(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 358 024 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
06.05.2020 Bulletin 2020/19

(21) Application number: **16851970.0**

(22) Date of filing: **07.06.2016**

(51) Int Cl.:
C22B 1/24 *(2006.01)*

(86) International application number:
PCT/KR2016/005995

(87) International publication number:
WO 2017/057822 (06.04.2017 Gazette 2017/14)

(54) APPARATUS FOR AGGLOMERATING REDUCED IRON COMPRISING A CHEEK PLATE

VORRICHTUNG ZUM AGGLOMERIEREN VON REDUZIERTEM EISEN MIT EINER WANGENPLATTE

APPAREIL POUR AGGLOMÉRER DU FER RÉDUIT COMPRENANT UNE JOUE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **02.10.2015 KR 20150139327**

(43) Date of publication of application:
08.08.2018 Bulletin 2018/32

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Description

[Technical Field]

[0001] The present invention relates to cheek plates which are installed at both sides of rollers of an agglomeration apparatus and prevent a leakage of reduced iron.

[Background Art]

[0002] Since reduced fine iron ore has high reactivity when the reduced fine iron ore is exposed to the air, there is a risk that the reduced fine iron ore is likely to be oxidized or ignited. The activity is caused by a specific surface area of the fine iron ore. The fine iron ore in the form of hematite is reduced to magnetite, such that a crystal structure thereof is greatly changed.

[0003] The hematite and the magnetite are quite different from each other in terms of a lattice structure, and as a result, the change in crystal structure causes volume expansion and a lot of internal cracks. The occurrence of cracks increases a specific surface area of the ore and increases an area of the ore which may react with gas, thereby finally assisting in increasing a reduction rate.

[0004] When a temperature of the fine iron ore in the form of limonite is raised to a temperature of 500°C or higher, crystal water present in the fine iron ore leaks to the outside such that the limonite is changed to the hematite. A space, which has been occupied by the crystal water, is exposed to the outside when the crystal water leaks, and as a result, an ore porosity and a specific surface area are increased. The reduced fine iron ore in the form of hematite and the reduced fine iron ore in the form of limonite have high reactivity because of a large specific surface area thereof, and as a result, the reduced fine iron ore in the form of hematite and the reduced fine iron ore in the form of limonite are highly likely to be ignited or reoxidized while reacting with oxygen even at room temperature.

[0005] For this reason, there are great efforts to reduce reactivity of the fine iron ore by coating the fine iron ore or performing purge with nitrogen, but it is difficult to store the fine iron ore over a long period of time or basically prevent a likelihood of ignition when transporting the fine iron ore over a long distance.

[0006] Therefore, it is necessary to reduce the specific surface area in order to reduce the reactivity of the fine iron ore, and thus a technology of agglomerating fine ore has been developed. As the agglomeration technology, there are a method of sintering fine iron ore by an oxidation reaction, and a method of plastically deforming reduced fine iron ore by physical pressure to make the fine iron ore in the form of a lump.

[0007] The method of sintering the fine iron ore by the oxidation reaction is not economically advantageous because the method reoxidizes the reduced fine ore, and as a result, a method of compacting the fine iron ore by physical pressure is mainly used.

[0008] The FINMET process, the FINEX process, and the like are performed by the process of agglomerating the reduced fine iron ore. The most efficient method of compacting the reduced fine iron ore is to supply and compress the reduced fine iron ore between two rotating rollers, and production may be adjusted by adjusting rotational speeds (rpm) of the rollers.

[0009] This apparatus is called a roller compactor. While the reduced iron is compressed between the rotating rollers, the reduced iron leaks to both sides of the rollers because an axial length of the roller is limited. Plate-shaped objects are in close contact with both sides of the rollers in order to prevent the leakage of the reduced iron, and the plate-shaped object is called a cheek plate. WO 2006/004350 A1 discloses an apparatus for manufacturing compacted irons wherein a couple of rolls compact the reduced material containing fine reduced irons discharged from a charging hopper and manufacture compacted irons, while a couple of cheek plates prevent leakage of the reduced materials containing fine reduced irons charged into the gap between the rolls.

[0010] Therefore, the reduced iron is compressed and molded between the rotating rollers and between the cheek plates which are in close contact with the rotating rollers, and in this case, gas, which fills pores between particles in the reduced iron, is also compressed in a molded product. When the molded product is unloaded from the rollers, pressure, which has been applied to the molded product, disappears, and the gas compressed in the molded product is expanded, which may cause the molded product to be destroyed.

[0011] This situation is called a spring-back, and it is necessary to allow the gas to be discharged well from the cheek plates in order to prevent the spring-back, but it is difficult to discharge the gas because of the close contact between the rollers and the cheek plates.

