invention has for its object the provision of a novel and improved cupola or furnace for producing alloys in which the alloying material is introduced during the operation of the cupola. Another object is the provision of a novel and improved means for introducing particulate alloying material into a cupola to cause it to combine with the molten metal. Still another object is the provision of an improved method of producing alloys, and in particular ferrous alloys, by introducing particulate alloying material, and especially molybdenum compounds and salts, into a cupola or furnace near the base thereof.

In carrying out the method of the present invention, a cupola is charged in the usual manner with coke, limestone, and steel or iron, or such other materials as may be necessary to produce the desired alloy. After the cupola has been ignited and the charge has been thoroughly heated so that the metal in the charge is dropping and forming a slag-covered pool at the bottom or crucible of the cupola, and while the tuyères are blowing heated air upwardly through the charge, a quantity of particulate alloying material of the correct amount to produce the desired alloy is introduced into the cupola near its base, preferably above the surface of the molten metal and slag thereon and at or below the level of the tuyères. Preferably, this introduction of the particulate alloying material is effected by blowing the material downwardly towards the surface of the molten metal, with the alloying material suspended in the blast of air. The mixture of the alloying material with the molten metal is also aided by the masses of molten material from the charge dropping into the pool of molten metal at the bottom of the cupola.

As additional metal is charged to the furnace and is melted, additional alloying material is introduced into the base of the cupola in sufficient quantity to produce the desired alloy from the new metal, or the alloying material may be fed in the blast of air more or less continuously, the rate of feed depending on the rate of smelting, and these rates being correlated to produce an alloy of the desired composition.

The method of the present invention is particularly useful in connection with the alloying of molybdenum with iron, using calcium molybdate as the source of the molybdenum, and practically none of the relatively light calcium molybdate is lost inasmuch as any of the calcium molybdate which is not reduced by or combined with the molten iron in the crucible of the cupola is carried upwardly through the burning charge in the tuyère zone until it combines with the melting metal, travelling downward towards the bottom of the furnace.

The method of the present invention is particuarly advantageous inasmuch as it insures better mixing of the alloy due to the fact that the alloying material is added while the molten metal is extremely hot, the alloying material is added directly to the molten metal, and there is no chance for the alloying material to sinter or float on the surface without being dissolved in the molten metal, inasmuch as the surface is continuously being agitated and disturbed by the falling drops of molten metal from the charge.

Referring now in detail to the illustrative embodiment of the apparatus forming part of the present invention, and as shown in the accompanying drawing, the cupola 1 is provided with the usual charging door 2 through which the charge may be introduced into the relatively high and narrow interior of the cupola. At the bottom or the crucible zone, the cupola is provided with the usual pouring spout 3 for the molten metal, and considerably above this is located the slag spout 4. Above the slag spout are provided the tuyères 6 through which heated air may be blown during the operation to increase the heat of the charge.

In accordance with the present invention, means are provided for introducing particulate alloying material at or below the level of the

tuyères, and these means preferably comprise means for blowing the particulate material suspended in the blast of air directly through the lower portion of charge, towards and against the surface of the molten metal. As embodied, a hopper 7 is provided into which is placed the required amount of particulate alloying material, such as calcium molybdate or particulate ferrochrome. The lower portion of hopper 7 is conical and communicates with a pipe 8 leading into a Y 9 which is also connected with an air supply 10 to form an injector. The outlet side of the injector communicates with a pipe 11 which is downwardly inclined towards the cupola and projects through the lining thereof and into the interior of the cupola, terminating at a point which is at or below the level of the tuyères 6. A pipe 12 is also preferably provided forming an extension of the pipe 11, and is provided at its outer end with a plug which may be removed for cleaning the Y 9 or pipe 11.

In carrying out the method of the invention with the embodiment of the apparatus just described, the particulate alloy material is introduced into the hopper 7, and after the melting of the charge in the cupola 1 is well under way, the air blast is started supplying air through pipe 10, withdrawing the particulate alloying material from hopper 7 and forcing it against the surface of the molten metal while suspended in the air blast, and this introduction of the alloying material may be repeated after each new charge is added to the cupola, or may be more or less continuous as explained above.

When using the present invention, very little of the alloying material is lost as it has been where the alloying material has been added to the cupola as a part of the charge. Also the resulting alloy is more uniform than where the alloying material is added to the charge in a fine state, or as briquettes which disintegrate, as with the old process, the fine material sifts through the charge unevenly and is not uniformly reduced by or combined with the melting metal. The mixing of the alloying material is more thorough than has been the case where it has been added to the metal as it is tapped or poured into the ladle. Furthermore, there is practically no sintering of the alloying material nor does it float on the surface of the metal as is usually the case in adding it to the ladle, and the alloying material is mixed by the dropping molten metal.

While the invention has been described with particular reference to cupolas, this term is to be construed as including similar furnaces, such as blast furnaces.

The invention in its broader aspects is not limited to the specific mechanisms and steps shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:—

1. A method of producing molybdenum iron alloys which includes charging the cupola with fuel and ferrous material, burning the charge to melt the iron, blowing air through the burning charge and introducing a particulate molybdenum salt into the cupola near the bottom of the charge and above the mass of molten metal in the cupola to reduce and alloy the melting and molten iron with molybdenum.

2. A method of producing molybdenum iron alloys which includes charging the cupola with fuel and ferrous material, burning the charge to melt the iron, blowing air through the burning charge and blowing a particulate molybdenum salt into the cupola near the bottom of the charge and above the mass of molten metal in the cupola to reduce and alloy the melting and molten iron with molybdenum.

3. A method of producing molybdenum iron alloys which includes charging the cupola with fuel and ferrous material, burning the charge to melt the iron, blowing air through the burning charge and blowing a particulate molybdenum salt into the cupola at or below the level of the tuyères and above the mass of molten metal in the cupola to reduce and alloy the melting and molten iron with molybdenum.

4. An apparatus for producing alloys including in combination a cupola adapted to receive a charge of metal and combustible material and having tuyères and a crucible at the bottom of the cupola and means for introducing particulate alloying material at a point between the tuyères and the surface of the molten metal in the crucible.

5. An apparatus for producing alloys including in combination a cupola adapted to receive a charge of metal and combustible material and having tuyères and a crucible at the bottom of the cupola and an injector having its outlet positioned between the tuyères and the surface of the molten metal in the crucible for introducing the alloying material into the cupola and blowing it onto the surface of the molten metal while the charge is burning.

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