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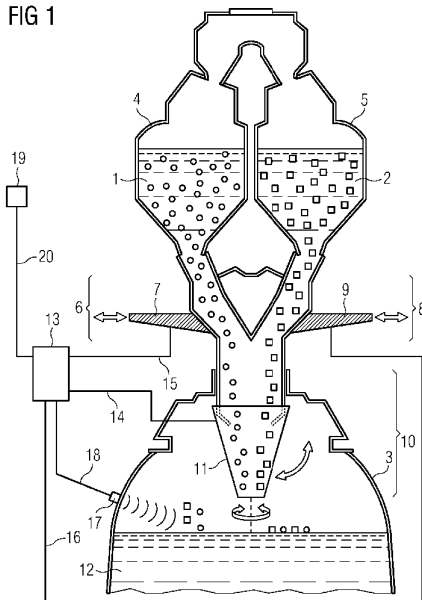
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(54) Title: METHOD AND DEVICE FOR CHARGING COAL-CONTAINING MATERIAL AND IRON CARRIER MATERIAL

(54) Bezeichnung : VERFAHREN UND VORRICHTUNG ZUM CHARGIEREN VON KOHLEHALTIGEM MATERIAL UND
EISENTRÄGER-MATERIAL

FIG 1



(57) Abstract: The present invention relates to a method for charging material, comprising coal-containing material in lump form and, preferably hot, iron carrier material, into a melter gasifier of a smelting reduction installation. This involves bringing together the coal-containing material in lump form and the, preferably hot, iron carrier material before and/or while they enter the melter gasifier. The ratio of the combined amounts of, preferably hot, iron carrier material and coal-containing material in lump form is variable. The method is characterized in that the combined amounts of, preferably hot, iron carrier material and coal-containing material in lump form are distributed over the cross section of the melter gasifier by means of a dynamic distributing device, and the ratio of the combined amounts of, preferably hot, iron carrier material and coal-containing material in lump form is set in dependence on the position of the dynamic distributing device.

(57) Zusammenfassung: Die vorliegende Erfindung betrifft ein Verfahren zur Chargierung von Material, umfassend stückiges kohlehaltiges Material, und bevorzugt heißes, Eisenträger-Material, in einen Einschmelzvergaser einer Schmelzreduktionsanlage. Dabei werden das stückige kohlehaltige Material und das, bevorzugt heiße, Eisenträger-Material vereinigt, bevor und/oder während sie in den Einschmelzvergaser eintreten. Das Verhältnis der vereinigten Mengen von, bevorzugt heißem, Eisenträger-Material und von stückigem

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kohlehaltigem Material ist veränderbar. Das Verfahren ist dadurch gekennzeichnet, dass die vereinigten Mengen von, bevorzugt heißem, Eisenträger-Material und von stückigem kohlehaltigem Material mittels einer dynamischen Verteilvorrichtung über den Querschnitt des Einschmelzvergasers verteilt werden, und das Verhältnis der vereinigten Mengen von, bevorzugt heißem, Eisenträger-Material und von stückigem kohlehaltigem Material in Abhängigkeit von der Position der dynamischen Verteilvorrichtung eingestellt wird.

Description

Title of the invention

Method and device for charging coal-containing material and
iron carrier material

Technical field

The present invention relates to a method for charging material, comprising lumped carbonaceous (coal-containing) material and (preferably hot) iron carrier material, into a melter gasifier of a smelting reduction plant.

Prior art

In the context of smelting reduction processes for producing pig iron in a melter gasifier, e.g. COREX® or FINEX®, material comprising carbonaceous material, iron carrier material and fluxes is charged into the melter gasifier. The carbonaceous material is gasified with oxygen to produce a reduction gas, the heat required to melt the iron carrier material being released in the process.

Carbonaceous material includes e.g. coal in lump form or carbonaceous briquettes. It is stored at ambient temperature in a charging bin for carbonaceous material, from which it is loaded into the melter gasifier. In the case of FINEX®, for example, the iron carrier material is hot-briquetted iron (HBI) or hot-compacted iron (HCI). HBI is hot-compacted iron having a very high proportion of metallic iron (often more than 90% metallization) and a density of approximately 5 g/cm³,

allowing transport by ship, for example. The material takes the form of individual briquettes, generally > 25 mm, and is therefore present in lump form. HCI is hot-compacted iron with fluxes and has a lower proportion of metallic iron than HBI. Its density is slightly less than 4 g/cm³. As part of the manufacturing process for pig iron, HCI is further processed immediately after production, being granulated by means of crushers and used in a form that is advantageous for a melter gasifier. HCI has a temperature of approximately 550-650°C in this case. In the case of COREX®, the iron carrier material is e.g. hot direct reduced iron (DRI).

Pyrolysis of coal or carbonaceous briquettes at high temperatures results in the development and release of volatile hydrocarbons and tar. Therefore the carbonaceous material cannot be stored together with hot iron carrier material in a charging bin, since the development and release of volatile hydrocarbons and tar, triggered by the contact with the hot iron carrier material, would result in conglutination and blockages in the charging bin and in the lines transporting the material to the melter gasifier.

The charging of carbonaceous material and iron carrier material into a melter gasifier usually takes place separately in existing prior art installations.

Carbonaceous material is transported from e.g. a charging bin for carbonaceous material via screw feeders to a distributing device which is disposed centrally in the dome of the melter gasifier and from which the carbonaceous material is distributed over the cross-section of the melter gasifier as it is introduced into the melter gasifier. Iron carrier

material is introduced into the melter gasifier e.g. via a plurality of drop shafts which are arranged around the circumference of the dome of the melter gasifier.

