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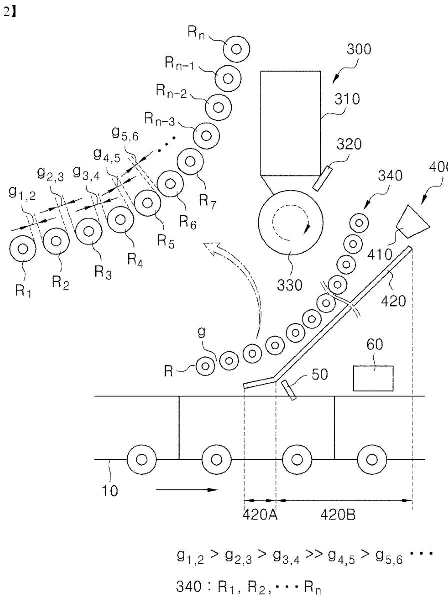
(54) APPARATUS AND METHOD FOR CHARGING RAW MATERIAL

(57) The present disclosure provides a raw material charging apparatus including a first hopper disposed above a storage vehicle traveling along a path; a first charging chute disposed below the first hopper and extending obliquely, wherein the first charging chute has a through-hole defined therethrough in a direction intersecting the extending direction of the first chute; a second hopper disposed above the storage vehicle and spaced apart from the first hopper; and a second charging chute disposed below the second hopper and the first charging chute and extending obliquely. Further, the present disclosure provides a raw material charging method using the apparatus. In this way, the apparatus and method may improve the collection rate and strength of the sintered ore in the upper portion of the raw material layer.

【FIG. 2】



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a raw material charging apparatus and a raw material charging method. More particularly, the present disclosure relates to a raw material charging method and apparatus for uniformly mixing and charging a solid fuel on an upper portion of a raw material layer to improve a collection rate and strength of a sintered ore in the upper portion of the raw material layer.

RELATED ART

[0002] A sintered ore is used as a raw material for making iron in a blast furnace. The sintered ore is produced by mixing sintered raw material such as iron ore with a solid fuel (e.g. a coke and an anthracite), combusting the solid fuel, and sintering the iron ore with the combustion heat. A manufacturing processes of the sintered ore in this manner will be described below.

[0003] First, various raw materials, side-raw materials, cokes, etc. are extracted from a raw material storage vehicle. Thereafter, the extracted raw materials, side-raw materials and cokes, etc. are mixed together with water in a blender to prepare a mixed-raw material. Thereafter, the mixed-raw material is transported to a surge hopper using a belt conveyor and temporarily stored in the surge hopper. Thereafter, an upper ore temporarily stored in an upper ore hopper and the mixed-raw material temporarily stored in the surge hopper are injected to a sintering vehicle. Thereafter, the sintering vehicle is passed through a lower side of an ignition-furnace to firing an upper portion of the mixed-raw material. Thereafter, the sintering vehicle is moved to an ore discharging unit side, and air is forcedly sucked to a lower portion of the mixed-raw material to firing the lower portion of the mixed-raw material.

[0004] In this connection, the combustion heat of the cokes transferred to the lower portion of the mixed-raw material is discharged to a suction blower after the raw material is dried and heated. Further, the combusted part of the mixed-raw material is cooled by the forcedly sucked air and the sintering is completed.

[0005] The mixed-raw material loaded on the sintering vehicle is sintered completely before the sintering vehicle reaches the ore discharging unit. Thereafter, when the sintering vehicle reaches the ore discharging unit, the completely sintered ore is discharged to the ore discharging unit. Thereafter, the sintered ore is crushed to a certain size or less in a crusher. Further, the sintered ore is loaded on a cooling apparatus and cooled thereby. Thereafter, the sintered ore is transported to the blast furnace and used as raw material in the iron making process. For example, a downward-suction Dwight-Lloyd type sintering apparatus is applied to the manufacturing processes of the sintered ore.

[0006] On the other hand, when the mixed-raw material is sintered in the above-described processes of the downward-suction Dwight-Lloyd type sintering apparatus, the amount of the heat is insufficient at an upper portion of the raw material layer of the mixed-raw material. Meanwhile the amount of the heat is excessive at a lower portion of the raw material layer. As described above, when the amount of the heat is insufficient at the upper portion of the raw material layer of the mixed-raw material and the amount of heat is excessive at the lower portion of the raw material layer, the sintered ore produced at the upper and lower portions of the raw material layer may not be sintered with sufficient strength.

[0007] (Patent document 1) KR10-2004-0088781 A

DISCLOSURE OF PRESENT DISCLOSURE

TECHNICAL PURPOSES

[0008] The present disclosure provides a raw material charging apparatus and a raw material charging method for improving a collection rate and strength of a sintered ore in an upper portion of a raw material layer.

[0009] The present disclosure provides a raw material charging apparatus and a raw material charging method for uniformly mixing and charging a mixed-raw material and a solid fuel on an upper portion of a raw material layer.

[0010] The present disclosure provides a raw material charging apparatus and a raw material charging method for regulating a charging condition of a solid fuel in a width direction of a raw material layer.

TECHNICAL SOLUTIONS

[0011] A raw material charging apparatus in accordance with the present disclosure includes a first hopper disposed above a storage vehicle traveling along a path; a first charging chute disposed below the first hopper and extending obliquely, wherein the first charging chute has a through-hole defined therethrough in a direction intersecting the extending direction of the first chute; a second hopper disposed above the storage vehicle and spaced apart from the first hopper; and a second charging chute disposed below the second hopper and the first charging chute and extending obliquely.

[0012] The first charging chute may include upper and lower portions, wherein at least the lower portion thereof includes at least one inclined plate extending upward-inclinedly with respect to a travelling direction of the storage vehicle, wherein the through-hole comprises a plurality of slits passing through the inclined plate at a plurality of positions thereof spaced apart from each other in the travelling direction of the storage vehicle.

[0013] The first charging chute may include upper and lower portions, wherein at least the lower portion thereof includes a plurality of rollers arranged upward-inclinedly with respect to a travelling direction of the storage vehicle, wherein the through-hole comprises a plurality of roller gaps defined between some or all of the rollers spaced apart from each other in the travelling direction of the storage vehicle.

[0014] At least the upper portion of the first charging chute may extend or orient at an angle of 55° to 90° relative to the storage vehicle, wherein an inclination angle of the first charging chute decreases from the upper portion to the lower portion.

[0015] The plurality of rollers arranged in least the lower portion of the first charging chute may be spaced apart from each other by a spacing between 3 mm and 50 mm.

[0016] The second hopper may be provided in plurality to be arranged in a width direction of the path.

[0017] A plurality of divided gates may be disposed in an outlet of the second hopper, wherein the gates are arranged in a width direction of the path.

[0018] The second charging chute may include at least one inclined plate, wherein the inclined plate extends upward-inclinedly with respect to the travelling direction of the storage vehicle.

[0019] At least an upper portion of the second charging chute may extend or orient at an angle of 55° to 90° relative to the storage vehicle, wherein an inclination angle of the second charging chute decreases from the upper portion to a lower portion thereof.

[0020] The second charging chute may be spaced apart from the first charging chute in the traveling direction of the storage vehicle such that a lower portion of the second charging chute faces a lower portion of the first charging chute.

[0021] The second charging chute at least partially may have a mixing-region, wherein a raw material dispensed from the through-hole of the first charging chute reaches the mixing-region.

[0022] In accordance with the present disclosure, there is provided a method for charging a raw material into a storage vehicle traveling along a path, the method comprising: dropping a raw material onto a first transfer path and guiding the raw material into the storage vehicle; dropping fuel onto a second transfer path and guiding the fuel into the storage vehicle; and mixing the raw material and fuel in at least a portion of the second transfer path.

[0023] Dropping the raw material onto the first transfer path and guiding the raw material into the storage vehicle may include inclinedly dropping the raw material onto the first transfer path extending upward-inclinedly with respect to a traveling direction of the storage vehicle, and guiding the raw material into the storage vehicle.

[0024] Dropping the fuel onto the second transfer path and guiding the fuel into the storage vehicle may include inclinedly dropping the fuel onto the second transfer path disposed below and spaced from the first path and extending upward-inclinedly with respect to the traveling direction of the storage vehicle, and guiding the fuel into the storage vehicle.

[0025] Dropping the fuel onto the second transfer path and guiding the fuel into the storage vehicle may include adjusting a supply amount of the fuel to be supplied to the second transfer path based on a plurality of positions in a width direction of the second transfer path, and inclinedly dropping the fuel to the second transfer path.

[0026] Dropping the fuel onto the second transfer path and guiding the fuel into the storage vehicle may include classifying fuels based on combustion rates thereof, and inclinedly dropping the fuel to the second transfer path such that a fuel having a relatively high combustion rate is supplied to a center of the second transfer path.

[0027] Mixing the raw material and fuel in at least the portion of the second transfer path may include: dispensing, toward the second transfer path, a portion of the raw material dropped inclinedly to the first transfer path; and guiding the raw material dispensed to the second transfer path to at least the portion of the second transfer path and mixing the raw material and the fuel on the at least the portion of the second transfer path.

[0028] Mixing the raw material and fuel in at least the portion of the second transfer path may include dropping, into a through-hole defined through the first transfer path, a portion of the raw material to be inclinedly dropped to the first transfer path.

[0029] Mixing the raw material and fuel in at least the portion of the second transfer path may include dispensing, a portion of the raw material inclinedly dropped to the first transfer path, to the second transfer path side while adjusting a dispensed amount of the raw material to be dispensed to the second transfer path.

ADVANTAGEOUS EFFECTS

[0030] According to an embodiment of the present disclosure, the solid fuel may be uniformly loaded in a height direction on the upper portion of the raw material layer. Further, the solid fuel may be loaded in the width direction by regulating the charging condition. From this, it is possible to improve the collection rate and strength of the sintered ore at the upper portion of the raw material layer.

