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- **JEONG, Hae Kwon**
Pohang-si
Gyeongsangbuk-do 790-826 (KR)
- **CHOI, Man Soo**
Pohang-si
Gyeongsangbuk-do 790-752 (KR)
- **SONG, Min Su**
Gwangyang-si
Jeollanam-do 545-775 (KR)
- **LEE, Sang Min**
Pohang-si
Gyeongsangbuk-do 791-754 (KR)

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(71) Applicant: **Posco**
Gyeongsangbuk-do 790-300 (KR)

(72) Inventors:
• **JEONG, Eun Ho**
Pohang-si
Gyeongsangbuk-do 790-761 (KR)
• **CHO, Byung Kook**
Pohang-si
Gyeongsangbuk-do 790-832 (KR)

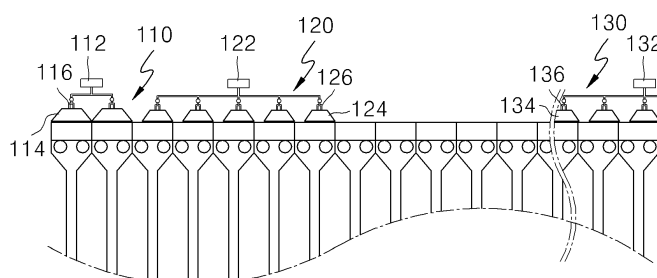
(74) Representative: **Zech, Stefan Markus**
Meissner Bolte Patentanwälte
Rechtsanwälte Partnerschaft mbB
Postfach 86 06 24
81633 München (DE)

(54) **EQUIPMENT FOR MANUFACTURING SINTERED ORE AND METHOD FOR MANUFACTURING SINTERED ORE USING SAME**

(57) The present disclosure relates to equipment for manufacturing sintered ore and a method for manufacturing sintered ore using the same. The equipment for manufacturing the sintered ore includes a plurality of sintering carts that are movable along a movement path and into which a raw material layer is fed, an ignition furnace installed above one side of the movement path to inject a flame to the raw material layer within each of the sin-

tering carts, an ore discharge part installed on the other side of the movement path to discharge the sintered ore in which sintering is completed, a wind box disposed between the ignition furnace and the ore discharge part on the movement path, and a heat quantity controller disposed between the ignition furnace and the ore discharge part over the movement path to supply heat and humidified air to the raw material layer.

[Fig.2]



Description**TECHNICAL FIELD**

5 **[0001]** The present disclosure relates to equipment for manufacturing sintered ore and a method for manufacturing sintered ore using the same, and more particularly, to equipment for manufacturing sintered ore, which is capable of controlling a quantity of heat within a raw material layer when a sintering process is performed to improve quality and productivity of sintered ore and a method for manufacturing sintered ore using the same.

BACKGROUND ART

10 **[0002]** In a process for manufacturing sintered ore, fine ore particles are sintered to be manufactured with a size that is suitable to be used in a furnace. In the sintering process, fine ore, subsidiary raw materials, and solid fuel (e.g., fine coke, anthracite, and the like) are put into a drum mixer to mix and humidify the fine ore, the subsidiary raw materials, and the solid fuel so that the sintering raw material has a pseudo-particle shape. Also, the raw material having the pseudo-particle shape is fed at a predetermined height on a sintering cart and surface-ignited by an ignition furnace. Then, the sintering raw material is plasticized while forcibly suctioning air from a lower side to manufacture sintered ore. The manufactured sintered ore is cooled in a cooler via a crusher and then is sorted to achieve a particle size of 5 mm to 50 mm which facilitates the feeding and reaction of the sintered ore.

20 **[0003]** Equipment for manufacturing sintered ore is illustrated in FIG. 1.

[0004] Upper ore stored in an upper ore hopper 10 and a sintering raw material stored in a surge hopper 20 are fed into a sintering cart and then transferred. Then, the moving sintering cart 50 passes through a lower portion of an ignition furnace 30. Here, a flame (i.e., blaze) injected from the ignition furnace 30 is ignited on an upper portion, i.e., a surface layer of the sintering raw material accommodated in the sintering cart 50. The sintering cart 50 passing through the ignition furnace 30 is transferred in a process proceeding direction by a transfer device 40. Here, the sintering cart 50 passes through upper sides of a plurality of wind boxes 70 arranged in the process proceeding direction. Suction force is generated downward in the sintering cart 50 passing through the upper sides of the wind boxes 70, and thus, the ignited flame moves downward by suctioned external air. Also, when the sintering cart 50 reaches the wind box 70 that is located at a process proceeding end point, the flame reaches the bottom of the sintering cart 50, and the sintering is completed. Thus, operations different from each other may be continuously performed by the plurality of sintering carts 50.

[0005] However, when the sintered ore is manufactured by using the above-described equipment, a difference in distribution of a heat quantity may occur in a depth direction of the raw material layer. That is, the heat quantity may be lacked in an upper layer of the raw material layer due to the introduction of the external air by the suction force of the wind boxes 70. In addition, since the external air is increased in temperature while passing through a combustion zone of a fuel layer and is continuously supplied to a lower layer, a phenomenon in which the heat quantity is excessively supplied to the lower layer may occur. Thus, after the sintering process is completed, the upper layer may be increased in surface area to manufacture the sintered ore having superior reducibility and low strength. Also, since the raw material layer is melted and then coagulated in the lower layer, the sintered ore that has superior strength, but has low reducibility due to a smooth surface thereof may be manufactured.

40 **[0006]** As described above, to solve the limitation in quality deviation of the sintered ore in the height direction of the sintering cart, a method in which oxygen, gas fuel, and liquid fuel are supplied to the upper layer of the raw material layer when the sintering process is performed, and an amount of solid fuel is reduced in the lower layer to uniformly control the heat quantity over the entire raw material, thereby forming a uniform combustion zone in the raw material layer is being used. However, when the liquid fuel is supplied, the risk of explosion may occur. Also, when the amount of solid fuel is reduced, the combustion of the raw material layer may not properly performed in the upper layer to more intensify the leakage of the heat quantity in the upper layer and also cause the leakage of the heat quantity in an intermediate layer. Also, when oxygen or gas fuel is supplied to the upper layer of the raw material layer, a method for measuring an accurate thickness or depth of the combustion zone within the raw material layer when the sintering process is performed is not disclosed. Thus, since a supply region of the oxygen or gas fuel is not established, it is difficult to accurately control the thickness or depth of the combustion zone formed in the raw material layer.

DISCLOSURE OF THE INVENTION**TECHNICAL PROBLEM**

55 **[0007]** The present disclosure provides equipment for manufacturing sintered ore, which is capable of suppressing an occurrence of a leak and surplus of a heat quantity in a raw material to uniformly control the heat quantity over the entire raw material, and a method for manufacturing sintered ore using the same.

[0008] The present disclosure provides equipment for manufacturing sintered ore, which is capable of reducing an amount of solid fuel to be used to reduce production costs and a method for manufacturing sintered ore using the same.

[0009] The present disclosure provides equipment for manufacturing sintered ore, which is capable of improving quality and productivity of the sintered ore and a method for manufacturing sintered ore using the same.

TECHNICAL SOLUTION

[0010] In accordance with an exemplary embodiment, equipment for manufacturing sintered ore includes: a plurality of sintering carts that are movable along a movement path and into which a raw material layer is fed; an ignition furnace installed above one side of the movement path to inject a flame to the raw material layer within each of the sintering carts; an ore discharge part installed on the other side of the movement path to discharge the sintered ore in which sintering is completed; a wind box disposed between the ignition furnace and the ore discharge part on the movement path; and a heat quantity controller disposed between the ignition furnace and the ore discharge part over the movement path to supply heat and humidified air to the raw material layer.

[0011] The heat quantity controller may include: an oxygen supply device configured to supply a gas including oxygen to the raw material layer; a gas fuel supply device disposed on one side of the oxygen supply device to supply gas fuel to the raw material layer; and a humidified air supply device disposed on one side of the gas fuel supply device to supply humidified air to the raw material layer.

[0012] The oxygen supply device may include: an oxygen storage unit configured to store the oxygen; a first hood disposed to surround an upper portion of the sintering cart above the movement path and having a through hole in a top surface thereof; and a first nozzle configured to supply the oxygen stored in the oxygen storage unit to the inside of the first hood.

[0013] The gas fuel supply device may include: a gas fuel storage unit configured to store the gas fuel; a second hood disposed to surround the upper portion of the sintering cart above the movement path and having a through hole in a top surface thereof; and a second nozzle configured to supply the oxygen stored in the gas fuel storage unit to the inside of the second hood.

[0014] The second hood may be disposed to be spaced apart from the first hood.

[0015] The oxygen supply device, the gas fuel supply device, and the humidified air supply device may be successively disposed in a moving direction of the sintering cart.

[0016] The gas fuel supply device may be disposed on an area that corresponds to 1/3 of the movement path between the ignition furnace and the ore discharge part, and the oxygen supply device may be disposed on an area that corresponds to 1/4 to 1/2 of the area on which the gas fuel supply device is disposed.

[0017] An inner space of the second hood may be divided into a plurality of spaces in the width direction of the sintering cart, and the second nozzle may be connected to each of the divided spaces of the second hood.

[0018] The second hood may be provided in plurality in the moving direction of the sintering cart, and the plurality of second hoods may be disposed to be spaced apart from each other.

[0019] The second hood may have a length that is greater by 2 times to 4 times than a distance between the second hoods.

[0020] The humidified air supply device may include: a moisture storage unit configured to store moisture; a third hood disposed to surround the upper portion of the sintering cart above the movement path and having a through hole in a top surface thereof; and a third nozzle configured to supply the moisture stored in the moisture storage unit to the inside of the third hood.

[0021] The humidified air supply device may be disposed at a rear side of the ore discharge part with respect to the moving direction of the sintering cart.

[0022] In accordance with another exemplary embodiment, a method for manufacturing sintered ore includes: preparing a sintering raw material; feeding the sintering raw material into a moving sintering cart to form a raw material layer; igniting the raw material layer; supplying heat to the raw material layer; supply humidified air to the sintered ore that is manufactured by sintering the sintering raw material to cool the sintered ore; and discharging the sintered ore.

[0023] In the preparing of the sintering raw material, solid fuel contained in the sintering raw material may have a content of 3.5 wt% to 4.5 wt% with respect to the total weight of the sintering raw material.

[0024] The supplying of the heat may include: supplying a gas including oxygen to the raw material layer; and supplying gas fuel to the raw material layer to which the gas including the oxygen is supplied.

[0025] The supplying of the oxygen may be performed after the igniting of the raw material layer.

[0026] In the supplying of the oxygen, the oxygen may be mixed with external air and supplied to the raw material layer at a concentration of 21% to 30%.

[0027] The supplying of the oxygen and the supplying of the gas fuel may be performed in a section in which combustion is performed up to a height corresponding to 2/3 from a surface of the raw material layer by measuring a temperature of a waste gas generated while the sintering raw material is burnt and a concentration of the oxygen of the waste gas.

[0028] The supplying of the oxygen may be performed until a temperature of a combustion zone formed in the raw material layer reaches the lowermost combustion temperature of the gas fuel.

[0029] The supplying of the gas fuel may include supplying the gas fuel so that the gas fuel has a lower limit concentration for the combustion at the temperature of the combustion zone.