The separate addition of carbonaceous material and iron carrier material into the melter gasifier involves considerable expense in terms of the construction and maintenance of those plant parts required for the separate addition. Moreover, in the case of separate addition, the carbonaceous material and iron carrier material are not distributed with an adequate degree of control on the material bed in the melter gasifier, and e.g. the formation of vertical islands of iron carrier material can occur, thereby adversely affecting the melting and gasification process.

It is known from EP0299231A1 to charge the carbonaceous material and the iron carrier material into the melter gasifier centrally via the same opening. Central charging as described in EP0299231A1 is disadvantageous in that fresh material is supplied to precisely that region of the material bed which is known as the "dead man" region in the melting and gasification process, wherein preheating and reduction processes take place less effectively than in the peripheral region of the melter gasifier. Moreover, fine and heavy material remains concentrated in the central region of the material bed due to segregation processes, while coarser and lighter material migrates toward the peripheral region. Accordingly, the mixture which is charged onto the material bed is again segregated to some extent and in an uncontrolled manner.

Summary of the Invention

It is an object of the present invention to substantially overcome or at least ameliorate one or more of the above disadvantages, or at least provide a useful alternative.

A preferred embodiment aims to provide a method and device associated with less construction and maintenance overhead and enabling controlled distribution.

Technical Solution

In a first aspect the present invention provides a method for charging material, comprising lumped carbonaceous material and iron carrier material, into a melter gasifier of a smelting reduction plant, wherein the lumped carbonaceous material and the iron carrier material are combined before and/or during entry into the melter gasifier, and the ratio of the combined quantities of iron carrier material and lumped carbonaceous material can be varied, wherein the combined quantities of iron carrier material and lumped carbonaceous material are distributed over the cross-section of the melter gasifier by means of a dynamic distributing device, and the ratio of the combined quantities of iron carrier material and lumped carbonaceous material is set as a function of the position of the dynamic distributing device.

In at least one embodiment the melter gasifier requires fewer plant parts and openings for charging than when lumped carbonaceous material and iron carrier material enter the melter gasifier separately.

Hot iron carrier material is understood to mean iron carrier material having a temperature higher than 100°C, preferably higher than 200°C, particularly preferably higher than 300°C. The iron carrier material contains elementary iron and/or iron oxide. The iron carrier material is present in lump form, in lump form with a proportion of fines, or as fine grain (preferably less than 10 mm).

The carbonaceous material is present in lump form. The proportion of coal in the lumped carbonaceous material represents at least 50% by weight, preferably 70% by weight, particularly preferably 90% by weight. In this case the proportion by weight relates to the weight of the constituents of the lumped carbonaceous material at the time when the constituents are loaded

into the charging bin. In addition to coal, the lumped carbonaceous material may also contain coke, for example.

No further details of the fluxes such as limestone and/or dolomite and/or quartz, for example, which are also charged into the melter gasifier (preferably via the iron carrier route) in the context of a method according to the invention, are included within the scope of the present application.

The lumped carbonaceous material and the (preferably hot) iron carrier material are preferably combined shortly before and/or during entry of the mixture, which is obtained by the combination, into the melter gasifier. In this case, lumped carbonaceous material and the (preferably hot) iron carrier material are merged during transport to the melter gasifier, e.g. in a chute, without previously being stored together in a bunker, in order to ensure that the time during which the two materials are present together in parts of the plant outside of the melter gasifier is restricted, preferably to less than a few seconds, e.g. up to 10 seconds. This reduces the risk that pyrolysis of the lumped carbonaceous material, triggered by contact with hot iron carrier material, will result in conglutination and blockages of the mixture, which is obtained by combination, in the plant parts leading to the melter gasifier.

The pyrolysis and gasification of the lumped carbonaceous material therefore first occurs in the melter gasifier.

The term melter gasifier does not include a blast furnace. In a blast furnace, layers of coke and iron carrier with fluxes are essentially added from above under environmental conditions. Pyrolysis and degasification of coal does not take place in the blast furnace, but beforehand during the production of the coke which is charged into the blast furnace. The temperatures at the top of a blast furnace range from approximately 80 to 250°C. In the case of a melting and gasification process in at least one embodiment in contrast, not coke but carbonaceous material is charged, and the charged carbonaceous material is pyrolyzed in the melter gasifier. The temperatures prevailing in the melter gasifier dome are approximately 1000°C in the region where material is charged into the melter gasifier.

As a result of charging lumped carbonaceous material and (preferably hot) iron carrier material together, it is possible to avoid the problem of uncontrolled and unwanted inhomogeneous distribution which occurs when they are charged separately, e.g. forming vertical islands of iron

carrier material in the melter gasifier. This also eliminates the expense associated with construction and maintenance of the plant parts that are required for separate charging.

A dynamic distributing device is understood to be a distributing device which may be moved in a controlled manner during the distribution process. An outlet opening of the dynamic distributing device may therefore be moved to various positions. Accordingly, the combined quantities of (preferably hot) iron carrier material and lumped carbonaceous material may be directed to various locations of the material bed in the melter gasifier.

The dynamic distributing device may be a rotating chute or a gimbal-mounted chute, for example, which may be moved such that its outlet opening describes circular, spiral or freely definable paths, for example, it being also possible to select different distribution tracks. The movement pattern of the dynamic distributing device may be varied.