[0031] For example, when the present disclosure is applied to a sintered ore manufacturing facility in a steel mill, the mixed-raw material and the solid fuel may be mixed into the upper layer and a surface layer of the raw material layer while charging the raw material layer into the storage vehicle. Specifically, the second transfer path is provided below the first transfer path, and using the second transfer path, a part of the mixed-raw material is dropped to the second transfer path and mixed with the solid fuel. Thus, the solid fuel and the mixed-raw material are uniformly mixed into the upper layer and the surface layer of the raw material layer. In this connection, the fine mixed-raw material may be mixed into the upper layer and surface layer of the raw material layer with charging of the solid fuel.

[0032] Further, the solid fuel may be loaded in the width direction of the raw material layer by regulating the charging condition of the solid fuel. In detail, a type and an amount of the solid fuel may be varied in the width direction of the traveling path, and a charging height of the solid fuel may be varied by classifying the solid fuel particle size.

[0033] In this way, it is possible to reduce a ratio of the solid fuel in the mixed-raw material, to increase the sintered ore collection rate at the upper layer of the raw material layer, and to reduce a quality difference of a completion material of the sintering ore in the width direction of the traveling path. Further, the imbalance and the insufficiency of the amount of the heat at the upper layer and the surface layer of the raw material layer may be reduced. As a result, a quality deviation of the manufactured sintered ore may be minimized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034]

Fig. 1 shows a processing facility using a raw material charging apparatus and a raw material charging method according to one exemplary embodiment of the present disclosure.

Fig. 2 shows a raw material charging apparatus according to one exemplary embodiment of the present disclosure.

Fig. 3 shows a raw material charging apparatus according to a variant of the present disclosure.

Fig. 4 shows an operation mode of a raw material charging apparatus according to one exemplary embodiment of the present disclosure.

Fig. 5 shows a graph illustrating a detailed structure of a charging chute according to one exemplary embodiment of the present disclosure.

Fig. 6 shows an operation mode of a raw material charging apparatus according to the comparison example of the present disclosure.

DETAILED DESCRIPTION

[0035] An embodiment of the present disclosure will now be described in detail with reference to the accompanying drawings. However, the present disclosure is not limited to an embodiment disclosed below but may be embodied in various different forms. An embodiment of the present disclosure, however, is provided in order to make the present disclosure complete and to give a complete knowledge of the invention to those of ordinary skill in the art. The drawings may be exaggerated or expanded to illustrate an embodiment of the present disclosure, wherein like reference numerals refer to like elements throughout.

[0036] In the present disclosure embodiment, the 'upper portion' refers to the upper portion of the component and the 'lower portion' refers to the lower portion of the component. That is, 'upper portion' and 'lower portion' are potions contained in 'corresponding component'. On the other hand, 'above' is used to mean a space or an area above a component, while 'below' is used to mean the space or area below the component. In this connection, a space or an area above a component is not contained in the component, and a space or an area below a component is not contained in the component. The space or area above a component or the space or area below a component is outside the component and may contact the component or may be spaced from the component.

[0037] The present disclosure relates to a raw material charging apparatus and a raw material charging method for charging the storage vehicle traveling along the path with the raw materials of various particle sizes to be vertically segregated. Hereinafter, one exemplary embodiment of the present disclosure will be described in detail based on a sintered ore manufacturing facility of a steel mill. However, the present disclosure may be applied to a variety of processing facilities for charging a to-be-processed material into the charging unit traveling in a predetermined direction, or processes using the processing facilities.

[0038] Fig. 1 is a schematic view showing a processing facility applied on a raw material charging apparatus and a raw material charging method according to one exemplary embodiment of the present disclosure, and Fig. 2 is a schematic view showing a raw material charging apparatus according to one exemplary embodiment of the present disclosure. (a) of Fig. 3 is a schematic view showing a second charging chute of a raw material charging apparatus according to a variant of the present disclosure. (b) of Fig. 3 is a schematic view showing a second charging chute of a raw material charging apparatus according to another variation of the present disclosure. Fig. 4 is a flow chart showing an operation mode of a raw material charging apparatus according to one exemplary embodiment of the present disclosure.

[0039] Referring to Fig. 1 to 4, the processing facility according to one exemplary embodiment of the present disclosure is described in detail. The processing facility according to one exemplary embodiment of the present disclosure includes a storage vehicle 10, an upper ore hopper 20, a first charging unit 300, a second charging unit 400, a surface layer treatment unit 50, an ignition-furnace 60, a wind-box 70 and an exhaust unit 80.

[0040] The storage vehicle 10 may include a vehicle configured to travel in one direction along the path. A space may be formed in the storage vehicle 10 and an upper portion thereof may be opened upward to allow the space formed in the storage vehicle 10 to communicate with the outside. A plurality of the storage vehicles 10 are provided and may be continuously disposed along the path to connected in an endless structure.

[0041] The path includes the upper side traveling path and the lower side returning path. The storage vehicle 10 may travel in one direction along the traveling path at the upper side of the path. The storage vehicle 10 may be returned in one direction along the returning path at the lower side of the path. The storage vehicle 10 travels along the traveling path and may form the raw material layer by charging the to-be-processed material therein. The raw material layer formed inside of the storage vehicle 10 may be manufactured as the sintered ore via sintering and cooling while traveling in one direction along the traveling path. Thereafter, the sintered ore may be discharged from the storage vehicle 10 in the course of the storage vehicle 10 entering the returning path. After the discharging is completed, the storage vehicle 10 may be returned to the returning path and then returned to the traveling path.

[0042] The to-be-processed material may be loaded into the inside of the storage vehicle 10 through the open upper portion of the storage vehicle 10. The to-be-processed material may include a raw material such as the mixed-raw material and a fuel such as a solid fuel. The mixed-raw material may be a mixed-raw material for manufacturing the sintered ore and the solid fuel may be a solid fuel used for manufacturing the sintered ore. The mixed-raw material may be loaded inside the storage vehicle 10 to form a lower layer of the raw material layer. Further, the mixed-raw material and the solid fuel are mixed into the upper side of the inside of the storage vehicle 10 to form the upper layer and the surface layer of the raw material layer.

[0043] The upper ore hopper 20 may include the hopper of various structures to store the upper ore therein. The upper ore hopper 20 may be located on above the traveling path and spaced upward from the vicinity of one end of the traveling path. A cut-out outlet may be formed at a lower end of the upper ore hopper 20. The upper ore may be dropped to the inner bottom of the storage vehicle 10 through the cut-out outlet.

[0044] The upper ore may be prepared by selecting a sintered ore having a particle size of 8 mm to 15 mm among the manufactured sintered ores. The upper ore prevents the mixed-raw material loaded in the storage vehicle 10 from being lost to a grate bar side of the pallet forming the bottom surface (not shown) of the storage vehicle 10 or attached to the grate bar.

[0045] The first charging unit 300 and the second charging unit 400 may be arranged to be spaced from the upper ore hopper 20 with respect to the traveling direction of the storage vehicle 10 above the traveling path. The first charging unit 300 is configured to charge the mixed-raw material into the storage vehicle 10 and the second charging unit 400 is configured to charge the solid fuel into the storage vehicle 10.

[0046] The first charging unit 300 and the second charging unit 400 described above constitute the raw material charging apparatus according to one exemplary embodiment of the present disclosure and will be described in detail below.

[0047] Hereinafter, the raw material charging apparatus according to one exemplary embodiment of the present disclosure will be described in detail with reference to Fig. 1 to Fig. 4. The raw material charging apparatus according to one exemplary embodiment of the present disclosure includes the first charging unit 300 storing the mixed-raw material and the second charging unit 400 storing the fuel.

[0048] The first charging unit 300 may include the first hopper 310, the first hopper gate 320, a drum feeder 330, and the first charging chute 340. In this connection, the first charging chute 340 may have the through-hole. The through-hole of the first charging chute 340 may be formed by penetrating at least a portion of the first charging chute 340 above the second charging unit 400 in a height direction that intersects the extending direction of the first charging chute 340.

[0049] With the above structure, in one exemplary embodiment of the present disclosure, a portion of the mixed-raw material of the first charging unit 300 may be dispensed to the second charging unit 400 side. For example, the first charging unit 300 may dispense a portion of the mixed-raw material dropping into the first charging chute 340 to the second charging unit 400 side through the through-hole of the first charging chute 340.

[0050] The first hopper 310 may be located above the storage vehicle 10 traveling along the path, such as the traveling path. The first hopper 310 may be configured to store the mixed-raw material therein. The first hopper 310 may be formed with the cut-out outlet at the lower end, and the first hopper gate 320 and the drum feeder 330 may be mounted at the cut-out outlet.

[0051] The first hopper gate 320 may be mounted on the cut-out outlet of the first hopper 310 to be liftable or rotatable and the drum feeder 330 may be mounted on the cut-out outlet to be rotatable. The mixed-raw material passes through the first hopper gate 320 mounted on the cut-out outlet of the first hopper 310 and thereafter is supplied to the drum feeder 330. Then, the dispensing amount of the mixed-raw material is regulated by regulating the number of rotations of the drum feeder 330 and the mixed-raw material may be dropped and supplied to the first charging chute 340.

[0052] The first charging chute 340 may be disposed below the first hopper 310 and extend obliquely to form the first transfer path that guides the mixed-raw material. In this connection, the first charging chute 340 may extend inclined to form the first transfer path in a shape of, for example, a straight line or a curved line such as a spline or a cycloid, taking into account a dropping trajectory or a departure rate and a departure angle of the mixed-raw material.