[0030] The supplying of the gas fuel may include alternately and repeatedly supplying the gas fuel and the external air.

[0031] In the supplying of the gas fuel, a section in which the gas fuel may be supplied is greater than that in which the external air is supplied.

[0032] The gas fuel may include at least one of a liquified natural gas (hereinafter, referred to as an "LNG"), a coke oven gas, and a furnace gas.

[0033] The supplying of the humidified air may be performed until the sintered ore is discharged after the combustion of the sintering raw material disposed on a bottom of the sintering cart is completed.

ADVANTAGEOUS EFFECTS

[0034] In the equipment for manufacturing the sintered ore and the method for manufacturing the sintered ore using the same in accordance with an exemplary embodiment, the occurrence of the non-uniform heat quantity that occurs in the depth direction of the raw material layer when the sintering operation is performed may be suppressed or prevented. That is, the deterioration in strength of the sintered ore due to the heat quantity lack that occurs in the upper portion of the raw material layer and the reduction in reducibility due to the excessive heat quantity in the lower portion of the raw material layer may be suppressed or prevented to improve the reducibility and the strength of the sintered ore as well as improve the productivity of the sintered ore. Therefore, the operation using the sintered ore, e.g., the furnace operation may be improved in process efficiency and productivity.

[0035] Also, since the content of the solid fuel of the sintering raw material is reduced, the resources may be saved, and also, the environmental pollution due to the waste gas may be suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

FIG. 1 is a view of equipment for manufacturing sintered ore in accordance with an exemplary embodiment.

FIG. 2 is a view illustrating a main part in a sintering section of the equipment for manufacturing the sintered ore, which is illustrated in FIG. 1.

FIG. 3 is a schematic view illustrating a structure of a heat quantity controller installed in the sintering section, which is illustrated in FIG. 2.

FIG. 4 is a view illustrating results obtained by measuring a temperature of a side surface of a sintering cart in general equipment for manufacturing sintered ore.

FIG. 5 is a graph illustrating a temperature of a wind-phase waste gas, a concentration of oxygen within the waste gas, and a temperature distribution within a sintering cart in a sintering section of the general equipment for manufacturing the sintered ore.

FIG. 6 is a graph illustrating a variation in temperature of a raw material layer within the sintering cart in the sintering section of the equipment for manufacturing the sintered ore in accordance with an exemplary embodiment.

FIG. 7 is a graph illustrating a variation in temperature of the side surface of the sintering cart depending on a concentration of oxygen in the sintering section.

FIG. 8 is a view illustrating a distribution in temperature of the side surface of the sintering cart depending on supply of gas fuel in the sintering section.

FIG. 9 is a graph illustrating a variation in temperature within a raw material layer in a width direction of a sintering direction in the sintering section of the general equipment for manufacturing the sintered ore.

FIG. 10 is a graph illustrating a variation in temperature of the side surface of the sintering cart depending on the concentration of the oxygen in the sintering section of the equipment for manufacturing the sintered ore in accordance with an exemplary embodiment.

FIG. 11 is a view illustrating a variation in temperature within the raw material layer depending on the supply of the gas fuel in the sintering section of the equipment for manufacturing the sintered ore in accordance with an exemplary embodiment.

FIG. 12 is a flowchart successively illustrating a process of manufacturing sintered ore by using a method for manufacturing the sintered ore in accordance with an exemplary embodiment.

MODE FOR CARRYING OUT THE INVENTION

[0037] Hereinafter, exemplary embodiments will be described in detail. The present disclosure may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these

[0038] FIG. 1 is a view of equipment for manufacturing sintered ore in accordance with an exemplary embodiment, FIG. 2 is a view illustrating a main part in a sintering section of the equipment for manufacturing the sintered ore, which is illustrated in FIG. 1, and FIG. 3 is a schematic view illustrating a structure of a heat quantity controller installed in the

[0039] Referring to FIG. 1, equipment for manufacturing sintered ore includes an upper ore hopper 10 in which upper ore fed to a bottom surface of a sintering cart is stored, a surge hopper 20 in which a mixed raw material, which is prepared after coke that is fed to an upper portion of the upper ore and used as a raw material of iron ore and solid fuel is mixed, is stored, a plurality of sintering carts 50 accommodating a sintering raw material and disposed to be movable in one direction, a transfer device 40 transferring the plurality of sintering carts 50 in a process proceeding direction, an ignition furnace 30 installed above the transfer device 40 at one side of the surge hopper 20 to inject a flame to a surface layer of the sintering raw material within the sintering carts 50, and a plurality of wind boxes 70 installed on a movement path of the sintering carts 50 to suction the inside of each of the sintering carts 50. Also, the equipment for manufacturing the sintered ore may include a heat quantity controller 100 for controlling the sintering raw material within the sintering cart 50, i.e., a heat quantity within the raw material layer. Also, the equipment for manufacturing the sintered ore includes a detector (not shown) for measuring a temperature of a waste gas generated while the raw material layer is burnt and a concentration of oxygen of the waste gas and a controller controlling an operation of the heat quantity controller 100 by using resultant values detected by the detector.

[0040] Here, the movement path of the sintering cart 50 may form a close loop so that the sintering cart 50 is rotated in a caterpillar manner. An upper movement path represents a sintering section in which the sintering raw material within the sintering cart 50 is sintered, and a lower movement path represents a turning section in which the empty sintering cart 50 from which the sintered ore is discharged moves to the upper movement path. Here, the upper ore hopper 10, the surge hopper 20, and the ignition furnace 30 are disposed above the upper movement path, and the wind boxes 70 are disposed under the upper movement path to suction the inside of the sintering cart 50 that moves along the upper movement path. Also, the sintered ore that is sintered in the sintering cart is discharged while the sintering cart 50 moves from the upper movement path to the lower movement path. Here, this section is called an ore discharge part 60, and the ore discharge part 60 is disposed at a side opposite to the ignition furnace 30 on the upper movement path.

[0041] Also, the sintering raw material is called upper ore provided from the upper ore hopper 10 and a mixed raw material provided from the surge hopper 20 and then is called a raw material layer after the sintering raw material is fed into the sintering cart 50.

[0042] The upper ore hopper 10 is disposed above one side of the upper movement path of the sintering cart 50. The upper ore is fed to prevent the sintering raw material from leaking to a grate bar disposed on the bottom of the sintering cart 50. The upper ore may be obtained by sorting a sintered ore having a particle size of 8 mm to 15 mm from the manufactured sintered ore.

[0043] The surge hopper 20 is disposed on a front side of the upper ore hopper 10, i.e., a front side with respect to the movement path of the sintering cart to feed the sintering raw material for manufacturing the sintered ore into the sintering cart. The surge hopper 20 may uniformly feed the sintering raw material in the width direction of the sintering cart without particle segregation and also particle-segregate and feed the sintering raw material in the depth direction of the sintering cart so that the sintering raw materials have particle sizes that are gradually decreased.

[0044] The ignition furnace 30 is disposed on a front side of the surge hopper 20 to supply a flame to the surface layer of the raw material layer that is provided by feeding the sintering raw material into the sintering cart 50, thereby igniting the surface layer of the raw material layer.

[0045] The wind box 70 is disposed below the movement path, more particularly, the upper movement path of the sintering cart to suction the inside of the sintering cart 50 that moves along the upper movement path. The wind box 70 may be disposed between the ignition furnace 30 and the ore discharge part 60. A duct 80 is connected to an end of the wind body 70, and a blower 84 is installed on an end of the duct 80 to generate a negative pressure within the wind body 70, thereby suctioning the inside the sintering cart 50. Also, a dust collector 82 is installed in the duct 80 at a front side of the blower 84 to filter foreign matters of the waste gas suctioned through the wind box 70 and discharge the filtered foreign matters through a chimney 86. The wind box 70 may suction external air to ignite the surface layer of the sintering raw material and allow the sintering raw material to be burnable, thereby producing the sintered ore.

[0046] The heat quantity controller 100 includes an oxygen supply device 110 disposed on a front side of the ignition furnace 30 with respect to the moving direction of the sintering cart to supply oxygen to the raw material layer, a gas fuel supply device 120 disposed on a front side of the oxygen supply device 110 to supply gas fuel to the sintering raw

material within the sintering cart, and a humidified air supply device 130 disposed on a front side of the gas fuel supply device 120 to supply humidified air to the sintering raw material within the sintering cart. Here, the oxygen supply device 110 and the gas fuel supply device 120 may be components for controlling a heat quantity of the upper layer of the raw material layer, and the humidified air supply device 130 may be a component for controlling a heat quantity of a lower layer of the raw material layer. The oxygen supply device 110, the gas fuel supply device 120, and the humidified gas supply device 130 may be successively disposed in the moving direction of the sintering cart on the movement path of the sintering cart.

[0047] The oxygen supply device 110 supplies oxygen from the front side of the ignition furnace to the raw material layer to maintain the heat ignited in the ignition furnace for a predetermined time, thereby rising a temperature of the raw material layer. Thus, the gas fuel supplied from the gas fuel supply device 120 may be easily burnt.

[0048] The oxygen supply device 110 may include an oxygen storage unit 112 storing oxygen, a first hood 114 disposed above the movement path to surround an upper portion of the sintering cart, and a first nozzle 116 supplying the oxygen stored in the oxygen storage unit 112 to the inside of the first hood 114.

[0049] The gas fuel supply device 120 supplies the gas fuel to the raw material layer to apply heat to a combustion zone formed in the raw material layer. Here, at least one of a liquified natural gas (hereinafter, referred to as an "LNG"), a coke oven gas, and a furnace gas may be used as the gas fuel. However, it is preferable that the LNG, which generates a high heat quantity per unit cost and does not generate a CO gas, is used as the gas fuel in consideration of a heat quantity, a cost, and safety.

[0050] The gas fuel supply device 120 may include a gas fuel storage unit 122 storing the gas fuel, a second hood 124 disposed above the movement path to surround the upper portion of the sintering cart, and a second nozzle 126 supplying the gas fuel stored in the gas fuel storage unit 122 to the inside of the second hood 124. The gas fuel supply device 120 may be disposed on the movement path between the ignition furnace and the ore discharge part, i.e., an area that corresponds to 1/3 of the sintering section. That is to say, the gas fuel supply device 120 may be disposed over an area that corresponds to 1/3 of the total length of the sintering cart. Also, the gas fuel supply device 120 may be disposed over an area that is greater by 2 times to 4 times than that on which the oxygen supply device 110 is disposed. This is done because the gas fuel supply device 120 substantially supplies the heat to the inside of the raw material layer. Thus, the gas supply device 110 may be disposed on an area that corresponds to 1/4 to 1/2 of the area on which the gas fuel supply device 120 is disposed.

[0051] The second hood 124 may be provided in plurality that are disposed to be spaced apart from each other along the sintering section. Here, the first hood 114 of the oxygen supply device 110 and the second hood 124 adjacent to the first hood 114 may be installed to be spaced apart from each other. This is done for a reason in which the solid fuel of the sintering raw material has a sufficient combustion time. Also, a reason in which the plurality of second hoods 124 are disposed to be spaced apart from each other is for supplying oxygen that is required for burning the gas fuel introduced to the raw material layer through the second hood 124. That is, the gas fuel is supplied through the second hoods 124, and the external air, i.e., the oxygen is supplied through a space between the second hoods 124 to suppress a phenomenon in which the gas fuel is not burnt, but is exhausted by the suction force of the wind box. Here, an area (a length of the second hood 124) to which the gas fuel is supplied may be greater by 2 times to 4 times than that (a length of the space between the second hoods 124) to which the external air is supplied. Since the external air and the gas fuel are repeatedly introduced to the raw material layer through the above-described constituents, the gas fuel may be completely burnable to sufficiently secure the heat quantity that is required for burning the sintering raw material.

