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[56]

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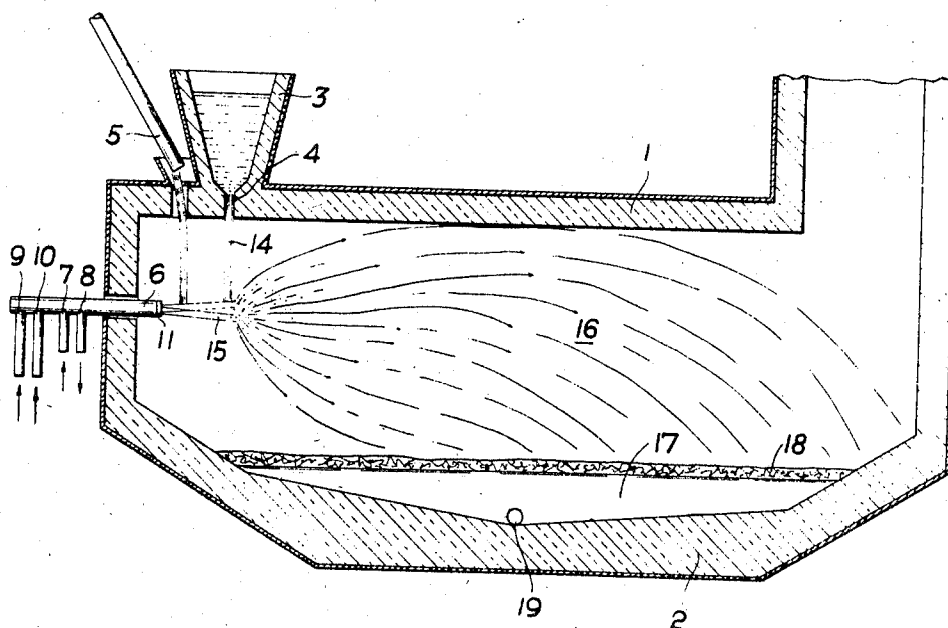
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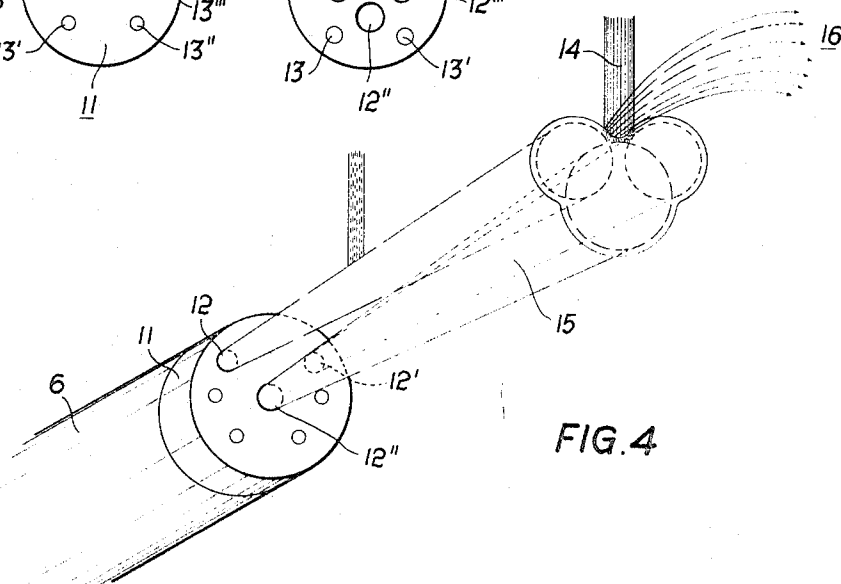
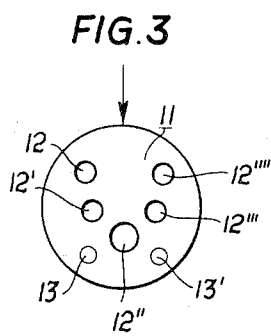
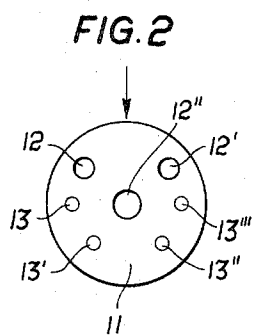
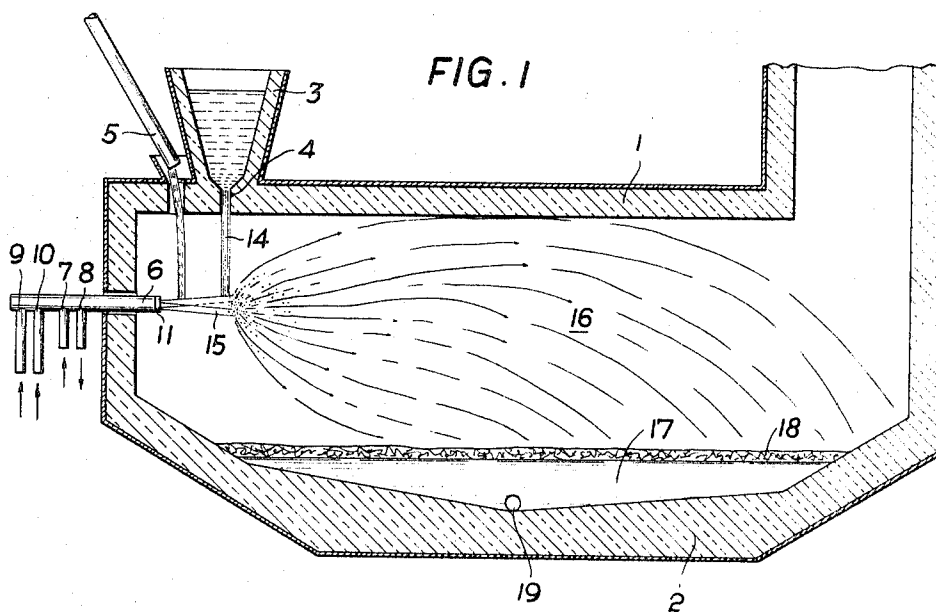
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[54] **APPARATUS FOR CARRYING OUT SPRAY
 STEELMAKING PROCESSES**
 9 Claims, 4 Drawing Figs.