[0053] The first charging chute 340 may guide the dropping of the mixed-raw material using the first transfer path to charge the mixed-raw material inside the storage vehicle 10. Meanwhile, the mixed-raw material may be sequentially stacked and vertically segregated based on the particle size of the mixed-raw material while the mixed-raw material being obliquely dropped.

[0054] That is, according to the inclined structure of the first charging chute 340, the mixed-raw material having a relatively small particle may be loaded on the inner upper side of the storage vehicle 10, and the mixed-raw material having a relatively large particle may be loaded on the inner lower side of the storage vehicle 10.

[0055] The detailed structure of the first charging chute 340 in which the overall shape is formed as described above will be described below.

[0056] The first charging chute 340 may include a plurality of the rollers R arranged at least at the lower portion upward-inclinedly with respect to the traveling direction of the storage vehicle 10. In the upper portion of the first charging chute 340 a plurality of rollers R are arranged upward-inclinedly with respect to the traveling direction of the storage vehicle 10. Otherwise, the upper portion is constituted by at least one inclined plate (not shown) extending upward-inclinedly with respect to the traveling direction of the storage vehicle 10.

[0057] In this connection, the first charging chute 340 may be divided into upper and lower portions based on a predetermined position in the height direction. Alternatively, the first charging chute 340 may be divided into upper and lower portions based on a predetermined position with respect to the traveling direction of the storage vehicle 10. For example, based on the position of the surface layer treatment unit 50, the upstream side of the traveling path, which is the opposite side of the ignition-furnace 60, may be the lower portion of the first charging chute 340, and the downstream side of the traveling path, which is the ignition-furnace 60 side, may be the upper portion of the first charging chute 340. Alternatively, the first charging chute 340 may be divided into upper and lower portions based on the inclination angle change rate. For example, the upper and lower portions may be distinguished based on a predetermined position of the first charging chute 340 in which the inclination angle change rate is changed from increase to decrease or from decrease to increase.

[0058] A plurality of rollers R may be inclinedly arranged at least the upper portion of the first charging chute 340 to have for example, 55 ° to 90 ° of the inclination angle. Further, the inclination angle may decrease as it goes down.

[0059] That is, the first charging chute 340 is formed in the inclination angle of 55 ° to 90 ° at the upper portion, so that an initial departure rate(velocity) of the mixed-raw material may be secured at a desired value. Also, a horizontal component of the departure rate may be secured at a desired value by reducing the inclination angle at the lower portion.

[0060] When the first charging chute 340 is provided as described above, the through-hole of the first charging chute 340 may include a plurality of the roll gaps g spaced apart from each other with respect to the traveling direction of the storage vehicle 10.

[0061] A plurality of rollers R arranged at least at the lower portion of the first charging chute 340 may be spaced apart from each other by an interval of 3 mm to 50 mm. A plurality of rollers R arranged at the upper portion of the first charging chute 340 may be spaced apart from each other by an interval of 3 mm to 50 mm, or less than 3 mm or less.

[0062] As such, a plurality of rollers R are spaced apart from each other by an interval of 3 mm to 50 mm at the lower portion of the first charging chute 340, so that the mixed-raw material may be dispensed to the second charging unit 400 side at a desired dispense amount. Further, the mixture of the mixed-raw material and the solid fuel may be loaded at a desired charging height of the raw material layer. That is, the mixture of the mixed-raw material and the solid fuel may be uniformly loaded in the upper layer and the surface layer of the raw material layer.

[0063] For example, when the roll gap g is less than 3 mm, the mixed-raw material dropping to the first charging chute 340 may not pass through the roll gap g, or although the mixed-raw material may pass through the roll gap g, the passage amount does not have a meaningful value. That is, when the roll gap g is less than 3 mm, the dispense amount of the mixed-raw material passing through the roll gap g and dispensed to the second charging unit 400 side is smaller than a desired value. Therefore, the mixed-raw material may not be uniformly mixed into the upper layer and the surface layer of the raw material layer, and the solid fuel may be biasedly loaded to the surface layer of the raw material layer.

[0064] When the roll gap g is exceeding 50 mm, the dispense amount of the mixed-raw material passing through the roll gap g and dispensed to the second charging unit 400 side is larger than the desired value. Therefore, the charging height of the mixed-raw material and the solid fuel mixture may be shifted from the upper layer to the lower layer side of the raw material layer, so that a permeability of the raw material layer may decrease.

[0065] Meanwhile, the first charging chute (not shown) according to another embodiment of the present disclosure may include the inclined plate which is inclined upwardly with respect to the traveling direction of the storage vehicle 10 travels, or may include a plurality of divided inclined plates extending upward-inclinedly with respect to the traveling direction of the storage vehicle 10.

[0066] For example, the first charging chute (not shown) according to another exemplary embodiment of the present disclosure may include at least one inclined plate (not shown) extending upward-inclinedly with respect to the traveling direction of the storage vehicle 10 at least at the lower portion thereof. In this connection, the first charging chute (not shown) according to another exemplary embodiment of the present disclosure may be constituted by at least one inclined plate extending upward-inclinedly with respect to the traveling direction of the storage vehicle 10, or a plurality of the rollers are arranged upward-inclinedly with respect to the traveling direction of the storage vehicle 10 at the upper portion thereof.

[0067] When the first charging chute according to another exemplary embodiment of the present disclosure is provided as described above, the through-hole of the first charging chute according to another exemplary embodiment of the present disclosure may include a plurality of the slits (not shown) penetrating the above-mentioned inclined plate at a plurality of the position with respect to the traveling direction of the storage vehicle 10.

[0068] Meanwhile, the first charging chute according to another exemplary embodiment of the present disclosure may be formed to have all of the technical characteristics of the first charging chute 340 according to one exemplary embodiment of the present disclosure. For example, at least the upper portion of the first charging chute according to another exemplary embodiment of the present disclosure may extend at the inclination angle of 55 ° to 90 °, with respect to the storage vehicle 10 and the inclination angle may decrease toward the lower portion. Further, the through-hole formed at least at the bottom of the first charging chute according to another exemplary embodiment of the present disclosure may have a width of 3 mm to 50 mm.

[0069] Hereinafter, the second charging unit of the raw material charging apparatus according to one exemplary embodiment of the present disclosure will be described in detail. The second charging unit 400 according to one exemplary embodiment of the present disclosure may include the second hopper 410 containing the solid fuel therein and the second charging chute charging the mixture of the solid fuel and the mixed-raw material to the storage vehicle 10. Particularly, the mixing-region A may be formed at least at a portion of the second charging chute, and the mixed-raw material dispensed from the through-hole of the first charging chute may pass through the mixing-region A. And the mixed-raw material may be uniformly mixed with the solid fuel.

[0070] In this connection, the mixed-raw material dispensed to the second charging chute 420 side and mixed with the solid fuel may include a mixed-raw material with relatively small particles in the total mixed-raw materials supplied to the first charging chute 340.

[0071] With this structure, in one exemplary embodiment of the present disclosure, the mixed-raw material and the solid fuel may be uniformly mixed at the second charging unit 400, and may be guided into the storage vehicle 10. Then the mixture of the mixed-raw material and the solid fuel may be loaded into the upper layer and the surface layer of the raw material layer. That is, before charging the mixed-raw material and the solid fuel into the storage vehicle 10, the mixed-raw material and the solid fuel may be uniformly mixed.

[0072] The second hopper 410 may be spaced apart from the first hopper 310 above the storage vehicle 10. The second hopper 410 may be configured to store the solid fuel therein. The second hopper 410 may have the outlet at the lower end, and the second hopper gate and the fuel feeder (not shown) may be mounted at the outlet.

[0073] The second hopper gate may be mounted on the outlet of the second hopper 410 to be liftable or rotatable and the fuel feeder may be provided to be rotatable or vibratable at the outlet of the second hopper 410. The solid fuel is supplied to the fuel feeder passing through the second hopper gate mounted at the outlet of the second hopper 410. Thereafter, the dispense amount is regulated by regulating the number of the rotations or the number of vibrations of the fuel feeder, and the solid fuel may be dropped and supplied to the second charging chute 420.

[0074] Meanwhile, in the variant of the present disclosure, as shown in Figure 3A, a plurality of the second hoppers 410 may be arranged in the width direction of the traveling path. Further, in another variation of the present disclosure, as shown in Figure 3B, a plurality of the divided second hopper gate are provided at the outlet of the second hopper 410, and arranged in the width direction of the traveling path.

[0075] Based on the above structure, in the variants of the present disclosure, the solid fuel may be supplied to the second charging chute 420 by regulating the dispense amount of the solid fuel by plural positions or regions in the width direction of the traveling path. For example, the solid fuels may be classified base on combustion rates thereof. In this connection, a solid fuel with a relatively high combustion rate may be selected and supplied to the second charging chute 420 in the width direction middle of the traveling path. Alternatively, the supply amount of the solid fuel may be adjusted at the positions of the width direction of the traveling path to increase the supply amount of the solid fuel at the edge portion in the width direction of the traveling path. Then, the solid fuel may be supplied to the second charging chute 420. Since the supply of the solid fuel may be regulated by biasing in the width direction, in the variation of the present disclosure, regulating the width direction of the flame spreading may be more easily performed.

[0076] Hereinafter, the second charging chute of the second charging unit according to one exemplary embodiment of the present disclosure will be described in detail. The second charging chute 420 may form the second transfer path that disposed below the first charging chute 340 and the second hopper 410 and extends obliquely to guide the solid fuel. In this connection, the second charging chute 420 may extend inclined to form the second transfer path in a shape of, for example, a straight line or a curved line such as a spline or a cycloid, taking into account the drop trajectory of the solid fuel.

[0077] The second charging chute 420 may guide the dropping of the mixture of the mixed-raw material and the solid fuel using the second transfer path to charge the mixture into the storage vehicle 10. Meanwhile, the mixture may be sequentially stacked and vertically segregated based on the particle size of the mixture while mixed-raw material being obliquely dropped.