[0052] Also, as illustrated in FIG. 3, a partition wall 125 may be disposed in the second hood 124 in the width direction of the sintering cart. Thus, an inner space of the second hood 124 may be divided into a plurality of spaces in the width direction of the sintering cart. Also, the second nozzles 126 may be respectively connected to the divided spaces of the second hood 124 to supply the gas fuel at flow rates different from each other for each region. Thus, a deviation in temperature within the raw material layer, which occurs in the width and depth directions of the sintering cart, may be suppressed or prevented. This will be described later.

[0053] The humidified air supply device 130 may be installed in a section in which the sintered ore is cooled before the sintered ore is discharged to the ore discharge part. The humidified air supply device 130 may include a moisture storage unit 132 storing moisture, a third hood 134 disposed above the movement path to surround the upper portion of the sintering cart, and a third nozzle 136 supplying the moisture stored in the moisture storage unit 132 to the inside of the third hood 134.

[0054] As illustrated in FIG. 3, top surfaces of the first hood 114, the second hood 124, and the third hood 134 may be provided as porous plates in which through holes 123 are formed. Thus, the external air and the oxygen, the gas fuel, and the moisture, which are supplied through each of the nozzles may be mixed with each other in each of the hoods and then introduced to the raw material layer. (Although only the second hood is illustrated in FIG. 3, the through holes may be formed in top surfaces of the first and third hoods)

[0055] According to the sintering equipment including the above-described constituents, the heat quantity of the combustion zone formed in the raw material layer may be uniformly distributed during the sintering to improve the quality

and productivity of the sintered ore.

[0056] Hereinafter, a method for determining an installation position of the heat quantity controller, i.e., the oxygen supply device, the gas fuel supply device, and the humidified air supply device will be described.

[0057] FIG. 4 is a view illustrating results obtained by measuring a temperature of a side surface of a sintering cart in general equipment for manufacturing sintered ore, FIG. 5 is a graph illustrating a temperature of a wind-phase waste gas, a concentration of oxygen within the waste gas, and a temperature distribution within a sintering cart in a sintering section of the general equipment for manufacturing the sintered ore, and FIG. 6 is a graph illustrating a variation in temperature of a raw material layer within the sintering cart in the sintering section of the equipment for manufacturing the sintered ore in accordance with an exemplary embodiment. Here, a raw material layer within a sintering cart may be divided into an upper layer, an intermediate layer, and a lower layer. In the total depth of the raw material layer, a region from a surface layer of the raw material layer to a position corresponding to 1/3 in a downward direction may be defined as the upper layer, a region from the upper layer to a position corresponding to 2/3 in the downward direction may be defined as the intermediate layer, and a region from the intermediate layer to a bottom surface of the sintering cart may be defined as the lower layer.

[0058] Referring to FIG. 4, when the surface layer of the raw material layer is ignited through an ignition furnace in the general equipment for manufacturing the sintered ore, the upper layer of the raw material layer is maintained at a high temperature by ignited heat of the ignition furnace at the front side of the ignition furnace with respect to the sintering direction. However, a transient region in which a temperature is relatively low may exist up to a section in which the solid fuel is normally burnt to maintain a high temperature. The transient region may be generated in an upper layer of a fuel layer to act as a factor that deteriorates quality of sintered ore that is produced in the upper layer. As mentioned in the limitations according to the related art, since the upper layer of the raw material layer is easily cooled by the external air that is introduced into the sintering cart by the suction force of the wind box, the heat quantity in the upper layer of the raw material layer may be lacked. Thus, since the sintering of the sintering raw material is not properly performed, the sintered ore produced in the upper layer of the raw material layer may have low strength and low productivity.

[0059] Referring to FIG. 5, a variation in temperature of the waste gas within the wind box in the sintering section in the equipment for manufacturing the sintered ore according to the related art are illustrated. Here, the variation in temperature within the sintering cart may be obtained based on a variation in temperature of the waste gas within the wind box and a variation in concentration of oxygen contained in the waste gas.

[0060] First, a temperature of the waste gas and a concentration of oxygen of the waste gas in the sintering section may be measured by using the detector installed in the wind box, i.e., a temperature measuring unit and an oxygen concentration measuring unit to obtain a waste gas temperature curve (hereinafter, referred to as a WTC) and an oxygen concentration curve.

[0061] Since the solid fuel is burnt until the combustion zone reaches the bottom of the sintering cart after being ignited in the ignition furnace, the oxygen is exhausted to reduce the concentration of the oxygen of the waste gas, thereby maintaining the oxygen concentration to a predetermined value. Thereafter, when the combustion is completely performed up to the bottom of the sintering cart, the concentration of the oxygen of the waste gas may be significantly increased, and thus, be the same as that of oxygen of the external air introduced by the suction force of the wind box.

[0062] Also, since heat is supplied for drying and water supply of a humid zone below the combustion zone until the combustion zone reaches the bottom of the sintering cart after the ignition, the temperature of the waste gas may be measured to a low temperature that is less than 100°C. Thereafter, when the combustion is completely performed up to the bottom of the sintering cart, after the combustion, sensible heat moves downward by the suction force of the wind box to significantly increase the temperature of the waste gas and maintain the temperature of the waste gas to a predetermined temperature by the introduction of the external air in a cooling section just before the ore discharge part, and then decrease the temperature of the waste gas again.

[0063] As described above, since the temperature of the waste gas and the concentration of the oxygen of the waste gas vary according to a predetermined pattern in the sintering section, a temperature distribution within the sintering cart may be predicted by using the above-described property.

[0064] That is, a burn contact point (hereinafter, referred to as a "BCP") at which the combustion is completely performed up to the bottom of the sintering cart after the ignition in the ignition furnace may correspond to a point at which the concentration of the oxygen of the waste gas and the temperature of the waste gas are significantly increased. Also, a burn infection point (hereinafter, referred to as a "BIP") at which the combustion of the raw material layer is physically completed after the BCP may correspond to an inflection point in the WTC of the waste gas as a point at which the concentration of the oxygen of the waste gas is the same as that of oxygen of the external air. After the BIP at which the combustion of the raw material layer is completely completed, the temperature of the waste gas is increased by the sensible heat after the combustion to reach a burn through point (hereinafter, referred to as a "BTP") at which the temperature of the waste gas is highest. A position of the BTP may be a section in which a speed of the sintering cart is controlled to be formed just before the ore discharge part to cool the sintered ore by using the external air from the BTO to the ore discharge part.

[0065] As described above, the temperature within the sintering cart is predicted by using the variation in measured temperature of the waste gas and the variation in measured concentration of the oxygen to define a temperature range of the combustion zone to a predetermined temperature range, e.g., a range of 1200°C or more. That is, a frame front line (hereinafter, referred to as a "FFL") at which combustion of coke that is the solid fuel starts after the fuel layer within the sintering cart is ignited and a frame back line (hereinafter, referred to as a "FBL") at which the combustion of the coke that is the solid fuel is completed, and thus, cooling of the coke starts may be predicted to define a combustion zone in which the coke that is the solid fuel is burnt to manufacturing the sintered ore.

[0066] The FFL corresponds to a straight line connecting a point P1 that is an ignition start point to a point P2 that is a position of the BCP. Also, the FBL corresponds to a straight line connecting a point P1 that is the ignition start point to a height h0 of hot ore on a section of a sintered cake in the BIP and the ore discharge part. The combustion zone is formed over a region between an upper portion of the FFL and a lower portion of the FBL. In this region, sintering reaction in which ore of the sintering raw material is melted and coagulated by the combustion of the coke may occur. As illustrated in FIG. 5, it is seen that the combustion zone moves downward in the proceeding direction of the sintering cart and thus is expanded in width.

[0067] Referring to FIG. 5, if a height (a height from the bottom of the sintering cart to the surface layer of the raw material layer) of the raw material layer within the sintering cart is H, when based on a width of the combustion zone in the intermediate layer having a depth of $2/3H$ to $1/3H$ with improved quality and productivity of the sintered ore, it is seen that the upper layer having a depth of H to a depth of $2/3H$ has a relatively narrow width of the combustion zone, and the lower layer having a depth of $1/3H$ to 0H has a relatively wide width of the combustion zone. As a result, a heat quantity required for forming the sintered ore may be lacked in the upper layer by the direct introduction of the external air having room temperature, and heat is continuously introduced from the upper layer and the intermediate layer to cause an excessive heat quantity in the lower layer. Thus, the quality and productivity of the sintered ore may be reduced in the upper layer and the lower layer of the raw material layer. In general, when the sintered ore is manufactured, the combustion zone formed in the raw material layer has to be maintained for approximately 150 seconds so as to obtain high-quality sintered ore. Here, this position may correspond to a depth of $2/3H$ from the surface of the raw material layer.

[0068] Thus, in an exemplary embodiment, the heat quantity within the raw material layer may be controlled to allow the combustion zone formed in the raw material layer to be maintained for approximately 150 seconds over the entire sintering section. The heat is provided to the upper layer of the raw material layer, in which the excessive region occurs, to increase the maintenance time of the combustion zone, and the maintenance time of the combustion zone is decreased in the lower portion to uniformly control the maintenance time of the combustion zone over the entire sintering section. The supplying of the heat to the upper layer of the raw material layer may be performed by supplying the oxygen and the gas fuel. Also, when the combustion is completely performed up to the lower portion of the sintering cart, the humidified air may be supplied into the sintering cart to promote the cooling of the sintered ore, thereby reducing the excessive heat quantity maintenance time in the lower layer. That is, the oxygen and the gas fuel may be supplied to the raw material layer during an initial sintering stage in which the combustion of the upper layer is performed so that the combustion of the upper layer is sufficiently performed. Also, after the sintering is completed, the humidified air may be supplied to the sintered ore in the section in which the sintered ore is cooled to reduce the heat quantity, thereby suppressing the occurrence of the excessive heat quantity in the lower layer.

[0069] In accordance with an exemplary embodiment, as illustrated in FIG. 6, the section in which the combustion zone is formed in the upper layer of the raw material layer may be expanded so that the maintenance time is uniformly formed over the entire sintering section, and the combustion zone may be reduced in the section in which the combustion zone is formed in the lower layer of the raw material layer to uniformly control the maintenance time of the combustion zone over the entire sintering section.

[0070] The oxygen and the gas fuel may be supplied to expand the combustion zone in the section in which the combustion zone is formed in the upper layer of the raw material layer, and the humidified air may be supplied in the section in which the combustion zone is formed in the lower layer of the raw material layer to cool the hot sintered ore, thereby reducing the combustion zone. Here, the FBL that corresponds to the line on which the combustion and cooling of the coke that is the solid fuel start may be changed to uniformly form the combustion zone over the entire sintering section.

[0071] Here, the section in which the combustion zone is expanded may correspond to a high-temperature section between the FFL and the FBL, i.e., a section, which is short and has a temperature of 1200°C or more, from the surface layer H of the raw material layer to a depth of $2/3H$, that is to say, a point E2 at which the combustion of the intermediate layer starts. This position may be called a heat interchange point (hereinafter, referred to as a "HIP") and may be a position at which the combustion zone is increased by the supply of the heat and then decreased by the reduction of the solid fuel. That is, the HIP may correspond to a point at which the most appropriate heat quantity is supplied for manufacturing the sintered ore in the sintering cart.