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 [51] Int. Cl..... C21c 7/00
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ABSTRACT: A spray apparatus is provided comprising a collecting vessel having a vertical inlet passage through which a stream of pig iron is fed by a free fall and a multihole blow pipe arranged inclined towards the axis of said vertical inlet passage, pressurized refining gas being supplied through the outlets of said blow pipe, said outlets being arranged in V- or U-fashion so as to form a gas jet with a channel like cross section owing to which fact the swaying flow of the pig iron stream does not impair the spraying effect as the pig iron stream is perfectly caught by the refining gas.





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APPARATUS FOR CARRYING OUT SPRAY STEELMAKING PROCESSES

The invention relates to an apparatus for carrying out spray steelmaking processes, in which liquid pig iron is sprayed and refined by an oxygen-containing gas, if desired in the presence of slag-forming materials, comprising a vertical inlet passage for the formation of a free-falling pig iron stream and a blow-pipe for supplying refining gas inclined towards the axis of the inlet passage.

Various devices for carrying out spray steelmaking processes have already become known, whereby an oxygen jet is blown against a falling pig iron stream and the pig iron is sprayed by the kinetic energy of the gas.

It has for example become known to permit a pig iron stream to fall through an annular nozzle with a number of outlets surrounding the pig iron stream. With this known spraying device the spraying effect is satisfactory, but the spraying direction is vertical, which involves constructional disadvantages, since the apparatus has to be arranged like a tower. It is desired to arrange the spraying zone horizontally and thus create a possibility to build the collecting vessel hearth or tub like with little height.

Known spray steelmaking plants with a horizontally arranged spraying zone are provided with tundishes, which have a vertical inlet passage for the liquid pig iron and a Laval-type single-jet supply nozzle for the refining gas inclined to same vertical inlet passage. This however, involves the disadvantage that the free-falling pig iron stream is not properly caught by the conically expanding gas jet, since the pig iron flow is swaying slightly; as a consequence, only parts of the pig iron stream are sprayed, while other parts are deflected without being sprayed, so that they do not participate in the reaction.

The aim of the invention is to prevent these disadvantages and difficulties by creating an apparatus with a horizontal direction of the spraying zone, by which the pig iron stream is satisfactorily caught and sprayed and by which apparatus admixtures can be added, if desired, without losses in the spraying zone. It is a further object of the invention to provide means for controlling the process in such a way so that the amount and kinetic energy of the refining gas as required for the spraying operation can be regulated independently from the amount of refining gas necessary for the metallurgically desired progress of the reaction.

These aims of the invention are achieved by an apparatus for carrying out spray steelmaking processes, in which liquid pig iron is sprayed and refined by an oxygen-containing gas, if desired in the presence of slag-forming materials, comprising a vertical inlet passage for the formation of a free-falling pig iron stream and a blow pipe for supplying the reaction gas inclined towards the axis of the inlet passage, which is characterized in that the blowpipe is provided with several outlets or nozzle mouths, which are located along the contours of a V or U for the formation of a gas jet of channellike cross section.

According to a preferred embodiment of the invention, which enables independent regulation of the amounts of oxygen, necessary on the one hand for carrying out the spraying process and on the other hand for the metallurgically desired progress of the reaction, there are provided, in addition to said outlets arranged in V- or U-fashion, further outlets which suitably have smaller cross sections.

The invention is further explained by way of an embodiment shown in the drawing. FIG. 1 shows a side view of the complete arrangement, comprising a collecting vessel with inlets for pig iron and admixtures and a blow pipe inserted at the front end of the vessel; FIGS. 2 and 3 represent two different embodiments of the blow pipe mouth plate, in which outlets for oxygen jets are provided; FIG. 4 illustrates the expansion of the oxygen jet for catching the pig iron stream.