[0078] That is, by the inclined structure of the second charging chute 420, the mixed-raw material and the solid fuel having the relatively large particle may be uniformly mixed and loaded into the upper layer of the raw material layer, the mixed-raw material and the solid fuel having the relatively small particle may be uniformly mixed and loaded into the surface layer of the raw material layer. In this connection, the inclination angle or the extension length of the second charging chute 420 may be appropriately selected to uniformly mix and charge the mixed-raw material and the solid fuel at the desired height in the upper portion of the storage vehicle 10.

[0079] The second charging chute 420 may be spaced apart from the first charging chute 340 with respect to the traveling direction of the storage vehicle 10. Therefore, at least the lower portion of the second charging chute 420 may face the lower portion of the first charging chute 340, and a mixing-region A may be formed at the lower portion 420A of the second charging chute 420. Thus, depending on the second charging chute 420 is spaced apart from the first charging chute 340 with respect to the traveling direction of the storage vehicle 10, it is possible to charge the mixture of the mixed-raw material and the solid fuel easily without interfering with the charging of the mixed-raw material performed at the first charging chute 340 and without interfered by each other. Meanwhile, the lower portion 420A of the second charging chute 420 may be positioned on the upstream side of the traveling path based on the position of the surface layer treatment unit 50. Therefore, the mixture of the mixed-raw material and the solid fuel may be easily loaded to the upper layer and the surface layer of the raw material layer in the preceding position of the surface layer treatment unit 50.

[0080] The detailed structure of the second charging chute 420 in which the basic structure is formed as described above will be described in more detail below.

[0081] The second charging chute 420 may include at least one inclined plate extending upward-inclinedly with respect to the traveling direction of the storage vehicle 10. In this connection, the second charging chute 420 may include an integral type inclined plate or a plurality of the divided type inclined plates.

[0082] For example, in one exemplary embodiment of the present disclosure illustrates a second charging chute 420 including an upper inclined plate 421 constituting the upper portion 420B and a lower inclined plate 422 constituting the lower portion 420A. In this case, the lower inclined plate 422 may be positioned between the lower end of the first charging chute 340 and the surface layer treatment unit 50, facing the lower portion of the first charging chute 340. The through-hole of the first charging chute 340 may be positioned above the lower inclined plate 422.

[0083] Meanwhile, the way of distinguishing the upper and lower portions of the second charging chute 420 may correspond to the way of distinguishing upper and lower portions of the first charging chute 340. For example, based on the position of the surface layer treatment unit 50, the upstream side of the traveling path may be the lower portion 420A of the second charging chute 420, and the downstream side of the traveling path may be the upper portion 420B of the second charging chute 420.

[0084] At least the upper portion of the second charging chute 420 may be extended to have the inclination angle of, for example, an angle of 55 ° to 90 ° based on the position of the storage vehicle 10, and the inclination angle of the second charging chute 420 may decrease as it goes downward.

[0085] That is, the second charging chute 420 may form the upper inclination plate 421 constituting at the upper portion 420B in the inclination angle of for example, 55 ° to 90 °. Therefore, an initial departure rate of the solid fuel may be secured at a desired value.

[0086] Further, a parallel component of the departure rate of the mixture of the mixed-raw material and the solid fuel may be secured at a desired value by reducing the inclination angle of the lower inclined plate 422 constituting the lower portion 420A of the second charging chute 420 less than that of the upper inclined plate 421.

[0087] Hereinafter, the remaining components of the processing facility according to one exemplary embodiment of the present disclosure will be described below.

[0088] The surface layer treatment unit 50 may be disposed so as to pass the upper portion of the storage vehicle 10 in the width direction of the traveling path spaced apart from the lower portion of the second charging chute 420 with respect to the traveling direction of the storage vehicle 10. While the storage vehicle 10 is traveling, the surface layer treatment unit 50 contacts the surface layer of the raw material layer, and uniformalizes the surface of the surface layer to make the surface height of the surface layer constant in the width direction and the traveling direction. For example, the surface layer treatment unit 50 may include a round bar-shaped or plate-shaped contact member extending in the width direction with respect to the traveling path, and a driving means (not shown) for supporting the contact member so as to move, elevate or rotate.

[0089] The ignition-furnace 60 may be spaced apart from the second charging unit 400 with respect to the traveling direction of the storage vehicle 10 and may be located above the traveling path. The ignition-furnace 60 may be formed to inject the flame downward. While the storage vehicle is traveling, the ignition-furnace supply the flame to fire the raw material layer loaded in the storage vehicle 10.

[0090] The crusher (not shown) and the cooler (not shown) may be disposed in the vicinity of the other end of the traveling path where the traveling path ends. The crusher may be configured to crush the sintered ore discharged from the storage vehicle 10 into a predetermined particle size. The cooler may be configured to cooling the crushed sintered ore from the crusher.

[0091] The wind-boxes 70 are provided at the lower portion of the traveling path, and a plurality of wind-boxes 70 may be arranged continuously with respect to the traveling direction. The wind-boxes 70 may be connected to the inside of the storage vehicle 10 traveling the traveling path. The wind-box 70 may generate a negative pressure to suck the inside of the storage vehicle 10. The flame surface spreads in the direction from the surface layer of the raw material layer loaded in the storage vehicle 10 to the surface layer by the wind box 70. Therefore, the raw material layer may be sintered to the sintered ore.

[0092] The exhaust unit 80 may include an exhaust chamber, a dust collector, a blower, and an exhaust port. The exhaust unit 80 provides a strong suction force, for example, a negative pressure, to exhaust the exhaust gas sucked at the wind-box 70 to the outside. The exhaust chamber includes a passage through which the exhaust gas passes, and may be connected to a plurality of wind-boxes 70. The dust collector may be configured to remove dust contained in the exhaust gas and may be connected to the end of the exhaust chamber. The blower may be connected to the dust collector on the opposite side of the exhaust chamber to guide the flow of the exhaust gas from the exhaust chamber to the dust collector. The exhaust port is connected to the blower to discharge the exhaust gas to the outsider.

[0093] Hereinafter, a raw material charging method according to one exemplary embodiment of the present disclosure will be described in detail with reference to Figure 1 to Figure 4. In this connection, the detailed specifications and the duplicated contents according to the exemplary embodiments and the variants will be omitted or briefly described below.

[0094] The raw material charging method according to one exemplary embodiment of the present disclosure includes: dropping the mixed-raw material to the first transfer path and guiding the mixed-raw material into the storage vehicle; dropping the solid fuel to the second transfer path and guiding the solid fuel into the storage vehicle; and mixing the mixed-raw material and the solid fuel in some regions of the second transfer path.

[0095] First, prepare raw materials and fuels. In this connection, the raw materials and the fuels may be prepared with a variety of raw materials and fuels, corresponding to the plural processes to which the present disclosure may be applied. In one exemplary embodiment of the present disclosure, the raw material and the fuel are prepared as follow.

[0096] First, the raw material, such as a mixed-raw material 91 is provided. The raw materials such as a fine iron ore, a limestone, a fine coke, and an anthracite are mixed and moisturized to prepare the mixed-raw material having a predetermined particle size. In this connection, the mixed-raw material includes a mixed-raw material for manufacturing a sintered ore. Further, the fuel such as a solid fuel 92 is provided. For example, at least one of a fine coke and an anthracite is provided as the solid fuel.

[0097] In this connection, in one embodiment of the present disclosure, the amount of the solid fuel to be mixed into the mixed-raw material to produce the sintered ore may be reduced and the amount of the reduced solid fuel may be prepared as a solid fuel used in the second charging unit 400. That is, some of the solid fuel is premixed in the mixed-raw material and the remaining solid fuel is prepared separately. Thereafter, through the second charging unit 400, the remaining solid fuel is loaded into the upper layer B2 and the surface layer B3 of the raw material layer B. In this connection, the amount of the solid fuel that is not mixed in the mixed-raw material and prepared separately may be determined considering the combustion heat, the combustion rate, etc. to be supplied to the upper layer and the surface layer of the raw material layer.

[0098] Thereafter, the mixed-raw material 91 is loaded to the first hopper 310 of the first charging unit 300 and the solid fuel 92 is loaded to the second hopper 410 of the second charging unit 400.

[0099] Thereafter, the mixed-raw material 91 is sloped down through the first transfer path using the first charging chute 340 of the first charging unit 300, which extends upward-inclinedly with respect to the traveling direction of the storage vehicle 10. Therefore, the mixed-raw material is guided to the inside of the storage vehicle 10. On the other hand, the upper ore is loaded to a predetermined height on the inner bottom surface of the storage vehicle 10, and the mixed-raw material 91 is loaded to the upper side of the upper ore.

[0100] The mixed-raw material is guided into the inside of the storage vehicle 10 and the solid fuel is guided into the inside of the storage vehicle 10 simultaneously. Specifically, the solid fuel 92 is obliquely dropped to the second transfer path by using the second charging chute 420 of the second charging unit 400 spaced apart from below the first transfer path in traveling direction of the storage vehicle 10 and extending upward-inclinedly, the mixed-raw material is guided into the traveling storage vehicle 10.

[0101] The mixed-raw material 91 is loaded to the inside of the storage vehicle 10 at the upstream side of the traveling path earlier than the solid fuel 92. The solid fuel 92 is loaded to the inside of the storage vehicle 10 later than the mixed-raw material 91 and form the upper layer B2 and the surface layer B3 of the raw material layer B.

[0102] Thus, in one exemplary embodiment of the present disclosure, the solid fuel may be guided into the storage vehicle 10 using the second transfer path spaced below the first transfer path so as to be distinguished from the first transfer path used as the charging path of the mixed-law material. Thus, the mixed-raw material may be loaded easily without interfered by the solid fuel.