In at least one embodiment the charged material forms a material bed in the melter gasifier. The combined quantities of (preferably hot) iron carrier material and lumped carbonaceous material are distributed by means of a dynamic distributing device over the cross-section of the melter gasifier, and the ratio of the combined quantities of (preferably hot) iron carrier material and lumped carbonaceous material is set as a function of the position of the dynamic distributing device. By virtue of the position of the dynamic distributing device in the melter gasifier defining the region in which the material to be distributed strikes the material bed in the melter gasifier, the distribution of (preferably hot) iron carrier material and lumped carbonaceous material on the material bed of the melter gasifier can be controlled and set according to the requirements of the melting and gasification process. Specific distribution patterns of (preferably hot) iron carrier material and lumped carbonaceous material can therefore be set in the melter gasifier. For example, a dead man of mainly carbonaceous material can be selectively developed during phased charging of carbonaceous material with little iron carrier material in the melter gasifier. The setting of specific distribution patterns of iron carrier material and carbonaceous material in the melter gasifier allows better control of the processes that take place in the melter gasifier when converting iron carrier material and carbonaceous material. This results in greater operational stability and improved process yield.

For the purpose of the melting and gasification process, the region in which it is particularly preferred to charge material onto the material bed in the melter gasifier may be derived from the

properties of the surface. In this case, the surface of the material bed is also understood to mean the top layer of the material bed, viewed in a vertical direction. The top layer is understood to be a layer having a layer thickness of up to 20 cm.

According to an embodiment of the inventive method, the ratio of the combined quantities of (preferably hot) iron carrier material and lumped carbonaceous material is set as a function of properties of the surface of the material bed.

According to an embodiment, the property of the surface of the material bed is the height level and/or the height profile of the material bed.

According to a further embodiment, the property of the surface of the material bed is the temperature profile at the surface of the material bed.

Pig iron and slag are run off from a melter gasifier at approximately regular intervals during the day, in order to prevent the liquid level in the melter gasifier from rising above the level of the nozzles for the oxygen supply. Inhomogeneous gasification and reduction ratios continuously arise during operation as a result of the running off. Negative effects of such inhomogeneities on the smelting reduction process can be counteracted by selectively charging to relevant regions within the overall area. Correspondingly, an embodiment provides for the ratio of the combined quantities of (preferably hot) iron carrier material and lumped carbonaceous material to be set as a function of the run-off sequence that is followed during the operation of the melter gasifier.

Not only the ratio of the combined quantities of (preferably hot) iron carrier material and lumped carbonaceous material, but also the grain size distribution and the types of materials have an effect on the melting and gasification process. With regard to the lumped carbonaceous material, grain size distribution in this case is understood to be the lump size of the lumped carbonaceous material. Various types of (preferably hot) iron carrier material have different proportions of metallic iron and iron oxide or other constituents, for example. Various types of lumped carbonaceous material have different proportions of coke or other constituents, for example. Various types of (preferably hot) iron carrier material and lumped carbonaceous material are dependent on the source from which they are obtained, for example. According to an embodiment, the grain size distribution of the (preferably hot) iron carrier material and/or the lump size of the lumped carbonaceous material are selected as a function of the position of the dynamic distributing device. According to a further embodiment, the type of charged (preferably

hot) iron carrier material and/or the type of lumped carbonaceous material are selected as a function of the position of the dynamic distributing device.

In a second aspect the present invention provides the subject matter of the present application also relates to a device for charging material, comprising lumped carbonaceous material and iron carrier material, into a melter gasifier of a smelting reduction plant, having at least one charging bin for lumped carbonaceous material, and having at least one charging bin for iron carrier material, wherein a first discharge line for lumped carbonaceous material emerges from the at least one charging bin for lumped carbonaceous material and comprises a first conveyor device for regulating the discharge of lumped carbonaceous material, and wherein a second discharge line for iron carrier material emerges from the at least one charging bin for iron carrier material and comprises a second conveyor device for regulating the discharge of iron carrier material, and having an input device for inputting material into the melter gasifier wherein the first discharge line for lumped carbonaceous material and the second discharge line for iron carrier material open into the input device for inputting material into the melter gasifier, wherein the input device for inputting material into the melter gasifier comprises a dynamic distributing device for distributing the material during the input, and a device is provided for controlling at least one of the conveyor devices from the group

- first conveyor device for regulating the discharge of lumped carbonaceous material
- second conveyor device for regulating the discharge of iron carrier material as a function of the position of the dynamic distributing device.

The method according to the first aspect may be performed using such a device. Carbonaceous material and (preferably hot) iron carrier material may be combined before and/or during entry into the melter gasifier.

The input device for inputting material into the melter gasifier can comprise screw feeders, for example.

At least one embodiment of the device may be operated in such a way that lumped carbonaceous material and (preferably hot) iron carrier material are continuously combined. It may also be operated in such a way that iron carrier material, preferably hot iron carrier material, is intermittently added to a continuous stream of carbonaceous material. It may also be operated such that lumped carbonaceous material is intermittently added to a continuous stream

of iron carrier material, preferably hot iron carrier material. It may also be operated in such a way that a stream of lumped carbonaceous material and a stream of (preferably hot) iron carrier material are input alternately into the melter gasifier via the input device for inputting material.

In an embodiment the input device for inputting material into the melter gasifier comprises a dynamic distributing device for distributing the material during the input. A distribution of the material over the horizontal cross-section of the interior of the melter gasifier is meant in this case. Specific distribution patterns of (preferably hot) iron carrier material and lumped carbonaceous material can therefore be set in the melter gasifier. The input device for inputting material into the melter gasifier and comprising a dynamic distributing device can be a gimbal-mounted chute, preferably driven via two axes, or a rotating chute, for example.