[0072] In the section in which the combustion zone is formed in the upper layer of the raw material layer, the oxygen and the gas fuel may be supplied to apply heat to the upper layer of the raw material layer and thus delay a time point

at which the combustion of the coke that is the solid fuel is completed, thereby expanding the combustion zone. Here, since a risk of firing of the gas fuel may occur by the flame of the ignition furnace, it is preferable that the time point at which the oxygen is supplied is performed at a portion that is spaced a predetermined distance from the ignition furnace.

[0073] When the surface layer of the raw material layer is ignited, the oxygen is supplied to the raw material layer within the sintering cart, and then, the gas fuel is supplied to the raw material layer. As described above, the reason in which the gas fuel is supplied after the oxygen is supplied is for facilitating the combustion of the gas fuel to be supplied by supplying the oxygen to the ignited raw material layer to promote the combustion of the solid fuel contained in the raw material layer. That is, the gas fuel is supplied to the raw material layer in a state of being diluted with the external air at a lower limit concentration for the combustion. Here, if the gas fuel is not raised to a minimum temperature that is required for the combustion of the gas fuel, the gas fuel may be exhausted in a non-combustion state by the suction force of the wind box. Thus, a process in which the oxygen is supplied to the raw material layer to promote and delay the combustion of the solid fuel and thus rise the temperature within the raw material layer to a minimum temperature at which the gas fuel is burnable may be needed. The oxygen may be supplied up to a point E1 at which the gas fuel is burnable at the lowest temperature (the lowest combustion temperature) in the fuel layer, and then the gas fuel may be supplied to provide heat to the upper layer of the raw material layer.

[0074] In FIG. 6, when the point E1 at which the gas fuel is burnable at the lowest temperature in the fuel layer is connected to the HIP, an ideal frame back line (hereinafter, referred to as an "IFBL") may be formed. When comparing the combustion zone formed by the existing FBL to the combustion zone formed by the IFBL in accordance with an exemplary embodiment, a region S1 formed in an upper portion of the HIP may represent a portion, at which the heat is supplied, in the region formed by the IFBL, and a region S2 formed by a lower portion of the HIP may represent a portion at which the heat quantity is reduced.

[0075] When the heat is supplied to the upper layer of the raw material layer, the excessive heat quantity may occur in the intermediate layer of the raw material layer during the sintering, and also, the occurrence of the excessive heat quantity in the lower layer may be more intensified. Thus, it is preferable that the solid fuel, i.e., the coke in the sintering raw material fed into the sintering cart is reduced in content to reduce the heat quantity. Here, a reduced amount of solid fuel may be the same as the heat quantity supplied to the upper layer of the raw material layer. When the content of the solid fuel in the raw material layer is reduced, the heat quantity may be reduced from the above-described HIP.

[0076] The WTC line may be obtained through the measured results of the temperature of the waste gas to determine positions of the BCP, the BIP, and the BTP and measure h_0 that is a height of the hot zone of the sintered ore within the sintering cart from the ore discharge part. As a result, a gas fuel supply section and a humidified air supply section may be derived from Equipments 1 to 4. Equation 1 is an equation for deriving the waste gas temperature curve (WTC), Equation 2 is an equation for deriving the FFL within the raw material layer, Equation 3 is an equation for deriving the FBL within the raw material layer, and Equation 4 is an equation for deriving the IFBL within the raw material.

【Equation 1】

$$T(x) = \frac{P}{\{ |x - x_{BTP}| / 4^n \} + S} + C$$

【Equation 2】

$$y_{FFL} = -\frac{H}{x_{BCP}} x + H$$

【Equation 3】

$$y_{FBL} = -\frac{2H}{3x_{BIP}} x + H$$

【Equation 4】

$$y_{IFBL} = -\frac{H}{x_{BCP}} x + \left(\frac{2}{3} + \frac{x_{BIP}}{2x_{BCP}} \right)$$

【0077】 In Equations 1 to 4, P, n, S, and C are operation variation indexes, determined by a structure and an operation state of a sintering machine, and contents that are capable of mathematizing a waste gas temperature distribution T(x) in a longitudinal direction x of the sintering machine. Where P is a temperature determination coefficient of the BTP and has a value of 15,000 to 18,000, n is a position determination coefficient of the BIP and has a value of 3.5 to 5, S is a position determination coefficient of the BIP and has a value of 38 to 45, and C represents a temperature (°C) of waste gas of a first wind box.

【0078】 When positions of the oxygen supply device 110, the gas fuel supply device 120, and the humidified air supply device 130 are determined through the above-described method, each of the oxygen supply device 110, the gas fuel supply device 120, and the humidified air supply device 130 is installed to supply oxygen, gas fuel, and humidified air according to process conditions, thereby performing a sintering operation.

【0079】 Hereinafter, effects obtained by controlling a heat quantity within the raw material layer during the sintering operation will be described.

【0080】 FIG. 7 is a graph illustrating a variation in temperature of the side surface of the sintering cart depending on a concentration of oxygen in the sintering section, FIG. 8 is a view illustrating a distribution in temperature of the side surface of the sintering cart depending on supply of gas fuel in the sintering section, FIG. 9 is a graph illustrating a variation in temperature within a raw material layer in a width direction of a sintering direction in the sintering section of the general equipment for manufacturing the sintered ore, FIG. 10 is a graph illustrating a variation in temperature of the side surface of the sintering cart depending on the concentration of the oxygen in the sintering section of the equipment for manufacturing the sintered ore in accordance with an exemplary embodiment, and FIG. 11 is a view illustrating a variation in temperature within the raw material layer depending on the supply of the gas fuel in the sintering section of the equipment for manufacturing the sintered ore in accordance with an exemplary embodiment.

【0081】 First, FIG. 7 illustrates results obtained by measuring a variation in temperature of the combustion zone within the raw material layer when only external air is suctioned in general sintering equipment and when oxygen is supplied to the raw material layer in accordance with an exemplary embodiment so as to confirm effects obtained by supplying the oxygen to the raw material layer during the sintering operation. Here, since 21% oxygen is contained in the external air, i.e., air, a concentration of the oxygen in the external air was expressed as 21%. Also, a variation in temperature of the combustion zone within the raw material layer when the concentration of the oxygen is increased to 30% was measured. In FIG. 7, when only the external air is suctioned, a maximum temperature is 1,200°C or less, or the oxygen concentration is increased to 30%, it is seen that a temperature of the combustion zone within the raw material layer is raised up to 1,200°C or more. Also, it is seen that a time point at which the temperature of the combustion zone is raised is quickly increased when compared that the only the external air is suctioned. Thus, it is seen that, when the oxygen is supplied to the raw material layer during the sintering operation, the combustion of the solid fuel within the sintering raw material is faster, and the temperature of the combustion zone is raised to a high temperature, i.e., a temperature at which the sintered ore is smoothly manufactured. Thus, the oxygen may be supplied to the upper layer having a relatively small thickness and a relatively low temperature, i.e., a portion just before the ignition furnace to expand the combustion zone. Therefore, the gas fuel supplied for the next process may be smoothly burnt.

【0082】 Next, FIGS. 8 to 11 illustrate results obtained by measuring a distribution in temperature of the side surface of the sintering cart and a variation in temperature within the raw material layer when only the external air is suctioned to perform the sintering process and when the sintering process is performed while supplying the gas fuel so as to examine the effects obtained by supplying the gas fuel.

【0083】 FIG. 8 illustrates a distribution in temperature of the side surface of the sintering cart, and FIG. 9 illustrates a distribution in temperature of the raw material layer in a sintering direction at points of 1/2 and 1/4 in a width direction of the sintering cart.

【0084】 Referring to FIG. 8, a region between the surface layer on which combustion starts by ignition before the gas fuel is injected and the intermediate layer in which the normal combustion is sufficiently performed may be in an excessive state and have a low temperature.

【0085】 Also, referring to (a) and (b) of FIG. 9, in temperatures of the raw material layer measured at a central portion that is a point of 1/2 in the width direction of the sintering cart and the side surface that is a point of 1/4 in the width direction of the sintering cart, if the temperatures are measured at depths of 150 mm and 200 mm from the surface layer of the raw material layer at the same position, the side surface may have a relatively low temperature. Particularly, it is

seen that the side surface is formed on a rear end at the highest temperature reaching position in the depth of 150 mm. That is, it is seen that the temperature within the sintering cart is intensified in deviation in the width direction and proceeding direction of the sintering cart. The temperature deviation in the width direction of the sintering cart occurs because the suction force of the wind box differently acts on the central portion and the side surface of the sintering cart.

Particularly, the introduction and discharge of the external air are not smoothly performed on the side surface of the sintering cart by the sidewall of the sintering cart to cause a bed influence on the combustion of the solid fuel.

[0086] As illustrated in FIG. 10, when the gas fuel is supplied, it is seen that the temperature of the region between the intermediate layers in which the normal combustion is performed after the surface layer of the surface layer is ignited in the ignition furnace is increased when compared to the case of FIG. 8. Also, it is seen that the temperature of the surface layer of the raw material layer that is ignited in the ignition furnace is increased in the proceeding direction of the sintering cart and a downward direction of the sintering cart.

[0087] FIG. 11 illustrates a distribution in temperature of the upper layer of the raw material layer depending to a flow rate of the gas fuel, (a) of FIG. 11 illustrates a case in which the gas fuel having a high flow rate is supplied, and (b) of FIG. 11 illustrates a case in which the gas fuel having a low flow rate is supplied.

[0088] Comparing FIG. 8 to FIG. 11, when the gas fuel is supplied, it is seen that a time for which a region of a high-temperature of 1200°C or more is maintained is increased. Also, comparing (a) of FIG. 11 to (b) of FIG. 11, it is seen that the more the flow rate of the supplied gas flue is increased, the more the time for which the region of a high-temperature of 1200°C or more is maintained is increased, and the temperature of the upper layer of the raw material layer is continuously maintained.

[0089] Therefore, the region of the combustion zone in which the sintering reaction is normally performed in the upper layer of the raw material layer by supplying the gas fuel may be expanded to improve the quality and productivity of the sintered ore to be produced. Also, the temperature deviation of the raw material layer, which occurs in the proceeding direction and downward direction of the sintering cart, may be reduced by controlling the flow rate of the gas fuel and supplying the gas fuel at the controlled flow rate. Thus, when the sintering process is performed, the oxygen and the gas fuel may be supplied to provide the sufficient heat quantity to the upper layer of the raw material layer in the initial sintering period and smoothly sinter the sintering raw material in the upper layer. Also, the flow rate of the gas fuel supplied in the width direction of the sintering cart may be controlled to control the temperature deviation of the raw material layer, which occurs in the width direction of the sintering cart.

[0090] Also, although not shown in the drawings, the humidified air may be supplied to the sintered ore before the sintered ore is discharged through the ore discharge part to promote the cooling of the sintered ore and suppress the phenomenon in the sintered ore is deteriorated in quality by the excessive heat quantity.

[0091] Hereinafter, a method for manufacturing sintered ore in accordance with an exemplary embodiment will be described.