[0103] Meanwhile, the process of guiding the solid fuel 92 into the the storage vehicle 10 may include the process of regulating the supply amount of the solid fuel supplied to the second transfer path by a plurality of positions in the width direction of the second transfer path, and the process of dropping the solid fuel to the second transfer path.

[0104] By this process, the charging amount of the solid fuel may be regulated by a plurality of positions in the width direction of the traveling path. For example, in one embodiment of the present disclosure, the solid fuel is regulated to be loaded more at opposite side ends in the width direction of the traveling path.

[0105] For example, when the raw material layer B is divided into five equal parts in the longitudinal direction, a strength and a fraction of the sintered ore are uniformly distributed in each equal part of the widthwise edge portion. Thus, in one exemplary embodiment of the present disclosure, the raw material layer B may be divided into five equal parts in the longitudinal direction so that more solid fuel is loaded to each equal part of the edge portion in the width direction.

[0106] On the other hand, the surface of the anthracite is hydrophobic compared to that of the fine coke, thus the anthracite has a low water retention ability. Further, the anthracite has a high machining rate compared to the fine coke, because the fine coke is subjected to the process of carbonization at high temperature, compared with the anthracite whose particle size is regulated by simple crushing. Further, the fine coke has more fixed carbon than anthracite. Due to these physical and chemical properties, the combustion rate of the fine coke is faster than that of the anthracite. Thus, when the anthracite and the fine coke are loaded as the solid fuel to the raw material layer without distinguished, it is difficult to take advantage of the inherent characteristics.

[0107] Thus, in one exemplary embodiment of the present disclosure, in the process of guiding the solid fuel 92 into the inside of the storage vehicle 10, the solid fuels are classified base on the characteristics, for example, the combustion rate. Therefore, the solid fuel having a relatively high combustion rate such as the fine coke is supplied to the central portion of the relatively poorly ventilated second transfer path and obliquely dropped to the second transfer path.

[0108] Further, in the process of guiding the solid fuel 92 into the storage vehicle 10, the solid fuels are classified base on the characteristics such as the combustion rate, the solid fuel having a relatively low combustion rate such as anthracite is supplied to the edge portion of the second transfer path and obliquely dropped to the second transfer path.

[0109] Via this process, the combustion imbalance of the raw material layer B in the width direction of the traveling path may be solved.

[0110] For example, conventionally, when the firing temperature at the center of the raw material layer B is in the range of 1128 °C to 1289 °C, the widthwise ends of the raw material layer B has a firing temperature in the range of 594 °C to 1174 °C. In one exemplary embodiment of the present disclosure, this temperature deviation between the central portion and the widthwise edge portion of the raw material layer B may be significantly reduced, and the firing temperature of the widthwise edge portion of the raw material layer B may increase to be close to the firing temperature at the central portion.

[0111] Further, conventionally, the edge portion in the width direction of the raw material layer B was rapidly cooled so that the firing heat was insufficient. Thus, the collection rate from the widthwise edge portion to the sintered ore was, for example, about 64.1 %. At this time, the sintered ore strength was 45.5 %, and the fraction less than -10 mm was about 80.5 %. In one exemplary embodiment of the present disclosure, the sintered ore collection rate, the sintering strength and the fraction less than -10 mm at the widthwise edge portion of the raw material layer B are may be increased to close to the completion material sintered ore level of the central portion of the raw material layer B.

[0112] The solid fuel is guided into the storage vehicle 10, and simultaneously the mixed-raw material and the solid fuel are mixed at some regions of the second transfer path. Specifically, a portion of the mixed-raw material obliquely dropped to the first transfer path is passed through the through-hole formed penetrating the first transfer path and to be dispensed to the second transfer path side. Thereafter, the mixed-raw material dispensed to the second transfer path side is passed to some region of the second transfer path, for example the mixing-region A side, and mixed with the mixed-raw material. Thereafter, the mixture of the mixed-raw material and the solid fuel is loaded to the upper layer B2 and surface layer B3 of the raw material layer B.

[0113] Thus, in one exemplary embodiment of the present disclosure, a portion of the mixed-raw material dropped to the first transfer path is passed through the second transfer path side to be mixed with the solid fuel, and then loaded to the upper layer B2 and the surface layer B3 of the raw material layer B.

[0114] Thus, the solid fuel may be loaded to the desired charge height in the upper layer B2 and the surface layer B3 of the raw material layer B and mixed uniformly in the mixed-raw material. Particularly, it is possible to prevent the solid fuel from being loaded in a biased manner in the upper layer B2 and the surface layer B3 of the raw material layer B or being loaded locally at a predetermined position and height Thus, it is possible to prevent the raw material layer B from being irregularly combusted when the raw material layer B regulates the combustion.

[0115] Further, since a portion of the mixed-raw material 91 may be mixed with the solid fuel 92 and may be uniformly loaded to the upper layer B2 and the surface layer B3 of the raw material layer B, the combustion efficiency and the sintered ore collection rate at the upper layer B2 and the surface layer B3 of the raw material layer B may be improved. That is, the combustion heat at the upper layer B2 and the surface layer B3 of the raw material layer B may be used for sintering the raw-mixed layer 91 loaded to the upper layer B2 and the surface layer B3 of the raw material layer B.

[0116] In this connection, the mixed-raw material to be mixed with the solid fuel may be in a fine state or with a particle size of 3 mm to 50 mm. The particle size of the mixed-raw material that is mixed into the solid fuel may be regulated by regulating the size and the position of the roll gap g of the second charging chute 340.

[0117] On the other hand, the process of mixing the mixed-raw material 91 and the solid fuel 92 at some regions of the second transfer path includes a process of regulating the dispense amount of the mixed-raw material dispensed to the second transfer path side, and dispensing a portion of the mixed-raw material to the second transfer path side.

[0118] Thus, by regulating the dispense amount of the mixed-raw material guided to the second transfer path side, the charging height of the mixture of the mixed-raw material and the solid fuel may be adjusted to a desired height. For example, increasing the dispense amount of the mixed-raw material guided to the second transfer path side, based on the bottom surface of the storage vehicle 10, it is possible to form a layer of the mixed-raw material and the solid fuel mixture at a lower height. On the other hand, when reducing the dispense amount of the mixed-raw material guided to the second transfer path side, based on the bottom surface of the storage vehicle 10, it is possible to form a layer of the mixed-raw material and the solid fuel at a larger height.

[0119] The storage vehicle 10 traveling along the traveling path is loaded the raw material layer B therein, while passing through the first charging unit 300 and the second charging unit 400. Thereafter, the storage vehicle 10 passes below the surface layer treatment unit 50. At this time, the surface layer treatment unit 50 is brought into contact with the surface of the surface layer B3 to flatten the surface layer B3 so that the surface of the surface layer B3 is uniform in the width direction.

[0120] Thereafter, the storage vehicle 10 travels along the traveling path and passes below the ignition-furnace 60. At this time, the raw material layer B is ignited and started to be sintered. Thereafter, the air is forcedly sucked to below the storage vehicle 10 to spread the flame from the upper portion of the raw material layer B to the lower portion.

[0121] The raw material layer B is manufactured as the sintered ore after sintering and cooling processed while the storage vehicle 10 travels along the traveling path. Thereafter, the storage vehicle 10 is discharged in the process of entering the returning path and may be carried to the following process, for example the iron making process.

[0122] As described above, the raw material charging apparatus and the raw material charging method according to one exemplary embodiment of the present disclosure may include the second transfer path disposed below the first transfer path, and may uniformly supply the solid fuel and the mixed-raw material into the upper layer and the surface layer of the raw material layer by using the second transfer path.

[0123] Further, the raw material charging apparatus and the raw material charging method according to one exemplary embodiment of the present disclosure may differentiate the type and the charging amount of the solid fuel in the width direction of the traveling path, and may classify the solid fuels base on the particle size of the solid fuels and differentiate the charging height of the solid fuel.

[0124] In this way, one exemplary embodiment of the present disclosure provides technical features which is to decrease the ratio of the solid fuel in the mixed-raw material, to increase the collection rate of the sintered ore at the upper layer of the raw material layer, and to significantly reduce the quality difference between the completion material sintered ores in the width direction of the traveling path. Further, one embodiment of the present disclosure provides technical features which is to solve imbalance of the amount of the heat and lack of the amount of the heat at the upper layer and the surface layer of the raw material layer. As a result, the quality deviation of the manufactured sintered ore may be minimized.

[0125] Fig. 5 is a graph showing the detailed structure of the first charging chute according to one exemplary embodiment of the present disclosure. In this connection, in the graph of Fig. 5, the horizontal axis represents the position information of the rollers constituting the first charging chute, and the vertical axis represents the roll gap information of the rollers constituting the first charging chute.

[0126] Referring to Fig. 2, and Fig. 4 to 5, the raw material charging apparatus and the raw material charging method according to one exemplary embodiment of the present disclosure are applied to the sintered ore manufacturing process to manufacture a sintered ore. Then, based on the sintered ore, the detailed structure of the apparatus is derived. Further, the detailed structure of the derived raw material charging apparatus is explained with focusing on the roller position and the roll gap size.

[0127] In this connection, the contents of the roller position and roll gap dimensions described below are intended to aid understanding of the present disclosure and are not intended to be limiting.

[0128] First, a raw material charging apparatus and a processing facility according to the embodiment of the present disclosure are provided. In this connection, a first charging chute 340 is provided in a structure in which a plurality of rollers (R) are successively arranged at upper and lower portions thereof. Thereafter, when the roll gaps (g) between the plural rollers (R) may be made different, the sintered ore manufacturing process is repeatedly performed. In this connection, the raw material layer is charged to form a very large thickness of about 800 mm or more, where 10% to 30% of the raw material layer is formed as an upper layer, and 5% to 10% is formed as a surface layer. Further, the upper ore occupies 5% to 10% of the height of the raw material layer. The process conditions are adjusted so that the effective sintered portion occupies 60% to 80% of the height of the raw material layer. Solid fuels including fine cokes and various dusts including heat sources are provided.