According to an embodiment two charging bins for (preferably hot) iron carrier material and/or two charging bins for lumped carbonaceous material are provided. It is thereby possible to ensure more uniform charging, because a second, full charging bin can be used when the first charging bin is completely empty. While the second charging bin is being emptied, the first charging bin can then be replenished such that it is available for the charging again when the second charging bin is completely empty. Moreover, it is thereby possible to charge different types of (preferably hot) iron carrier material and/or different types of lumped carbonaceous material, or to charge different grain sizes of (preferably hot) iron carrier material and/or different lump sizes of lumped carbonaceous material, if the two charging bins are filled accordingly. It is also possible to provide more than two charging bins for iron carrier material, preferably hot iron carrier material, and/or more than two charging bins for lumped carbonaceous material.

According to an embodiment, the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device for regulating the discharge of (preferably hot) iron carrier material comprise/comprises one or more material flow gates.

According to an embodiment, the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device for regulating the discharge of (preferably hot) iron carrier material comprise/comprises one or more screw feeders. Screw feeders allow more effective regulation of quantities than material flow gates and the material can be transported horizontally, wherein a plurality of charging bins can be arranged next to one

another and the materials can be conveyed to the shared input device and thence to the melter gasifier.

According to an embodiment, the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device for regulating the discharge of (preferably hot) iron carrier material comprise/comprises one or more cellular wheel sluices. Cellular wheel sluices allow more effective regulation of quantities than material flow gates and, in comparison with screw feeders, can minimize an undesirable gas flow via the cellular wheel sluice if there is a pressure difference.

Hybrid forms are also possible, e.g. a device in which a screw feeder is provided for regulating the discharge of lumped carbonaceous material in the first discharge line, and a material flow gate is provided for regulating the discharge of (preferably hot) iron carrier material in the second discharge line. Such a hybrid form is preferable if it is necessary to generate a continuous stream of lumped carbonaceous material, for example.

According to a preferred embodiment, a device is provided for regulating the distribution track which is realized during the input by the dynamic distributing device for the purpose of distributing the material. The dynamic distributing device has an outlet opening from which the material exits the dynamic distributing device. The distribution track is understood to be the track, as projected onto a horizontal plane, which is left on this plane by the outlet opening during charging. Specific distribution patterns of (preferably hot) iron carrier material and lumped carbonaceous material can be set in the melter gasifier by varying the distribution track over the horizontal cross-section of the interior of the melter gasifier.

According to a particularly preferred embodiment, a device is provided for controlling the first conveyor device for regulating the discharge of lumped carbonaceous material, and/or the second conveyor device for regulating the discharge of (preferably hot) iron carrier material, as a function of the distribution track which is realized during the input by the dynamic distributing device for the purpose of distributing the material. It is therefore possible to set a specific distribution pattern of (preferably hot) iron carrier material and carbonaceous material in the melter gasifier. This device is used to control the material flow gates and/or the screw feeders, for example.

In an embodiment at least one device is provided for capturing properties of the surface of the material bed that has formed in the melter gasifier. Such a device may be e.g. a microwave measuring device or a radar measuring device for determining height and/or profile and/or temperature and/or the composition of the gas escaping from the material bed, or a thermometer for determining the temperature or the temperature profile at the surface of the material bed. A plurality of such devices may also be present.

According to an embodiment, a device is provided for controlling the first conveyor device for regulating the discharge of lumped carbonaceous material, and/or the second conveyor device for regulating the discharge of (preferably hot) iron carrier material, as a function of the properties which have been captured by the device for capturing properties of the surface of the material bed that has formed in the melter gasifier. In this way the ratio of the combined quantities of (preferably hot) iron carrier material and lumped carbonaceous material can be set as a function of properties of the surface of the material bed.

According to an embodiment, provision is made for at least two charging bins for lumped carbonaceous material, these being filled with lumped carbonaceous material of different lump sizes. For example, a first charging bin for lumped carbonaceous material is filled with a lump size A, and a second charging bin for lumped carbonaceous material is filled with a lump size B, where the lump sizes A and B are different. If applicable, a third charging bin for lumped carbonaceous material may be present and filled with a lump size C, where the lump size C is different from the lump sizes A and B.

According to an embodiment, provision is made for at least two charging bins for lumped carbonaceous material, these being filled with different types of lumped carbonaceous material. For example, a first charging bin for lumped carbonaceous material is filled with a type A, and a second charging bin for lumped carbonaceous material is filled with a type B, where the types A and B are different. If applicable, a third charging bin for lumped carbonaceous material may be present and filled with a type C, where the type C is different from the types A and B.

According to an embodiment, provision is made for at least two charging bins for (preferably hot) iron carrier material, these being filled with iron carrier material, preferably hot iron carrier material, of different grain sizes. For example, a first charging bin for (preferably hot) iron carrier material is filled with a grain size A, and a second charging bin for (preferably hot) iron

carrier material is filled with a grain size B, where the grain sizes A and B are different. If applicable, a third charging bin for (preferably hot) iron carrier material may be present and filled with a grain size C, where the grain size C is different from the grain sizes A and B.

According to an embodiment, provision is made for at least two charging bins for (preferably hot) iron carrier material, these being filled with different types of (preferably hot) iron carrier material. For example, a first charging bin for (preferably hot) iron carrier material is filled with a type A, and a second charging bin for (preferably hot) iron carrier material is filled with a type B, where the types A and B are different. If applicable, a third charging bin for (preferably hot) iron carrier material may be present and filled with a type C, where the type C is different from the types A and B.

Description of the Embodiments

The present invention is explained in the following with reference to exemplary embodiments and the appended exemplary schematic figures, in which:

Figure 1 shows an embodiment of the inventive device having material flow gates, and

Figure 2 shows an embodiment of the inventive device having screw feeders.