[0092] FIG. 12 is a flowchart successively illustrating a process of manufacturing sintered ore by using a method for manufacturing the sintered ore in accordance with an exemplary embodiment.

[0093] A method for manufacturing sintered ore in accordance with an exemplary embodiment includes a process (S110) of preparing a sintering raw material, a process (S112) of feeding the sintering raw material into a sintering cart to form a raw material layer, a process (S114) of igniting a surface layer of the raw material layer, a process (S116) of supplying oxygen to the raw material layer, a process (S118) of supplying gas fuel to the raw material layer, a process (S120) of moving the sintering cart along a sintering section to supply humidified air to sintered ore when the sintered ore is manufactured, and a process (S122) of discharging the sintered ore. Upper ore may be prepared to be supplied into an upper ore hopper 10, and the sintering raw material including iron ore and a solid raw material may be prepared to be supplied into a surge hopper 20 to prepare a raw material for manufacturing the sintered ore. Here, when the sintering raw material is prepared, a content of the solid raw material may be reduced by approximately 50 wt% to approximately 60 wt% when compared to the existing content of the solid raw material. In general, if the content of the solid raw material occupies approximately 9 wt% in the total weight of the sintering raw material, the content of the solid raw material may be reduced to approximately 3.5 wt% to approximately 4.5 wt%, and a content of the iron ore may be increased. As described above, the content of the solid raw material may be reduced to suppress the excessive heat quantity in the intermediate layer and the lower layer of the raw material layer, which occurs by supplying the oxygen and the gas fuel to the raw material layer during the sintering process. Also, discharge of contaminants such as carbon monoxide may be reduced to reduce possibility of an occurrence of the environmental pollution.

[0094] Thereafter, the plurality of sintering carts successively pass downward through the upper ore hopper 10 and the surge hopper 20 to feed the upper ore and the sintering raw material into each of the plurality of sintering carts, thereby forming the raw material layer. The surface layer of the raw material layer may be ignited by a flame while each of the plurality of sintering carts passes through a lower side of the ignition furnace 30, and each of the sintering carts may move in a direction of an ore discharge part 60 by a transfer device 40. Here, each of the sintering carts may successively pass through upper side of a plurality of wind boxes 70 arranged in a sintering section.

[0095] When the flame is ignited on the surface layer of the raw material layer, oxygen is supplied to the raw material

layer through an oxygen supply device 110. Here, the oxygen may be mixed with external air in a first hood 114 of the oxygen supply device 110 to have a concentration of approximately 21% to approximately 35%. If the oxygen concentration is less than the proposed range, it is difficult to rise a temperature of the raw material layer to a desired temperature. Even though the oxygen concentration is greater than the proposed range, the rising of the temperature of the raw material layer may be limited. When the oxygen is supplied to the raw material layer, the frame on the surface layer moves downward by the suction force of the wind box 70 to burn the solid fuel within the raw material layer. Thus, the temperature within the raw material layer is raised up to the lowest combustion temperature of the gas fuel to be supplied.

[0096] Thereafter, the supply of the oxygen to the raw material layer may be stopped to supply the gas fuel. Here, it is preferable to secure a time for which the gas fuel is not supplied after the supply of the oxygen is stopped, but the solid fuel is sufficiently burnt through the supply of the oxygen. Also, the gas fuel may be supplied at a high concentration to a second hood 124 through a second nozzle 126 and mixed with the external air introduced into a through hole 123 formed in a top surface of the second hood 124. As a result, the gas fuel may be diluted with the external air at a concentration equal to or less than a lower limit concentration of approximately 0.8% to approximately 3% and then be supplied. Thus, the gas fuel may move into the raw material layer by the suction force of the wind box to reach a combustion zone formed in the raw material layer and then be burnt.

[0097] The gas fuel may be intermittently supplied through the second hood 124 installed to be spaced in the sintering section. Thus, since the gas fuel and the external air are repeatedly supplied, the leakage of the oxygen, which occurs by burning the solid fuel together with the combustion of the gas fuel may be suppressed to prevent the gas fuel that is not burnt from being discharged through the wind box.

[0098] Also, when the gas fuel is supplied, a flow rate of the gas fuel is controlled in each of spaces through the second hood 124 that is divided into the plurality of spaces in the width direction of the sintering cart to suppress an occurrence of a temperature deviation that occurs in the width direction of the sintering cart.

[0099] Then, while the supply of the gas fuel is stopped, and the sintering cart 50 moves to the ore discharge part 60, the raw material layer within the sintering cart 50 may be sintered to manufacture the sintered ore.

[0100] When the sintered ore is manufactured, humidified air is supplied to the sintered ore through a humidified air supply device 130 at a position just before the ore discharge part 60 to cool the sintered ore. Here, since the lower layer of the sintered ore is continuous in a hot state, the sintered ore of the lower layer may be excessively sintered. Thus, the humidified air may be supplied to promote the cooling of the hot sintered ore.

[0101] The supply of the humidified air may be performed up to a position just before the ore discharge part after the combustion of the solid fuel is completed on the bottom of the sintering cart.

[0102] Although the present invention has been described with reference to the accompanying drawings and foregoing embodiments, the present invention is not limited thereto and also is limited to the appended claims. Thus, it is obvious to those skilled in the art that the various changes and modifications can be made in the technical spirit of the present invention.

INDUSTRIAL APPLICABILITY

[0103] In the equipment for manufacturing the sintered ore and the method for manufacturing the sintered ore using the same, when the sintering process is performed, the heat quantity within the raw material layer may be uniformly controlled to improve the quality and the productivity of the sintered ore. Thus, the operation using the sintered ore, e.g., the operation in the furnace may be improved in process efficiency and productivity.

Claims

1. Equipment for manufacturing sintered ore, comprising:

a plurality of sintering carts that are movable along a movement path and into which a raw material layer is fed;
 an ignition furnace installed above one side of the movement path to inject a flame to the raw material layer within each of the sintering carts;
 an ore discharge part installed on the other side of the movement path to discharge the sintered ore in which sintering is completed;
 a wind box disposed between the ignition furnace and the ore discharge part on the movement path; and
 a heat quantity controller disposed between the ignition furnace and the ore discharge part over the movement path to supply heat and humidified air to the raw material layer.

2. The equipment of claim 1, wherein the heat quantity controller comprises:

an oxygen supply device configured to supply a gas comprising oxygen to the raw material layer;
a gas fuel supply device disposed on one side of the oxygen supply device to supply gas fuel to the raw material layer; and
a humidified air supply device disposed on one side of the gas fuel supply device to supply humidified air to the raw material layer.

3. The equipment of claim 2, wherein the oxygen supply device comprises:

an oxygen storage unit configured to store the oxygen;
a first hood disposed to surround an upper portion of the sintering cart above the movement path and having a through hole in a top surface thereof; and
a first nozzle configured to supply the oxygen stored in the oxygen storage unit to the inside of the first hood.

4. The equipment of claim 3, wherein the gas fuel supply device comprises:

a gas fuel storage unit configured to store the gas fuel;
a second hood disposed to surround the upper portion of the sintering cart above the movement path and having a through hole in a top surface thereof; and
a second nozzle configured to supply the oxygen stored in the gas fuel storage unit to the inside of the second hood.

5. The equipment of claim 4, wherein the second hood is disposed to be spaced apart from the first hood.

6. The equipment of claim 4 or 5, wherein the oxygen supply device, the gas fuel supply device, and the humidified air supply device are successively disposed in a moving direction of the sintering cart.

7. The equipment of claim 6, wherein the gas fuel supply device is disposed on an area that corresponds to 1/3 of the movement path between the ignition furnace and the ore discharge part, and the oxygen supply device is disposed on an area that corresponds to 1/4 to 1/2 of the area on which the gas fuel supply device is disposed.

8. The equipment of claim 4, wherein an inner space of the second hood is divided into a plurality of spaces in the width direction of the sintering cart, and the second nozzle is connected to each of the divided spaces of the second hood.

9. The equipment of claim 8, wherein the second hood is provided in plurality in the moving direction of the sintering cart, and the plurality of second hoods are disposed to be spaced apart from each other.

10. The equipment of claim 9, wherein the second hood has a length that is greater by 2 times to 4 times than a distance between the second hoods.

11. The equipment of claim 2, wherein the humidified air supply device comprises:

a moisture storage unit configured to store moisture;
a third hood disposed to surround the upper portion of the sintering cart above the movement path and having a through hole in a top surface thereof; and
a third nozzle configured to supply the moisture stored in the moisture storage unit to the inside of the third hood.

12. The equipment of claim 11, wherein the humidified air supply device is disposed at a rear side of the ore discharge part with respect to the moving direction of the sintering cart.

13. A method for manufacturing sintered ore, comprising:

preparing a sintering raw material;
feeding the sintering raw material into a moving sintering cart to form a raw material layer;
igniting the raw material layer;
supplying heat to the raw material layer;

supply humidified air to the sintered ore that is manufactured by sintering the sintering raw material to cool the sintered ore; and
discharging the sintered ore.

14. The method of claim 13, wherein, in the preparing of the sintering raw material, solid fuel contained in the sintering raw material has a content of 3.5 wt% to 4.5 wt% with respect to the total weight of the sintering raw material.

15. The method of claim 13, wherein the supplying of the heat comprises:

supplying a gas comprising oxygen to the raw material layer; and
supplying gas fuel to the raw material layer to which the gas comprising the oxygen is supplied.

16. The method of claim 15, wherein the supplying of the oxygen is performed after the igniting of the raw material layer.

17. The method of claim 16, wherein, in the supplying of the oxygen, the oxygen is mixed with external air and supplied to the raw material layer at a concentration of 21% to 30%.

18. The method of claim 17, wherein the supplying of the oxygen and the supplying of the gas fuel are performed in a section in which combustion is performed up to a height corresponding to 2/3 from a surface of the raw material layer by measuring a temperature of a waste gas generated while the sintering raw material is burnt and a concentration of the oxygen of the waste gas.

19. The method of claim 18, wherein the supplying of the oxygen is performed until a temperature of a combustion zone formed in the raw material layer reaches the lowermost combustion temperature of the gas fuel.

20. The method of claim 19, wherein the supplying of the gas fuel comprises supplying the gas fuel so that the gas fuel has a lower limit concentration for the combustion at the temperature of the combustion zone.