In the drawing numeral 1 denotes a collecting vessel having a hearth 2. At the top part of the collecting vessel a funnel-shaped pig iron supply vessel 3 is provided, which has a vertical outlet duct 4. Numeral 5 denotes a feed chute serving to

supply pulverized or granular admixtures. A water-cooled, axially displaceable blowpipe 6 is inserted into the collecting vessel at its front end; numerals 7 and 8 denote the inlet and outlet openings for the cooling agent, 9 and 10 the supply pipes for oxygen. The blow pipe 6 is closed at its mouth by a plate 11.

FIGS. 2 and 3 illustrate two different embodiments of the nozzle plate 11. According to the embodiment shown in FIG. 2 three main outlets 12, 12', 12'' are provided, placed along the contours of an upwardly opening V. 13, 13', 13'' and 13''' denote further outlets, which are approximately semicircularly arranged below the main outlets. The embodiment of the closing plate according to FIG. 3 comprises five main outlets 12, 12', 12'', 12''', 12''''', which are placed along the contours of a U, and apart from that two auxiliary outlets 13 and 13' are provided.

The way in which the arrangement operates may be gathered from FIGS. 1 and 4. The pig iron stream 14 is permitted to fall freely from the pig iron inlet passage 4. It is impinged upon by the oxygen jet 15, which is formed by the jets leaving the main outlets of the nozzle plate 11 and has a channellike cross section, as shown in FIG. 4. Owing to the individual jets widening to a channellike cross section, the pig iron stream is perfectly caught; the swaying flow of the pig iron stream does not have any influence upon the spraying effect.

The pressure and the amount, respectively, of the jets leaving the main outlets is so regulated that at the point of impact of the jet 15 on the pig iron stream 14 the kinetic energy necessary for spraying is available for a perfect atomization of the pig iron. The additional control of the oxygen amount for the desired metallurgical operation is achieved by means of secondary oxygen, which is supplied from the auxiliary outlets.

If admixtures are necessary, they are added through the chute 5; it has been found that they are completely absorbed by the jet and directed to the spraying zone. The spraying zone is denoted by numeral 16; it develops in horizontal direction and the height of the vessel 1 may be small. At the bottom of the hearth the liquid metal 17 is collected, covered by a slag layer 18. The metal can be drawn off through tap hole 19.

I claim:

1. Apparatus for carrying out spray steelmaking processes, in which liquid pig iron is sprayed and refined by an oxygen-containing gas, comprising

a collecting vessel having a hearth-type bottom, substantially vertical sidewalls and a closed top,

a vertical inlet passage arranged in the top of said vessel adjacent one of said sidewalls,

means for supplying liquid pig iron by a free fall through said inlet passage,

a blow pipe extending through said one of said sidewalls, said blow pipe being inclined at an angle to the path of fall of said pig iron,

a nozzle plate, at the end of said blow pipe within said vessel, said nozzle plate having a plurality of main outlets arranged in a manner to form a gas jet with a channel-shaped cross section, and

means for supplying pressurized refining gas to said blow pipe.

2. Apparatus as set forth in claim 1, wherein said outlets are arranged in V shape on said blow pipe.

3. Apparatus as set forth in claim 1, wherein said outlets are arranged in U shape on said blow pipe.

4. An apparatus as set forth in claim 1 wherein a plurality of secondary outlets are provided in said nozzle plate.

5. An apparatus for carrying out in a vessel spray steelmaking processes, in which liquid pig iron is sprayed and refined by an oxygen-containing gas, comprising

a vertical inlet passage in said vessel through which a stream of pig iron is fed by a free fall,

a blow pipe in said vessel for supplying pressurized refining gas, said blow pipe being inclined at an angle to the path

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of fall of said pig iron and having a plurality of nozzle outlets arranged in a manner to form a gas jet with a channel-like cross section, and

a supply duct, said duct being positioned in said vessel to supply pulverize admixtures to the gas jet between said stream of pig iron and said blowpipe nozzle outlets.

6. A spray steelmaking apparatus comprising in combination:

a collecting vessel having a hearth-type bottom, substantially vertical sidewalls and a closed top,

a vertical inlet passage arranged in the top of said vessel near its sidewall,

means for supplying liquid pig iron by a free fall through said inlet passage,

a supply duct for finely divided admixtures disposed between said inlet passage and said sidewall,

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a water-cooled blast tube extending through said vessel sidewall adjacent to said inlet passage and supply duct, means for supplying pressurized refining gas to said blast tube,

said blast tube being closed by a nozzle plate having a plurality of main outlets spaced along an upwardly diverging contour so as to form a trough-shaped refining gas jet.

7. The apparatus set forth in claim 6 wherein a number of small secondary outlets are provided in said nozzle plate below said main outlets.

8. The apparatus set forth in claim 6 wherein said main outlets are arranged in V-shape on said nozzle plate.

9. The apparatus set forth in claim 6 wherein said main outlets are arranged in U-shape on said nozzle plate.

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