[0129] The manufacturing of the sintered ore was repeatedly carried out under the predetermined process conditions to obtain the results thereof. The detailed structure of the raw material charging apparatus at this time is shown in Fig. 5. In this figure, the detailed structure of the raw material charging apparatus shown in the graph is a detailed structure of the raw material charging apparatus when the collection rate and the strength in the upper layer and the surface layer of the manufactured sintered ore are relatively improved. Meanwhile, the numerical values shown in Fig. 5 are the values included in the detailed structure of the first charging chute described in the raw material charging apparatus and method according to the embodiment of the present disclosure and the variant example thereof. The technical meaning of the numerical values has been fully explained above. Thus, each numerical value shown in Figure 5 is briefly described below.

[0130] Among a plurality of rollers R forming the structure of the first charging chute 340, a roller positioned at the lowest height is referred to as a first roller R1, and a roller located adjacent to the first roller R1 and at the second lowest height is called a second roller R2. In this way, the number of the roller R is determined in order. The roller at the highest position becomes a n-th roller Rn.

[0131] In the graph in Fig. 5, the roll gap g between the rollers R is plotted for the rollers from the first roller at the lowest level to the fifteenth lowest-height roller.

[0132] In the graph of FIG. 5, the roll gaps g between the rollers R vary according to the downward inclination angle of the first charging chute 340. In this connection, it is confirmed that the collection rate and strength in the upper and surface layers of the fabricated sintered ore may be relatively improved when the size of the roll gap g decreases as the inclination angle of the arrangement of the rollers R increases from 25° to 40°.

[0133] Further, the graph in Fig. 5 shows that the size of the roll gaps decreases continuously from the roll gap $g_{1,2}$ between the first roller R1 and second roller R2 to the roll gap $g_{3,4}$ between the third roller R3 and fourth roller R4, whereas the size of the roll gaps decreases discontinuously from the roll gap $g_{3,4}$ between the third roller R3 and fourth roller R4 to the roll gap $g_{4,5}$ between the fourth roller R4 and fifth roller R5. In this connection, a rear end D of the discontinuous region C of the roll gap size acts as a reference line for distinguishing the upper and lower portions of the first charging chute (340). In the rear end D of the discontinuous region C of the roll gap size, the surface layer treatment unit 50 is installed. Thus, when the mixed-raw material dropped onto the first charging chute passes through sequentially from the roll gap $g_{1,2}$ between the first roller R1 and second roller R2 to the roll gap $g_{3,4}$ between the third roller R3 and fourth roller R4 and then is dispensed into the mixing-region A of the second charging chute 420, and when the dispense of the mixed-raw material through the roll gap $g_{4,5}$ between the fourth roller R4 and fifth roller R5 is suppressed, the manufacturing of the sintered ore proceeds smoothly. Thus, the collection rate and the strength in the upper layer and the surface layer of the manufactured sintered ore are relatively improved .

[0134] To better understand the technical features presented in the present disclosure, the following example illustrates a raw material charging apparatus according to a comparative example of the present disclosure. Further, the operation and results of the raw material charging apparatus according to a comparative example will be compared with those of the raw material charging apparatus according to a present example.

[0135] Fig. 6 is a flow chart showing the manner in which the raw material charging apparatus according to the comparative example of the present disclosure is operated.

[0136] In the comparison example of the present disclosure, a mixed-raw material charging unit 1 and a solid fuel charging unit 3 are provided above the sintering vehicle 5. The solid fuel nozzle 4 is disposed on a top face of the mixed material chute 2. In this way, the raw material charging apparatus is provided.

[0137] When the charge path of the mixed-raw material and the charge path of the solid fuel are overlapped in one path, the mixed-raw material 6 and solid fuel 7 may not be mixed, as shown in the drawing, and may form separated layers which in turn is injected into the sintering vehicle 5.

[0138] In this case, the solid fuel 7 loaded on the upper face of the mixed-raw material 6 does not contribute sufficiently to the upper layer sintering of the mixed-raw material 6 but may be consumed away via combustion. Thus, it is difficult to produce a melt in the upper portion of the mixed raw material 6. Further, the air-permeability is lowered by the layer of the solid fuel 7 being formed on the upper surface of the mixed-raw material 6. Particularly, fine solid fuels with a diameter of 1 mm or less have a relatively high combustion rate, so they burn quickly and allow formation of the combusted zone as is thinner, which may not act as a heat source. As a result, in the above-mentioned comparative example of the present disclosure, the sintered ore with the sufficient intensity in the surface layer and the upper layer of the mixed-raw material is not manufactured and thus is regarded as a returned ore. Thus, the collection rate of the completed sintered ore is relatively low.

[0139] On the other hand, in the embodiment of the present disclosure, the first transfer path and the second transfer path are provided to be spaced from each other vertically. Therefore, the mixed-raw material dropped onto the first transfer path may be partially dropped onto the second transfer path. Thus, the mixed-raw material may be easily mixed with the solid fuel, and the mixture between the mixed-raw material and solid fuel may be charged smoothly to the upper layer and surface layer of layer of the raw material layer. As a result, in the present embodiment, the mixed-raw material is sufficiently sintered in the upper layer and the surface layer of the raw material layer, and, thus, the collection rate of the completed sintered ore is considerably high.

[0140] It should be noted that the above embodiment of the present disclosure is for the explanation of the present disclosure and not for the limitation of the present disclosure. The present disclosure will be implemented in a variety of different forms within the scope of claims and equivalent technical ideas. Those skilled in the art will appreciate that the present disclosure is susceptible to various embodiments within the scope of the technical idea of the present disclosure.

Claims

1. A raw material charging apparatus comprising:

   a first hopper disposed above a storage vehicle traveling along a path;
   a first charging chute disposed below the first hopper and extending obliquely, wherein the first charging chute has a through-hole defined therethrough in a direction intersecting the extending direction of the first chute;
   a second hopper disposed above the storage vehicle and spaced apart from the first hopper; and
   a second charging chute disposed below the second hopper and the first charging chute and extending obliquely.

2. The raw material charging apparatus according to claim 1, wherein the first charging chute includes upper and lower portions, wherein at least the lower portion thereof includes at least one inclined plate extending upward-inclinedly with respect to a travelling direction of the storage vehicle,
   wherein the through-hole comprises a plurality of slits passing through the inclined plate at a plurality of positions thereof spaced apart from each other in the travelling direction of the storage vehicle.

3. The raw material charging apparatus according to claim 1, wherein the first charging chute includes upper and lower portions, wherein at least the lower portion thereof includes a plurality of rollers arranged upward-inclinedly with respect to a travelling direction of the storage vehicle,
   wherein the through-hole comprises a plurality of roller gaps defined between some or all of the rollers spaced apart from each other in the travelling direction of the storage vehicle.

4. The raw material charging apparatus according to claim 2 or 3, wherein at least the upper portion of the first charging chute extends or orients at an angle of 55° to 90° relative to the storage vehicle,
   wherein an inclination angle of the first charging chute decreases from the upper portion to the lower portion.

5. The raw material charging apparatus of claim 3, wherein the plurality of rollers arranged in least the lower portion of the first charging chute are spaced apart from each other by a spacing between 3 mm and 50 mm.

6. The raw material charging apparatus according to claim 1, wherein the second hopper is provided in plurality to be arranged in a width direction of the path.

7. The raw material charging apparatus according to claim 1, wherein a plurality of divided gates is disposed in an outlet of the second hopper, wherein the gates are arranged in a width direction of the path.

8. The raw material charging apparatus according to claim 1, wherein the second charging chute comprises at least one inclined plate,
   wherein the inclined plate extends upward-inclinedly with respect to the travelling direction of the storage vehicle.

9. The raw material charging apparatus of claim 8, wherein at least an upper portion of the second charging chute extends or orients at an angle of 55° to 90° relative to the storage vehicle,
   wherein an inclination angle of the second charging chute decreases from the upper portion to a lower portion thereof.

10. The raw material charging apparatus of claim 8, wherein the second charging chute is spaced apart from the first charging chute in the traveling direction of the storage vehicle such that a lower portion of the second charging chute faces a lower portion of the first charging chute.

11. The raw material charging apparatus of claim 1, 8, or 10, wherein the second charging chute at least partially has a mixing-region, wherein a raw material dispensed from the through-hole of the first charging chute reaches the mixing-region.

12. A raw material charging method for charging a raw material into a storage vehicle traveling along a path, the method comprising:

    dropping a raw material onto a first transfer path and guiding the raw material into the storage vehicle;
    dropping fuel onto a second transfer path and guiding the fuel into the storage vehicle; and
    mixing the raw material and fuel in at least a portion of the second transfer path.

13. The raw material charging method of claim 12, wherein dropping the raw material onto the first transfer path and guiding the raw material into the storage vehicle comprises inclinedly dropping the raw material onto the first transfer path extending upward-inclinedly with respect to a traveling direction of the storage vehicle, and guiding the raw material into the storage vehicle.

14. The raw material charging method of claim 13, wherein dropping the fuel onto the second transfer path and guiding the fuel into the storage vehicle comprises inclinedly dropping the fuel onto the second transfer path disposed below and spaced from the first path and extending upward-inclinedly with respect to the traveling direction of the storage vehicle, and guiding the fuel into the storage vehicle.

15. The raw material charging method of claim 12, wherein dropping the fuel onto the second transfer path and guiding the fuel into the storage vehicle comprises adjusting a supply amount of the fuel to be supplied to the second transfer path based on a plurality of positions in a width direction of the second transfer path, and inclinedly dropping the fuel to the second transfer path.