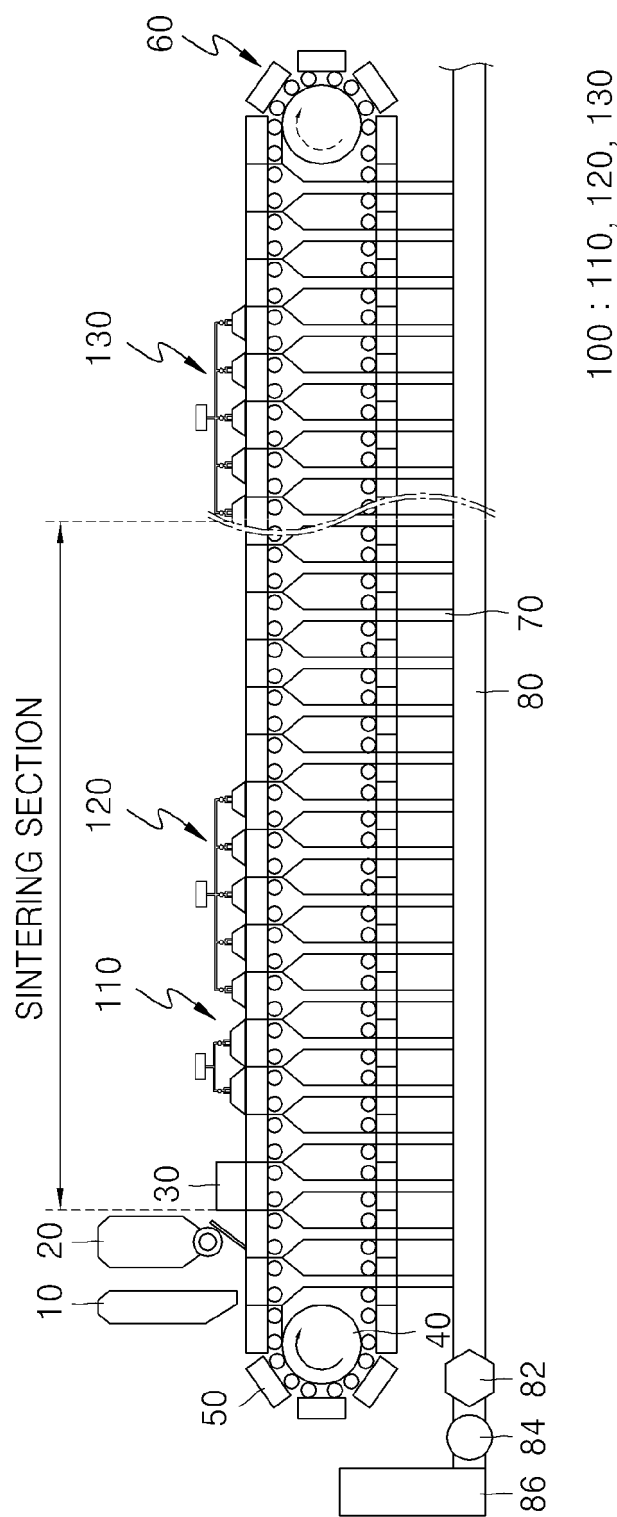
21. The method of claim 20, wherein the supplying of the gas fuel comprises alternately and repeatedly supplying the gas fuel and the external air.

22. The method of claim 21, wherein, in the supplying of the gas fuel, a section in which the gas fuel is supplied is greater than that in which the external air is supplied.

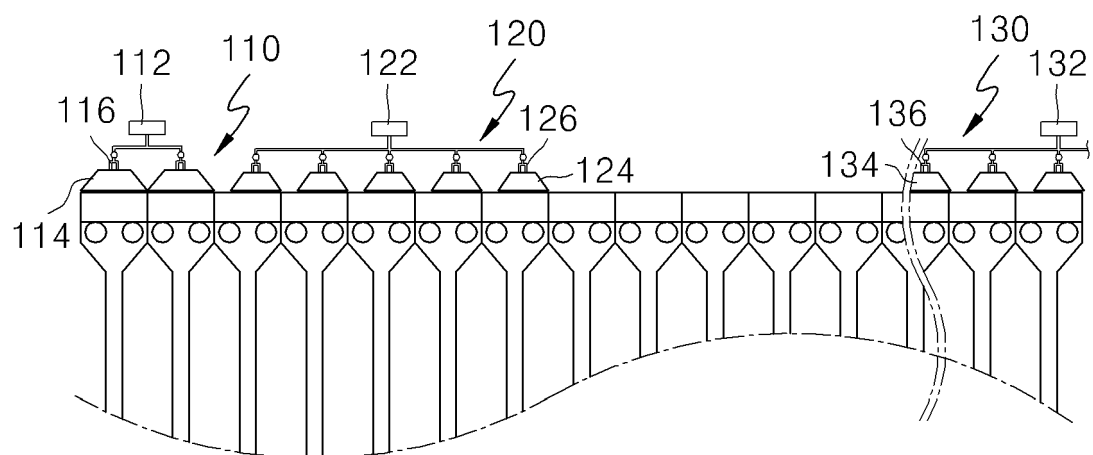
23. The method of any one of claims 13 to 22, wherein the gas fuel comprises at least one of a liquified natural gas (hereinafter, referred to as an "LNG"), a coke oven gas, and a furnace gas.

24. The method of claim 23, wherein the supplying of the humidified air is performed until the sintered ore is discharged after the combustion of the sintering raw material disposed on a bottom of the sintering cart is completed.

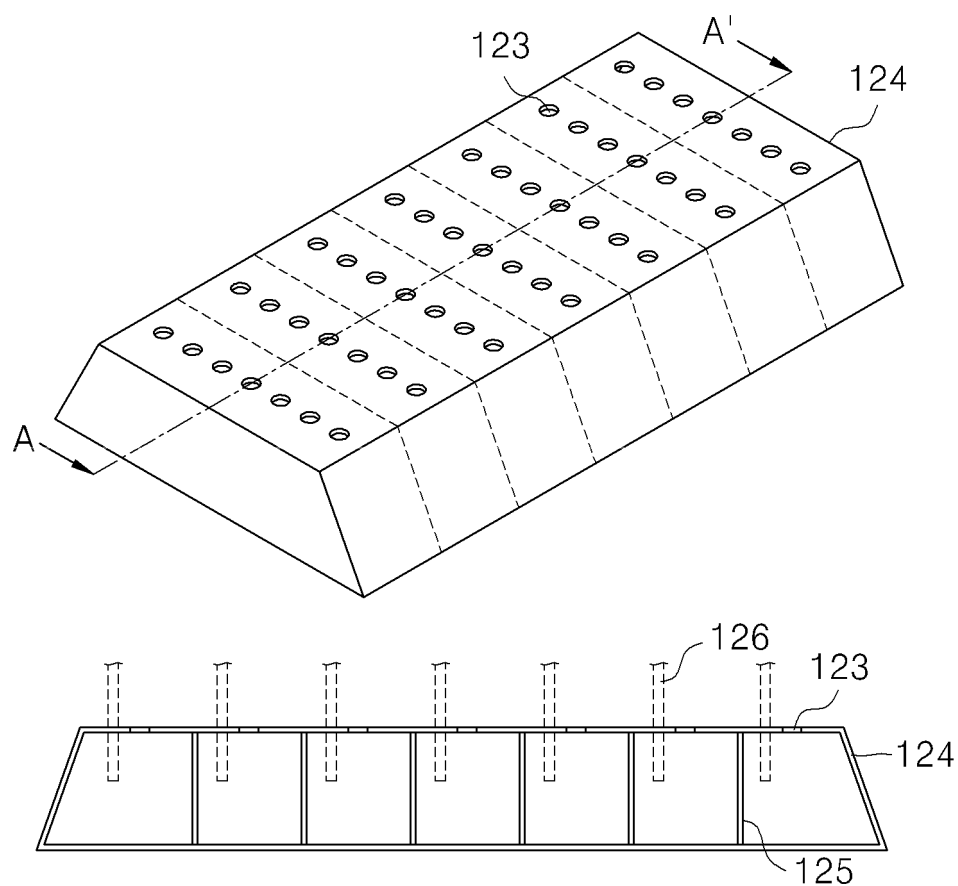
[Fig.1]



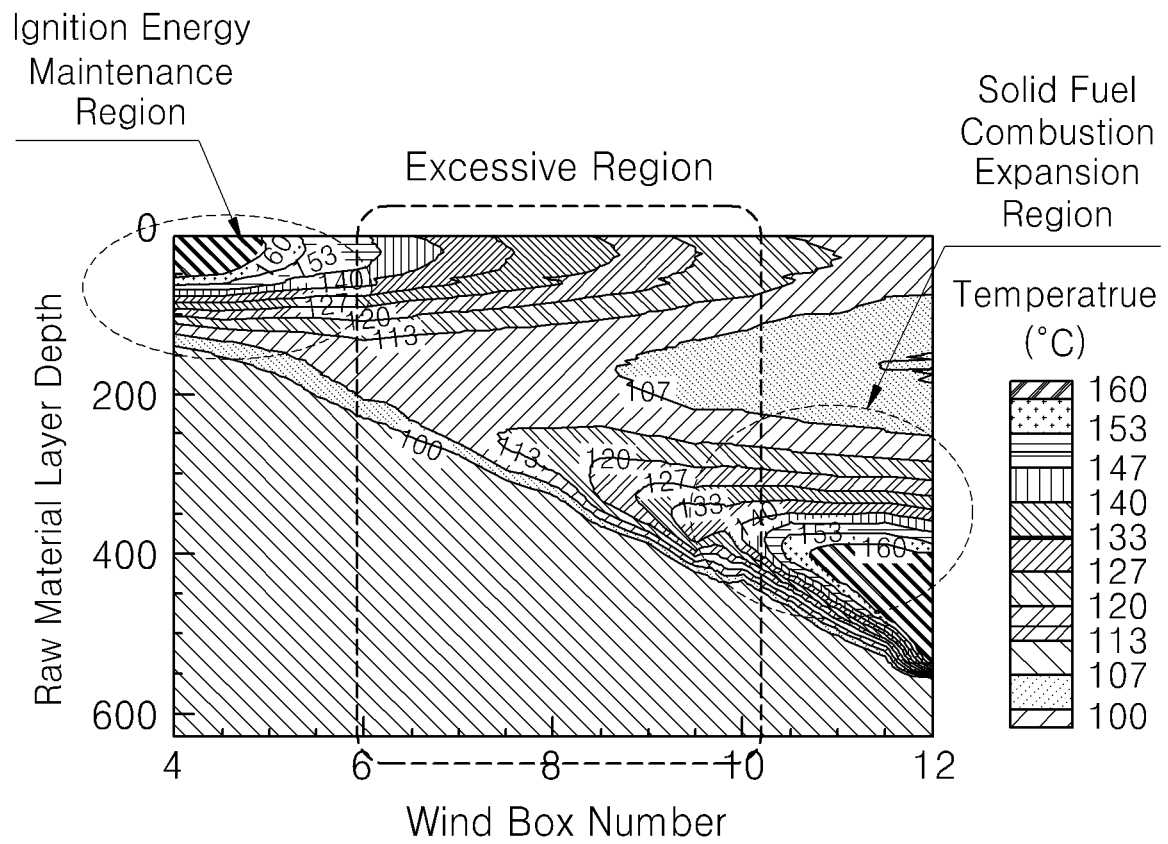
[Fig.2]