Figure 1 shows a device for charging material, comprising lumped carbonaceous material 1, this being represented by circles, and hot iron carrier material 2, this being

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represented by squares, into a melter gasifier 3 of a smelting reduction plant. The device has a charging bin 4 for lumped carbonaceous material and a charging bin 5 for hot iron carrier material. A first discharge line 6 for lumped carbonaceous material emerges from the charging bin 4 for lumped carbonaceous material, said first discharge line comprising a first conveyor device 7 for regulating the discharge of lumped carbonaceous material 1. A second discharge line 8 for hot iron carrier material emerges from the charging bin 5 for hot iron carrier material, said second discharge line comprising a second conveyor device 9 for regulating the discharge of hot iron carrier material 2. The first conveyor device 7 for regulating the discharge of lumped carbonaceous material 1 and the second conveyor device 9 for regulating the discharge of hot iron carrier material 2 are embodied as material flow gates. These material flow gates can be moved, as indicated by straight dual-headed arrows. Figure 1 illustrates the material flow gates in a position at which they do not restrict the first discharge line 6 for lumped carbonaceous material and/or the second discharge line 8 for hot iron carrier material. The illustration of a position at which they are partially pushed in, and therefore restrict the first discharge line 6 for lumped carbonaceous material or, as the case may be, the second discharge line 8 for hot iron carrier material, has been omitted for the clarity of illustration reasons. The lumped carbonaceous material 1 and the hot iron carrier material 2 are combined before they enter the melter gasifier 3. For this purpose the first discharge line 6 for lumped carbonaceous material and the second discharge line 8 for hot iron carrier material open into an input device 10 for inputting material into the melter gasifier 3.

Lumped carbonaceous material 1 and hot iron carrier material 2 are input into the melter gasifier via the input device 10 for inputting material into the melter gasifier. The input device 10 for inputting material into the melter gasifier 3 comprises a dynamic distributing device 11 for distributing the material during the input, this being a gimbal-mounted chute in the illustrated case. The possible rotation of the gimbal-mounted chute is indicated by a curved dual-headed arrow which embraces the rotational axis of the rotational movement indicated by a dashed line. The pivoting movement of the gimbal-mounted chute is indicated by a curved dual-headed arrow. Lumped carbonaceous material 1 and hot iron carrier material 2 are distributed on the material bed 12 in the melter gasifier 3 in a controlled manner by means of the gimbal-mounted chute.

The ratio of the combined quantities of hot iron carrier material 2 and lumped carbonaceous material 1 can be varied. For this purpose a control device 13 is used to control at least one of the conveyor devices from the group

- first conveyor device 7 for regulating the discharge of lumped carbonaceous material
- second conveyor device 9 for regulating the discharge of hot iron carrier material

as a function of the position of the dynamic distributing device 10. Toward that end, the control device 13 is connected to the dynamic distributing device 11 via the signal line 14 for the purpose of transmitting information relating to the position of the dynamic distributing device 11.

For example, it is possible to determine the current position

of the gimbal-mounted chute in relation to the circular arc that is described by the movement of the gimbal-mounted chute. The first conveyor device 7, embodied in the form of a material flow gate, for regulating the discharge of lumped carbonaceous material 1 is inventively controlled, via the signal line 15, as a function of the position of the dynamic distributing device 10.

The second conveyor device 9, embodied in the form of a material flow gate, for regulating the discharge of hot iron carrier material 2 is inventively controlled, via the signal line 16, as a function of the position of the dynamic distributing device 10.

Also provided is a device 17 for capturing properties of the surface of the material bed that has formed in the melter gasifier, said device taking the form of a radar measuring device with integrated temperature measuring device in the illustrated case. The radar measuring device collects information relating to height level and height profile of the material bed 12 in the melter gasifier 3. The temperature measuring device collects information relating to the temperature profile at the surface of the material bed. Said information relating to properties of the surface of the material bed that has formed in the melter gasifier is transmitted via the signal line 18 to the control device 13 for the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device, where it is used to regulate the discharge of hot iron carrier material as a function of the captured properties.

In this way the ratio of the combined quantities of hot iron

carrier material 2 and lumped carbonaceous material 1 can be set as a function of properties of the surface of the material bed.

Information relating to the run-off sequence that is followed during the operation of the melter gasifier can be transmitted to the control device 13 for the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device by means of an information input device 19 which is connected for data transmission purposes via the signal line 20 to the control device 13 for the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device. The ratio of the combined quantities of hot iron carrier material and lumped carbonaceous material can therefore be set as a function of the run-off sequence that is followed during the operation of the melter gasifier. The cited signal lines may be provided physically in the form of cables, although the possibility of wireless signal transmission is also included.

Figure 2 shows a device for charging material, comprising lumped carbonaceous material 1, this being represented by circles, and hot iron carrier material 2, this being represented by squares, into a melter gasifier 3 of a smelting reduction plant. The device has two charging bins for lumped carbonaceous material, one charging bin 4a for lumped carbonaceous material and one charging bin 4b for lumped carbonaceous material. Lumped carbonaceous material 1a having a lump size A is stored in the charging bin 4a for lumped carbonaceous material, while lumped carbonaceous material 1a having a lump size B is stored in the charging bin 4b for

lumped carbonaceous material. The lump sizes A and B are different, this being represented by circles of different sizes. The device for charging material also has a charging bin 5 for hot iron carrier material. A first discharge line 6 for lumped carbonaceous material emerges from the two charging bins 4a/4b for lumped carbonaceous material, said first discharge line comprising a first conveyor device 7 for regulating the discharge of lumped carbonaceous material 1. A second discharge line 8 for hot iron carrier material emerges from the charging bin 5 for hot iron carrier material, said second discharge line comprising a second conveyor device 9 for regulating the discharge of hot iron carrier material 2. The first conveyor device 7 for regulating the discharge of lumped carbonaceous material 1 and the second conveyor device 9 for regulating the discharge of hot iron carrier material 2 are embodied as screw feeders.