16. The raw material charging method of claim 12, wherein dropping the fuel onto the second transfer path and guiding the fuel into the storage vehicle comprises classifying fuels based on combustion rates thereof, and inclinedly dropping the fuel to the second transfer path such that a fuel having a relatively high combustion rate is supplied to a center of the second transfer path.

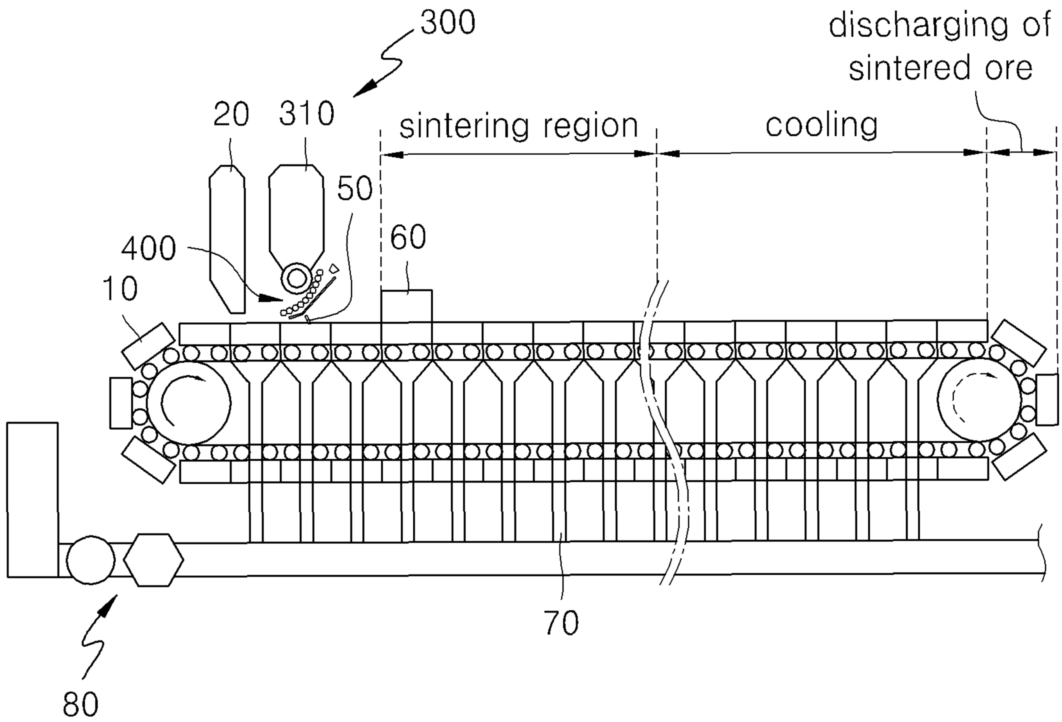
17. The raw material charging method of claim 12, wherein mixing the raw material and fuel in at least the portion of the second transfer path comprises:

dispensing, toward the second transfer path, a portion of the raw material dropped inclinedly to the first transfer path; and
guiding the raw material dispensed to the second transfer path to at least the portion of the second transfer path and mixing the raw material and the fuel on the at least the portion of the second transfer path.

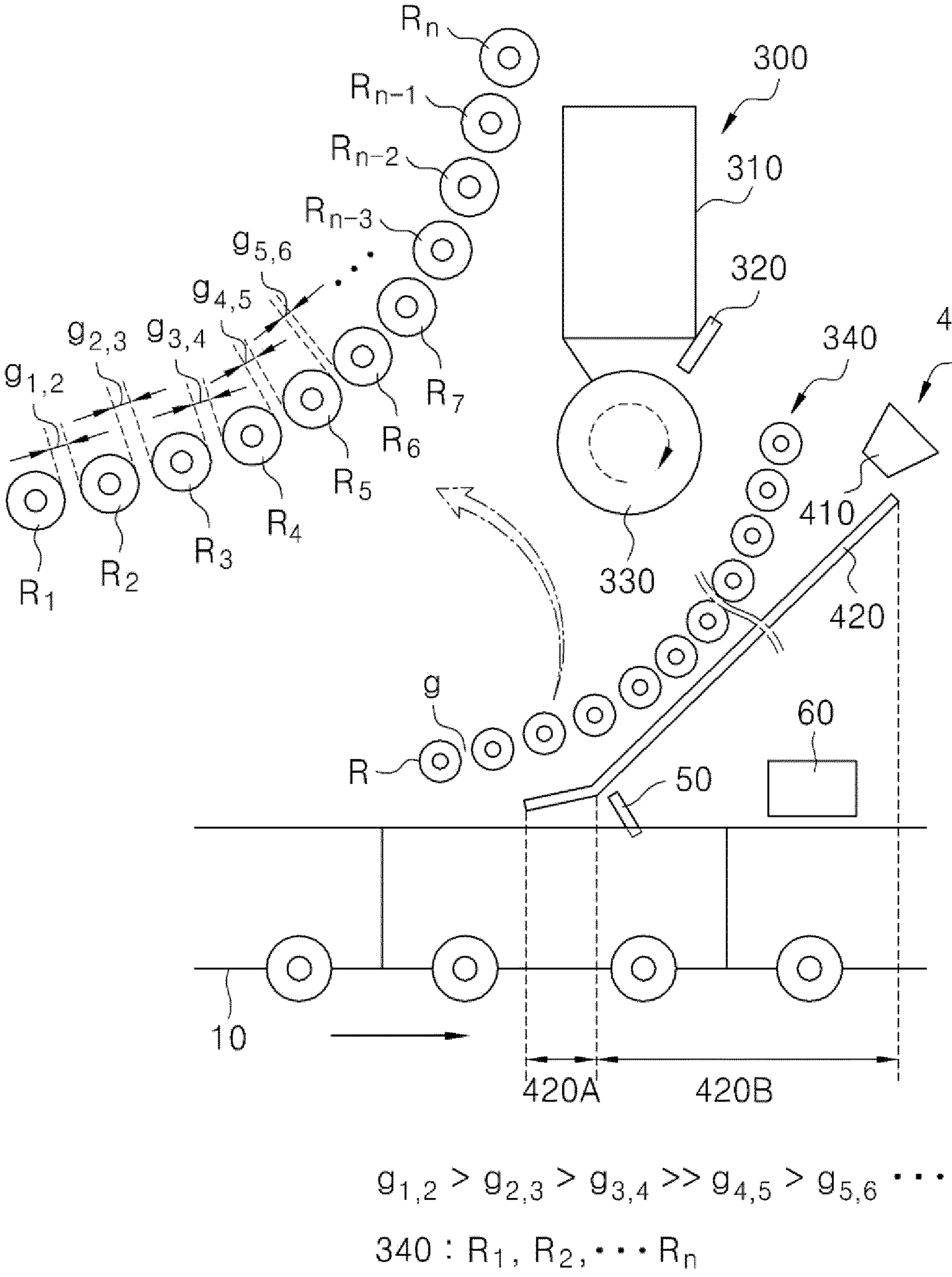
18. The raw material charging method of claim 17, wherein mixing the raw material and fuel in at least the portion of the second transfer path comprises dropping, into a through-hole defined through the first transfer path, a portion of the raw material to be inclinedly dropped to the first transfer path.

19. The raw material charging method of claim 17, wherein mixing the raw material and fuel in at least the portion of the second transfer path comprises dispensing, a portion of the raw material inclinedly dropped to the first transfer path, to the second transfer path side while adjusting a dispensed amount of the raw material to be dispensed to the second transfer path.

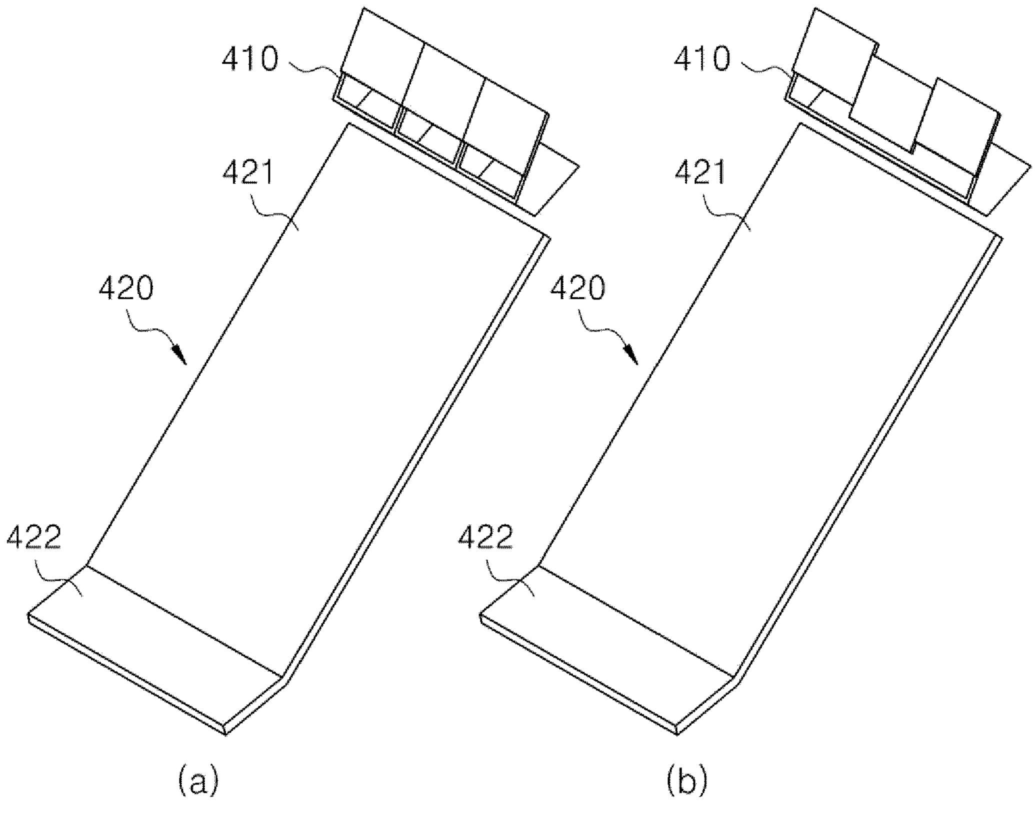
【FIG. 1】


300
discharging of
sintered ore
20
310
sintering region
cooling
50
60
400
10
70
80