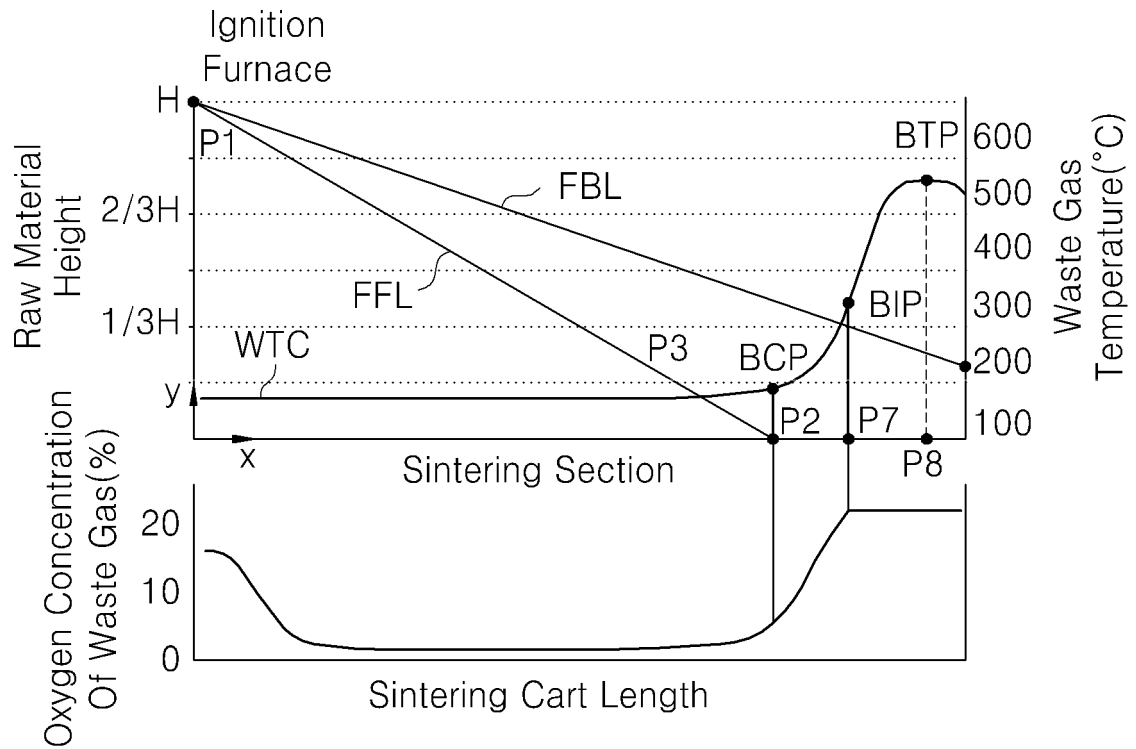
[Fig.3]



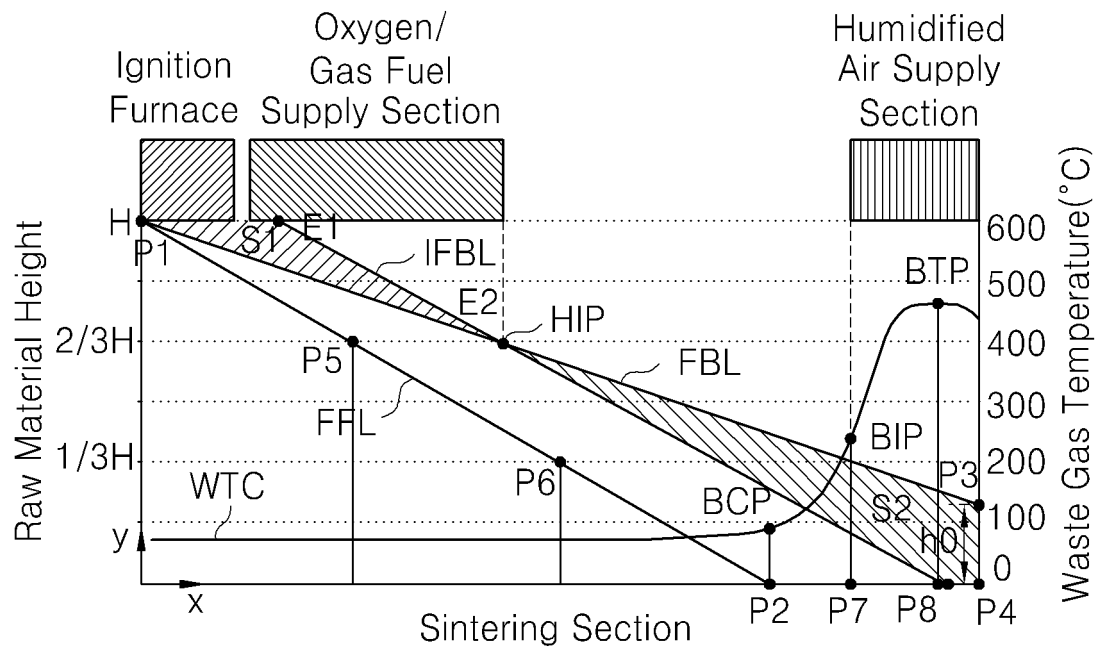
[Fig.4]



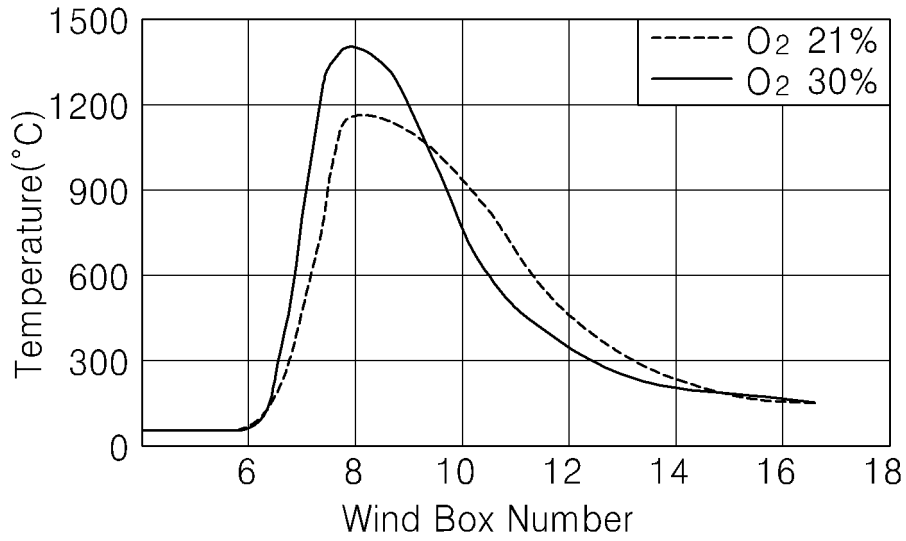
[Fig.5]



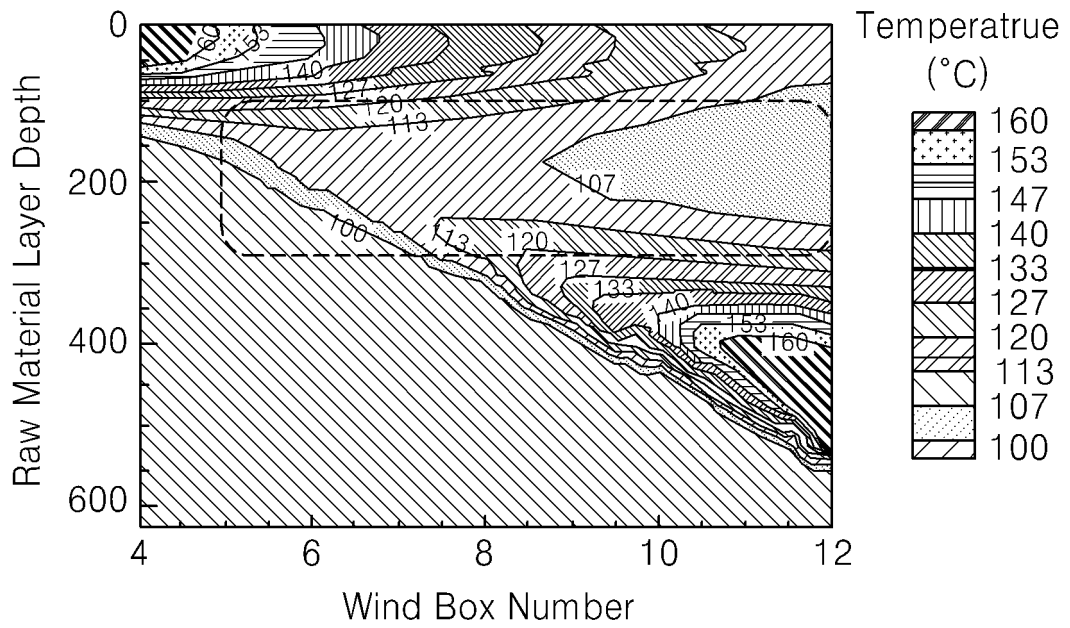
[Fig.6]



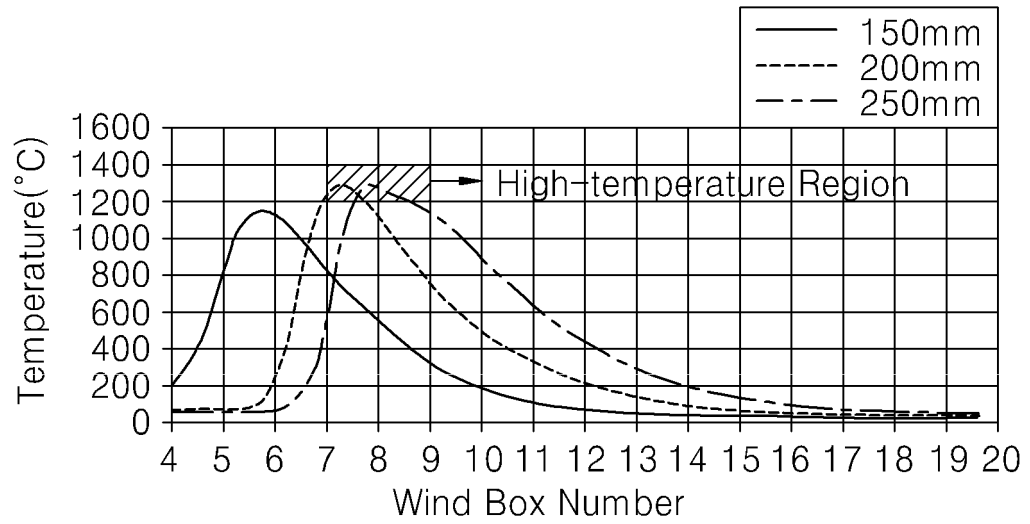
[Fig.7]



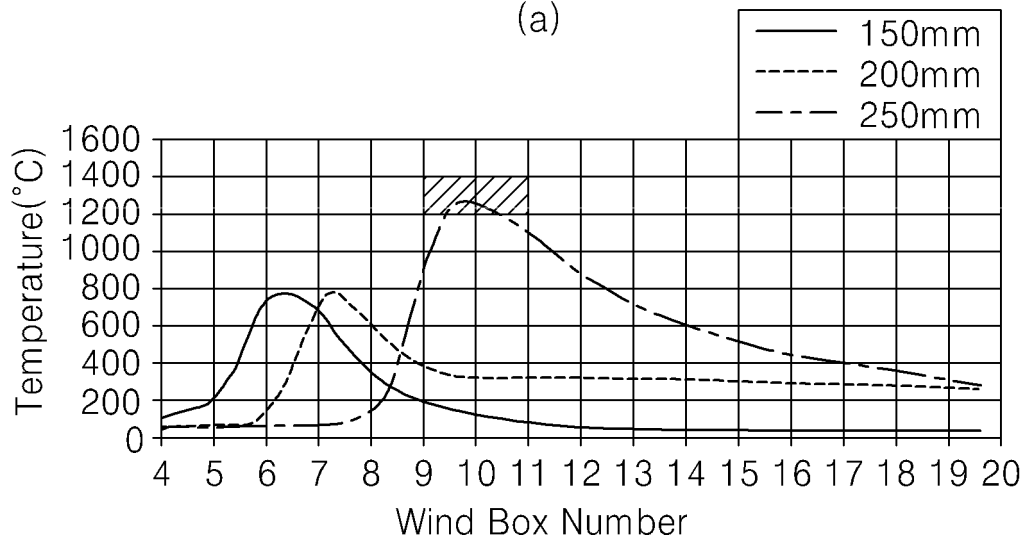
[Fig.8]