The lumped carbonaceous material 1a/1b and the hot iron carrier material 2 are combined before they enter the melter gasifier 3. For this purpose the first discharge line 6 for lumped carbonaceous material and the second discharge line 8 for hot iron carrier material open into an input device 10 for inputting material into the melter gasifier 3.

Lumped carbonaceous material 1a/1b and hot iron carrier material 2 are input into the melter gasifier 3 via the input device 10 for inputting material into the melter gasifier. The input device 10 for inputting material into the melter gasifier 3 comprises a dynamic distributing device 11 for distributing the material during the input, this being a gimbal-mounted chute in the illustrated case. For clarity of illustration reasons, details of the gimbal mounting are not

shown. The gimbal-mounted chute can be rotated about a rotational axis and adjusted in its inclination. The possible rotation of the gimbal-mounted chute is indicated by a curved dual-headed arrow which embraces the rotational axis of the rotational movement indicated by a dashed line. The adjustability of the inclination is indicated such that the outline of the gimbal-mounted chute is represented as a continuous line for one position and as a broken line for another position. The adjustability of the inclination is also indicated by a curved dual-headed arrow. Lumped carbonaceous material 1a/1b and hot iron carrier material 2 are distributed on the material bed 12 in the melter gasifier 3 in a controlled manner by means of the gimbal-mounted chute. The movement pattern of the gimbal-mounted chute can be varied, describing e.g. circular or elliptical paths by means of different inclinations and therefore different resulting distributions on the material bed 12.

As illustrated analogously in Figure 1 above, the ratio of the combined quantities of hot iron carrier material 2 and lumped carbonaceous material 1a/1b can be varied. For this purpose a control device 13 is used to control at least one of the conveyor devices from the group

- first conveyor device 7 for regulating the discharge of lumped carbonaceous material
- second conveyor device 9 for regulating the discharge of hot iron carrier material

as a function of the position of the dynamic distributing device 10. Toward that end, the control device 13 is connected to the dynamic distributing device 11 via the signal line 14 for the purpose of transmitting information relating to the position of the dynamic distributing device 11.

For example, it is possible to determine the current position of the gimbal-mounted chute in relation to its path of rotation, and its current inclination. The first conveyor device 7, embodied in the form of a screw feeder, for regulating the discharge of lumped carbonaceous material 1a/1b is inventively controlled, via the signal line 15, as a function of the position of the dynamic distributing device 10. The discharge can be regulated by changing the rotational speed of the screw feeder, for example.

The second conveyor device 9, embodied in the form of a screw feeder, for regulating the discharge of hot iron carrier material is inventively controlled, via the signal line 16, as a function of the position of the dynamic distributing device 10.

Also provided is a device 17 for capturing properties of the surface of the material bed that has formed in the melter gasifier, said device taking the form of a radar measuring device with integrated temperature measuring device in the illustrated case. The radar measuring device collects information relating to height level and height profile of the material bed 12 in the melter gasifier 3. The temperature measuring device collects information relating to the temperature profile at the surface of the material bed. Said information relating to properties of the surface of the material bed that has formed in the melter gasifier is transmitted via the signal line 18 to the control device 13 for the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device, where it is used to regulate the discharge of hot iron

carrier material as a function of the captured properties. In this way the ratio of the combined quantities of hot iron carrier material 2 and lumped carbonaceous material 1 can be set as a function of properties of the surface of the material bed. The opening mechanism of the charging bin 4a for lumped carbonaceous material can be activated by the control device 13 via the signal line 21, and the opening mechanism of the charging bin 4b for lumped carbonaceous material can be activated by the control device 13 via the signal line 22. This activation allows the lump size of the lumped carbonaceous material to be selected as a function of the position of the dynamic distributing device. The opening mechanism of the charging bin 5 for hot iron carrier material can obviously also be activated by the control device 13, though for clarity of illustration reasons this is not shown here. The cited signal lines may be provided physically in the form of cables, although the possibility of wireless signal transmission is also included.

In a similar manner to the illustrated possibility of selecting the lump size of the lumped carbonaceous material as a function of the position of the dynamic distributing device, the type of lumped carbonaceous material can be selected as a function of the position of the dynamic distributing device if lumped carbonaceous materials 1a and 1b are of different types.

If provision is similarly made for two charging bins 5 for hot iron carrier material, these being filled with hot iron carrier material of a different grain size distribution and/or different type in each case, the grain size distribution and/or the type of the hot iron carrier material can be

selected as a function of the position of the dynamic distributing device in a similar manner to the lumped carbonaceous material.

A device 23 is provided for regulating the distribution track which is realized during the input by the dynamic distributing device for distributing the material. This is illustrated schematically and works by influencing the drive mechanism of the dynamic distributing device 11 or by influencing those plant parts which are responsible for the inclination of the distributing device 11.

By means of varying the distribution track over the horizontal cross-section of the interior of the melter gasifier, it is possible to set specific distribution patterns of hot iron carrier material and lumped carbonaceous material in the melter gasifier. The device 23 for regulating the distribution track which is realized during the input by the dynamic distributing device for distributing the material is connected via the signal line 24 to the control device 13 for controlling at least one of the conveyor devices from the group

- first conveyor device for regulating the discharge of lumped carbonaceous material
- second conveyor device for regulating the discharge of hot iron carrier material

as a function of the position of the dynamic distributing device.