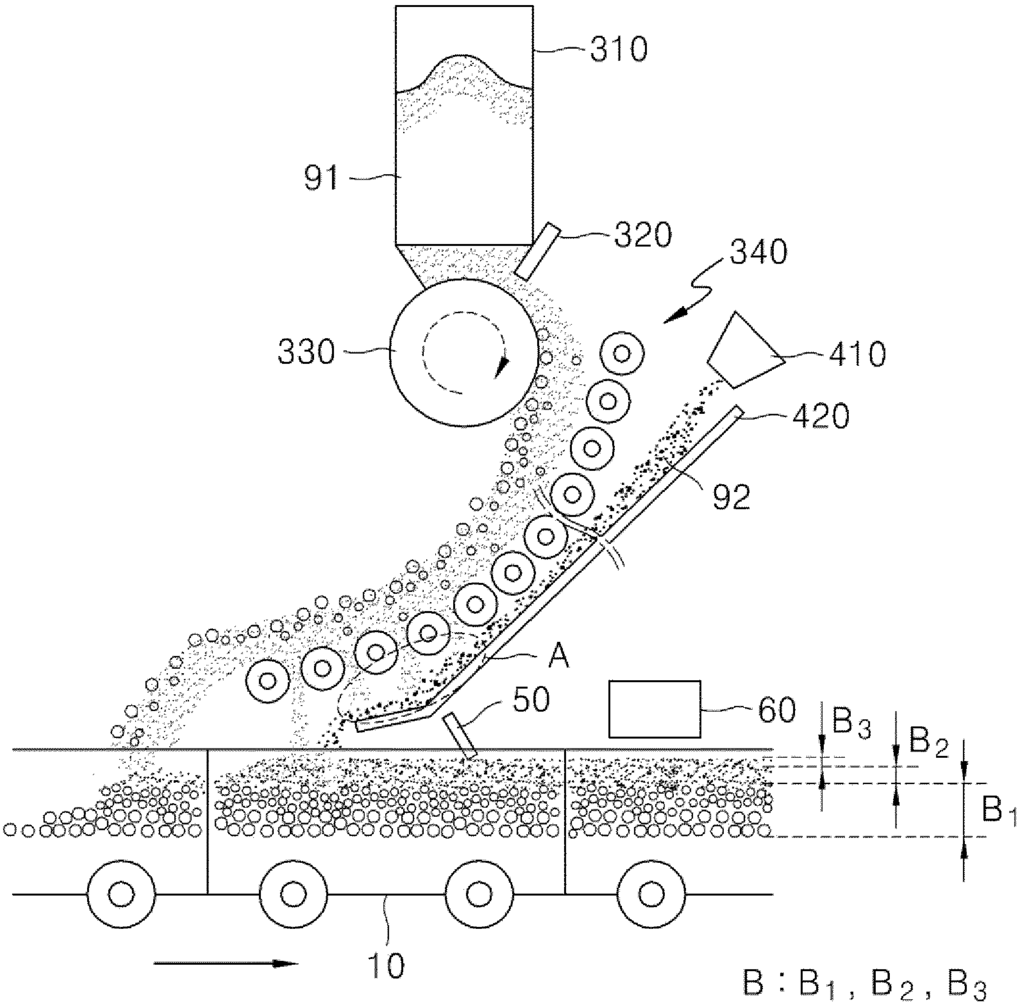
【FIG. 2】


R_n
R_{n-1}
R_{n-2}
R_{n-3}
$g_{5,6}$
$g_{4,5}$
$g_{3,4}$
$g_{2,3}$
$g_{1,2}$
R_7
R_6
R_5
R_4
R_3
R_2
R_1
300
310
320
330
340
400
410
420
g
R
50
60
10
420A
420B
$g_{1,2} > g_{2,3} > g_{3,4} >> g_{4,5} > g_{5,6} \cdots$
340 : $R_1, R_2, \cdots R_n$

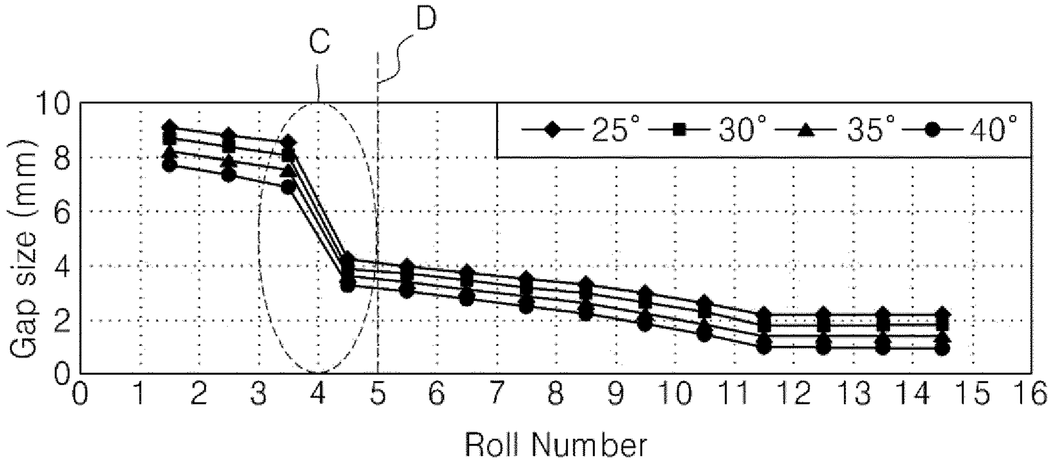
【FIG. 3】



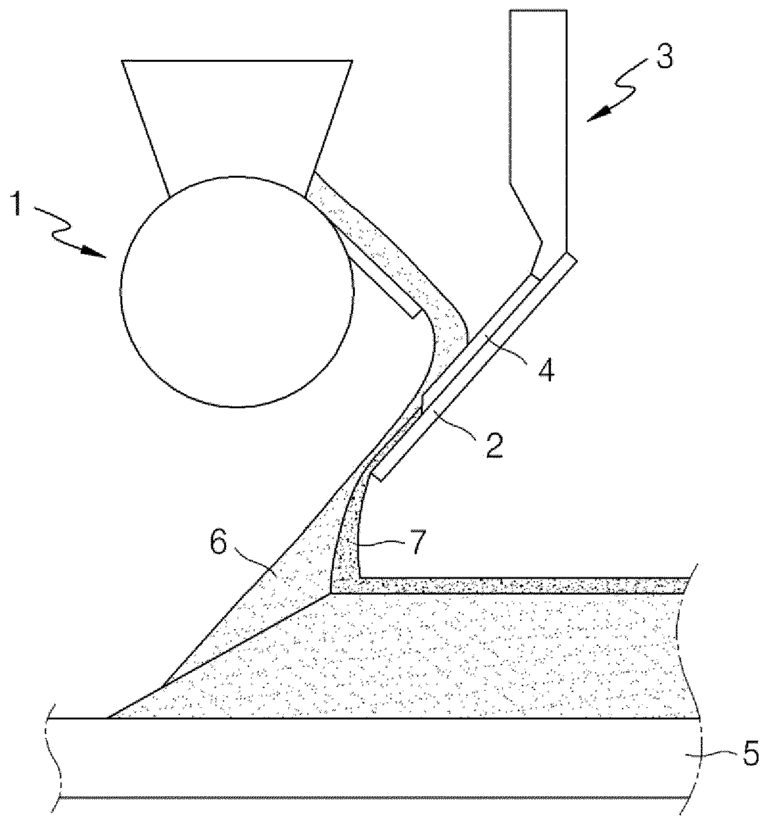
【FIG. 4】


310
91
320
340
330
410
420
92
A
50
60
B_3
B_2
B_1
10
B : B_1 , B_2 , B_3

【FIG. 5】


C
D
Gap size (mm)
Roll Number
25°
30°
35°
40°
0
2
4
6
8
10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

【FIG. 6】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2016/012592

A. CLASSIFICATION OF SUBJECT MATTER

F27D 3/00(2006.01)i, F27D 3/10(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)
F27D 3/00; C22B 1/20; C22B 1/16; F27B 21/10; F27D 3/10

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, base material, fuel, charging chute, inclined plate, roller, gate and hopper

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000-096158 A (SUMITOMO METAL IND., LTD.) 04 April 2000 See paragraphs [0015]-[0029] and figures 3, 5.	1-2,4,6-15,17-19
Y		3,5,16
Y	JP 2005-226113 A (KOBE STEEL LTD.) 25 August 2005 See paragraph [0008] and figure 2.	3,5
Y	KR 10-1462549 B1 (POSCO) 18 November 2014 See paragraphs [0024]-[0030] and figure 2.	16
A	JP 2000-144266 A (SUMITOMO METAL IND., LTD.) 26 May 2000 See claim 1 and figures 1-3.	1-19
A	KR 10-2002-0012789 A (POHANG IRON & STEEL CO., LTD.) 20 February 2002 See claims 1-2, 6 and figure 1.	1-19

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

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Date of the actual completion of the international search	Date of mailing of the international search report
02 FEBRUARY 2017 (02.02.2017)	**03 FEBRUARY 2017 (03.02.2017)**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2016/012592

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KR 10-2002-0012789 A	20/02/2002	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020040088781 A **[0007]**