[Fig.9]

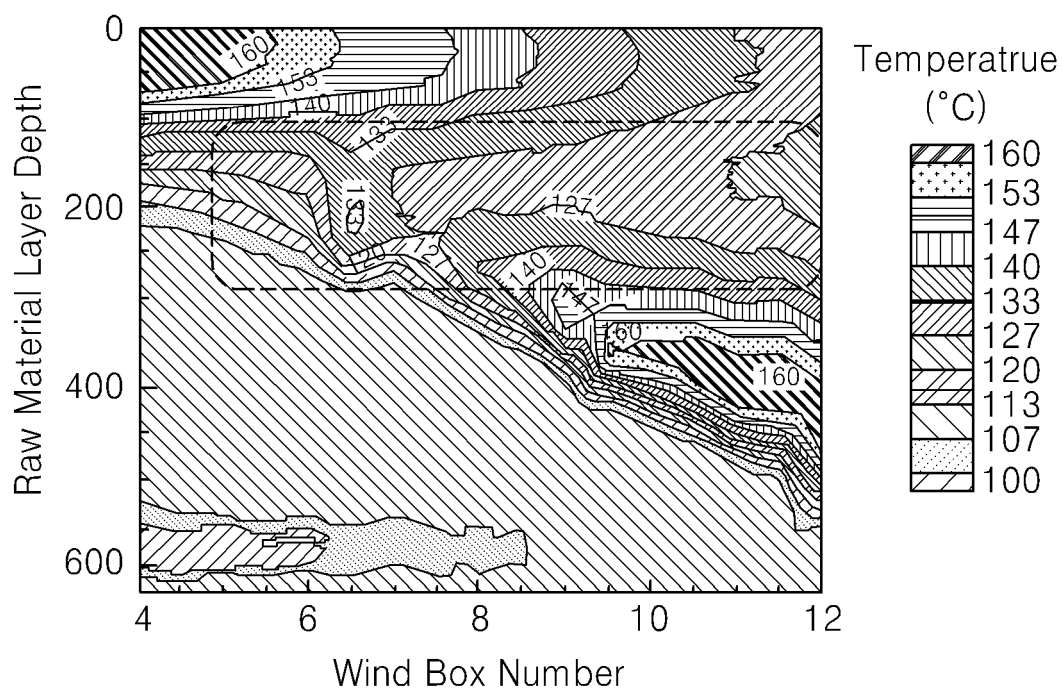


(a)

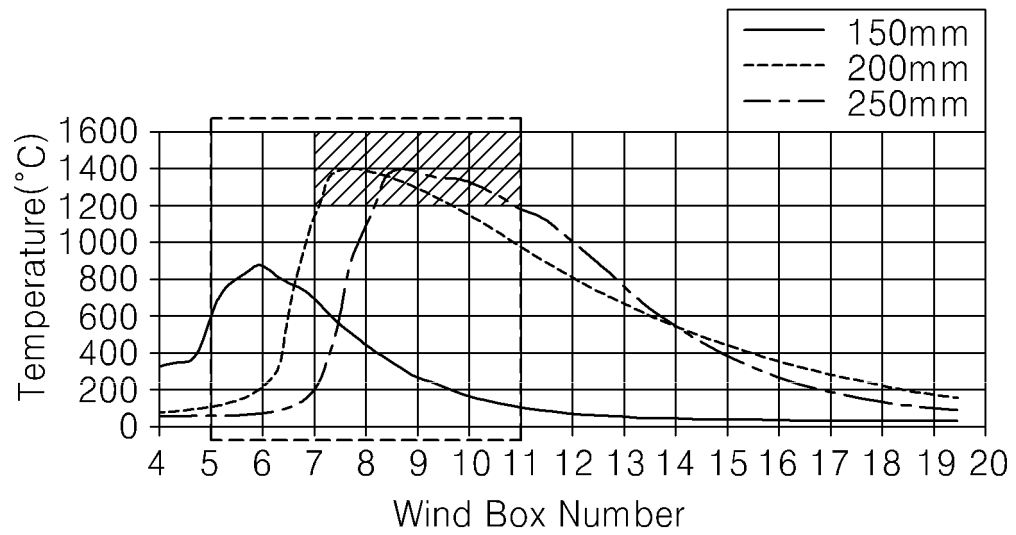


(b)

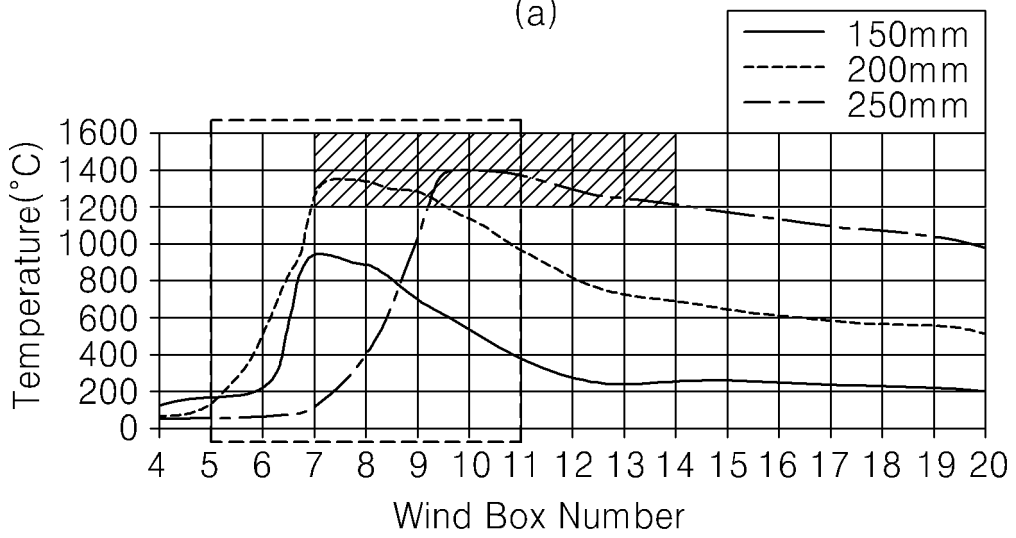
[Fig.10]



[Fig.11]

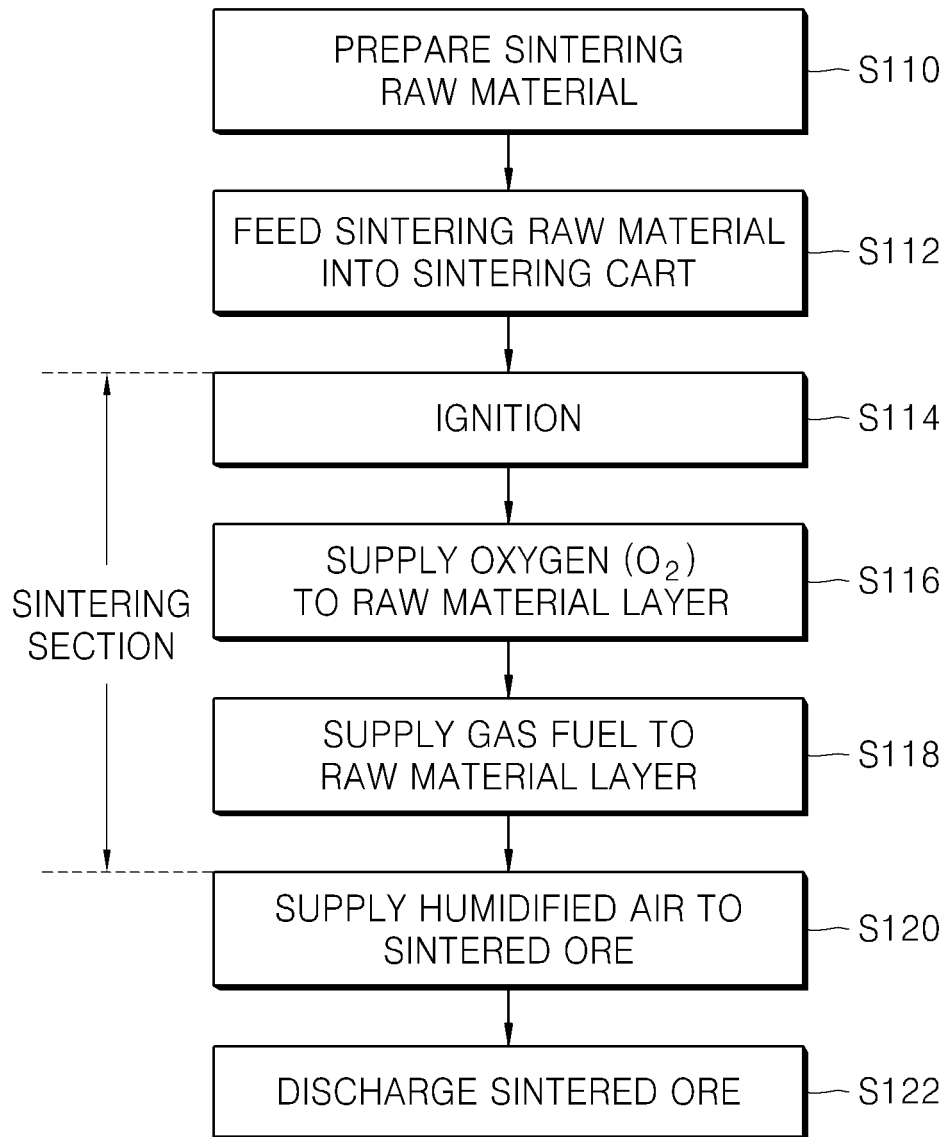


(a)



(b)

[Fig.12]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2013/012129

A. CLASSIFICATION OF SUBJECT MATTER

F27B 21/08(2006.01)i, C22B 1/16(2006.01)i, C22B 1/26(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F27B 21/08; C22B 1/20; B01D 53/74; C22B 1/16; C22B 1/26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: sintered ore, sinter trailer, ignition furnace, light distribution part, windbox, heat quantity controller, oxygen, gas fuel, humidification air, hood

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2010-126774 A (JFE STEEL CORP.) 10 June 2010 See abstract, paragraphs [0015],[0018]-[0019] and figure 1.	1-2,11-17,23-24
A		3-10,18-22
Y	KR 10-2000-0041264 A (POSCO) 15 July 2000 See abstract, lines 8-11 on page 2, lines 19-26 on page 3 and figures 2-3.	1-2,11-17,23-24
A	KR 10-2011-0059903 A (JFE STEEL CORP.) 07 June 2011 See abstract, paragraphs [0041]-[0045] and figure 1.	1-24
A	KR 10-2012-0130260 A (JFE STEEL CORP.) 29 November 2012 See abstract, paragraphs [0071]-[0072] and figure 16.	1-24
A	US 2010-0242684 A1 (LAABER et al.) 30 September 2010 See abstract, paragraphs [0049]-[0050] and figure 1.	1-24

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

24 SEPTEMBER 2014 (24.09.2014)

Date of mailing of the international search report

24 SEPTEMBER 2014 (24.09.2014)

Name and mailing address of the ISA/KR


 Korean Intellectual Property Office
 Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701,
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Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2013/012129

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