Since the realized distribution track is determined by the position of the dynamic distributing device, the control device 13 also constitutes a device for controlling the first

conveyor device for regulating the discharge of lumped carbonaceous material, and/or the second conveyor device for regulating the discharge of hot iron carrier material, as a function of the distribution track 23 which is realized during the input by the dynamic distributing device for distributing the material. A specific distribution pattern of hot iron carrier material and carbonaceous material can therefore be set in the melter gasifier. This device can be used to control the material flow gates and/or the screw feeders, for example.

Although the invention has been illustrated and described in detail with reference to the preferred exemplary embodiments, the invention is not restricted by the examples disclosed herein, and other variations may be derived herefrom by a person skilled in the art without thereby departing from the scope of protection of the invention.

Documents cited

Patent documents

EP0299231A1

List of reference signs

- 1 Lumped carbonaceous material
- 1a Lumped carbonaceous material
- 1b Lumped carbonaceous material
- 2 Hot iron carrier material
- 3 Melter gasifier
- 4 Charging bin for lumped carbonaceous material
- 4a Charging bin for lumped carbonaceous material
- 4b Charging bin for lumped carbonaceous material
- 5 Charging bin for hot iron carrier material
- 6 First discharge line (for lumped carbonaceous material)
- 7 First conveyor device (for regulating the discharge of lumped carbonaceous material)
- 8 Second discharge line (for hot iron carrier material)
- 9 Second conveyor device (for regulating the discharge of hot iron carrier material)
- 10 Input device for inputting material into the melter gasifier
- 11 Dynamic distributing device for distributing the material during the input
- 12 Material bed
- 13 Control device (for controlling at least one of the conveyor devices from the group
 - first conveyor device for regulating the discharge of lumped carbonaceous material
 - second conveyor device for regulating the discharge of hot iron carrier materialas a function of the position of the dynamic distributing device)
- 14 Signal line
- 15 Signal line

- 16 Signal line
- 17 Device for capturing properties (of the surface of the material bed that has formed in the melter gasifier)
- 18 Signal line
- 19 Information input device
- 20 Signal line
- 21 Signal line
- 22 Signal line
- 23 Device for regulating the distribution track which is realized during the input by the dynamic distributing device for distributing the material
- 24 Signal line

CLAIMS

1. A method for charging material, comprising lumped carbonaceous material and iron carrier material, into a melter gasifier of a smelting reduction plant,
wherein the lumped carbonaceous material and the iron carrier material are combined before and/or during entry into the melter gasifier, and the ratio of the combined quantities of iron carrier material and lumped carbonaceous material can be varied,
wherein the combined quantities of iron carrier material and lumped carbonaceous material are distributed over the cross-section of the melter gasifier by means of a dynamic distributing device, and the ratio of the combined quantities of iron carrier material and lumped carbonaceous material is set as a function of the position of the dynamic distributing device.
2. The method as claimed in claim 1, wherein the charged material forms a material bed in the melter gasifier, wherein the ratio of the combined quantities of iron carrier material and lumped carbonaceous material is set as a function of properties of the surface of the material bed.
3. The method as claimed in claim 2, wherein the property of the surface of the material bed is the height level and/or the height profile of the material bed.
4. The method as claimed in claim 2, wherein the property of the surface of the material bed is the temperature profile at the surface of the material bed.
5. The method as claimed in any one of claims 1 to 4, wherein the ratio of the combined quantities of iron carrier material and lumped carbonaceous material is set as a function of the run-off sequence that is followed during the operation of the melter gasifier.
6. The method as claimed in any one of claims 1 to 5, wherein the movement pattern of the dynamic distributing device can be varied.
7. The method as claimed in any one of claims 1 to 6, wherein the grain size distribution of the iron carrier material and/or the lump size of the lumped carbonaceous material is selected as a function of the position of the dynamic distributing device.

8. The method as claimed in any one of claims 1 to 7, wherein the type of charged iron carrier material and/or the type of lumped carbonaceous material is selected as a function of the position of the dynamic distributing device.
9. A device for charging material, comprising lumped carbonaceous material and iron carrier material, into a melter gasifier of a smelting reduction plant, having at least one charging bin for lumped carbonaceous material, and having at least one charging bin for iron carrier material, wherein a first discharge line for lumped carbonaceous material emerges from the at least one charging bin for lumped carbonaceous material, said first discharge line comprising a first conveyor device for regulating the discharge of lumped carbonaceous material, and wherein a second discharge line for iron carrier material emerges from the at least one charging bin for iron carrier material, said second discharge line comprising a second conveyor device for regulating the discharge of iron carrier material, and having an input device for inputting material into the melter gasifier, wherein the first discharge line for lumped carbonaceous material and the second discharge line for iron carrier material open into the input device for inputting material into the melter gasifier, wherein the input device for inputting material into the melter gasifier comprises a dynamic distributing device for distributing the material during the input, and a device is provided for controlling at least one of the conveyor devices from the group
- first conveyor device for regulating the discharge of lumped carbonaceous material
 - second conveyor device for regulating the discharge of iron carrier material as a function of the position of the dynamic distributing device.
10. The device as claimed in claim 9, wherein two charging bins for iron carrier material and/or two charging bins for lumped carbonaceous material are provided.
11. The device as claimed in claim 9 or 10, wherein the first conveyor device for regulating the discharge of lumped carbonaceous material and/or the second conveyor device for regulating the discharge of iron carrier material comprises one or more material flow gates and/or screw feeders and/or cellular wheel sluices.
12. The device as claimed in any one of claims 9 to 11, wherein a device is provided for regulating the distribution track which is realized during the input by the dynamic distributing device for distributing the material.

13. The device as claimed in any one of claims 9 to 12, wherein a device is provided for controlling the first conveyor device for regulating the discharge of lumped carbonaceous material, and/or the second conveyor device for regulating the discharge of iron carrier material, as a function of the distribution track which is realized during the input by the dynamic distributing device for distributing the material.
14. The device as claimed in any one of claims 9 to 13, wherein a device is provided for capturing properties of the surface of the material bed that has formed in the melter gasifier.
15. The device as claimed in any one of claims 9 to 14, wherein a device is provided for controlling the first conveyor device for regulating the discharge of lumped carbonaceous material, and/or the second conveyor device for regulating the discharge of iron carrier material, as a function of the properties which have been captured by the device for capturing properties of the surface of the material bed that has formed in the melter gasifier.
16. The device as claimed in any one of claims 9 to 15, wherein at least two charging bins are provided for lumped carbonaceous material, said bins being filled with lumped carbonaceous material of different lump sizes.
17. The device as claimed in any one of claims 9 to 15, wherein at least two charging bins are provided for lumped carbonaceous material, said bins being filled with lumped carbonaceous material of different types.
18. The device as claimed in any one of claims 9 to 15, wherein at least two charging bins are provided for iron carrier material, said bins being filled with iron carrier material, preferably hot iron carrier material, of different grain sizes.
19. The device as claimed in any one of claims 9 to 15, wherein at least two charging bins are provided for iron carrier material, said bins being filled with iron carrier material, preferably hot iron carrier material, of different types.

20. The method as claimed in any one of claims 1 to 8, wherein the iron carrier material is hot.
21. The device as claimed in any one of claims 9 to 19, wherein the iron carrier material is hot.

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FIG 1

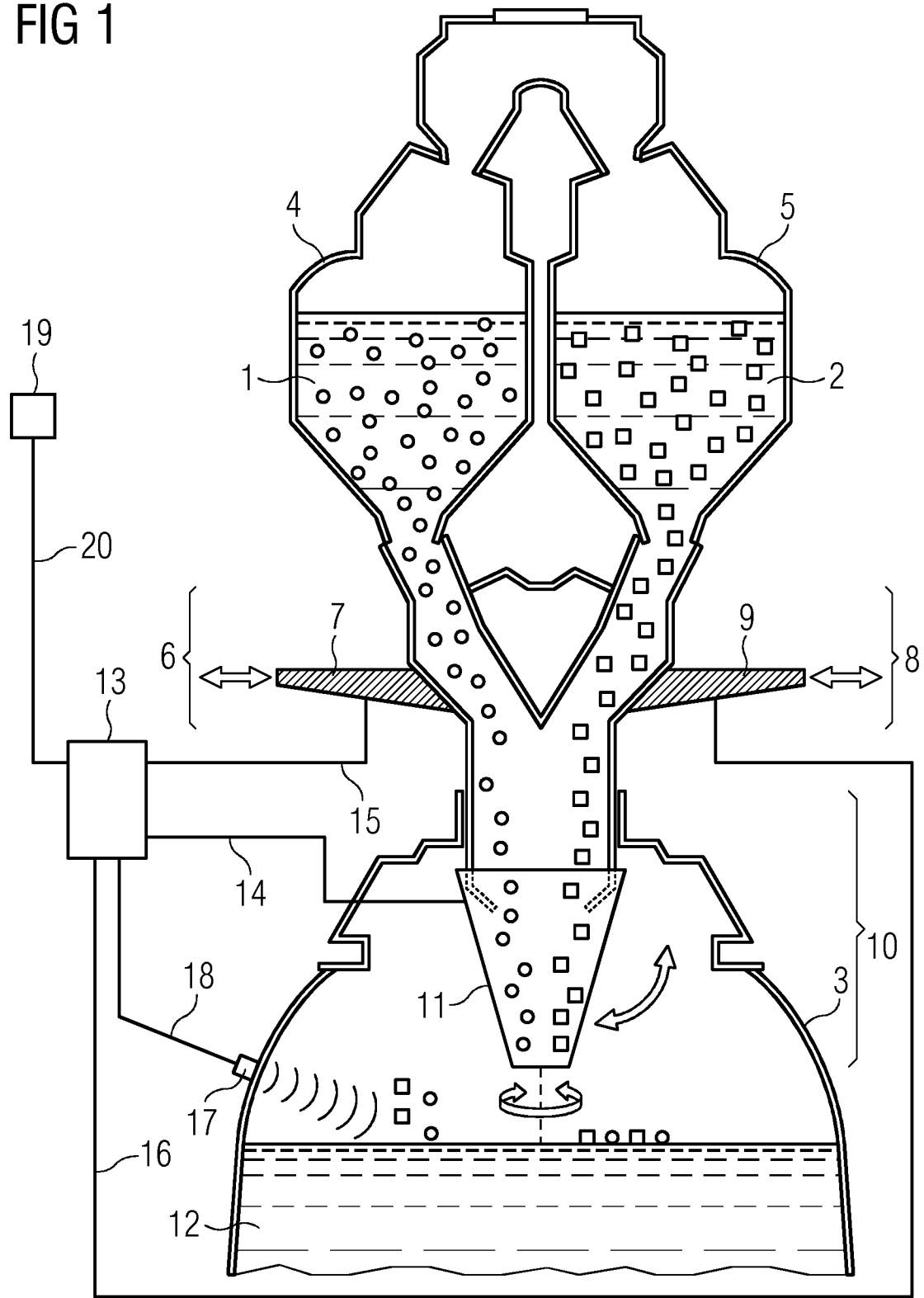


FIG 2