[DISCLOSURE]

[Technical Problem]

[0012] The present invention has been made in an effort to provide a cheek plate for an apparatus for agglomerating reduced iron, which is capable of effectively discharging gas, which is produced when processing the reduced processing the reduced iron, while increasing close contact force between the cheek plates and both sides of rollers.

[Technical Solution]

[0013] An exemplary embodiment of the present invention provides an apparatus for agglomerating reduced iron, the apparatus comprising: a pair of rollers for processing the reduced iron; and a cheek plate positioned between the pair of rollers, wherein the cheek plate comprises: a cover portion which has a fan shape and is installed at each of both sides of a pair of rollers for processing the reduced iron to prevent the reduced iron from leaking to a lateral space formed between the rollers; roller close contact portions which protrude from inner rim portions of the cover portion and are in close contact with outer portions of the rollers to maintain airtightness of the space between the rollers; and gas discharge portions which extend along plate surfaces of the roller close contact portions at a contact portion between the roller and the cheek plate, and discharge gas produced when processing the reduced iron, wherein the gas discharge portion includes one or more gas guide grooves which guide the produced gas to the outside from the roller.

[0014] The roller close contact portions may be formed in a pair to be symmetrical to each other so that the roller close contact portions are in close contact with the rollers.

[0015] The roller close contact portions may have a V shape protruding in a circumferential direction of the rollers. The gas discharge portion may include one or more gas guide grooves which guide the produced gas to the outside from the roller.

[0016] The gas guide groove may extend along a surface of the roller close contact portion.

[0017] The gas discharge portion may further include one or more gas discharge grooves which are formed in a horizontal direction with respect to a close contact surface of the roller close contact portion and discharge gas.

[0018] The one or more gas discharge grooves may be formed at predetermined intervals in the horizontal direction with respect to the gas guide groove.

[0019] The gas discharge groove and the gas guide groove may intersect each other.

[0020] An internal cross-sectional shape of each of the gas discharge groove and the gas guide groove may be any one of triangular, quadrangular, and semi-circular shapes.

[0021] The roller close contact portion may have a concave-convex portion in which a groove portion and a protruding portion are alternately formed by the gas guide groove.

[0022] The protruding portion of the concave-convex portion may have a conical shape.

[0023] The protruding portion, which is in close contact with the roller, may have a double structure including a first contact portion and a second contact portion.

[0024] The first contact portion of the protruding portion may be structured to initially come into contact with the roller.

[0025] The second contact portion of the protruding portion may be structured to come into contact with the roller after the first contact portion is abraded because of the contact with the roller.

[0026] The cheek plate may further include one or more drilled holes which are formed at positions adjacent to the gas guide grooves and guide discharge of gas.

[Advantageous Effects]

[0027] According to an exemplary embodiment of the present invention, the gas, which is produced when processing reduced iron, is effectively discharged, and as a result, it is possible to solve a problem of a limitation in supplying reduced iron powder, and it is also possible to prevent a loss of reduced iron powder.

[0028] In addition, it is possible to discharge gas while increasing close contact force between the rollers and the cheek plates, and as a result, it is possible to smoothly manufacture briquettes (HCI) and improve quality of the produced briquettes.

[Description of the Drawings]

[0029]

FIG. 1 is a view schematically illustrating a cheek plate for an apparatus for agglomerating reduced iron according to an exemplary embodiment of the present invention.

FIG. 2 is a view schematically illustrating the cheek plate according to the exemplary embodiment of the present invention.

FIG. 3 is a cross-sectional view taken along line A-A in FIG. 2.

FIG. 4 is a view schematically illustrating another structure of the cheek plate according to the exemplary embodiment of the present invention.

FIG. 5 is a cross-sectional view taken along line A-A in FIG. 4.

FIG. 6 is a cross-sectional view taken along line B-B in FIG. 4.

FIG. 7 is a view schematically illustrating another structure of a gas discharge portion according to the exemplary embodiment of the present invention.

FIG. 8 is a view schematically illustrating another exemplary embodiment of the cheek plate according to the exemplary embodiment of the present invention.

FIG. 9 is a cross-sectional view taken along line A-A in FIG. 8.

[Mode for Invention]

[0030] The technical terms used below are merely for the purpose of describing a specific exemplary embodiment, and not intended to limit the present invention. Singular expressions used herein include plural expressions unless they have definitely opposite meanings. The terms "comprises" and/or "comprising" used in the specification specify particular features, regions, integers, steps, operations, elements, components, but do not preclude the presence or addition of other particular features, regions integers, steps, operations, elements, components, and/or groups thereof.

[0031] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings so that those skilled in the art to which the present invention pertains may easily carry out the exemplary embodiments. It can be easily understood by those skilled in the art to which the present invention pertains that the following exemplary embodiments may be modified to various forms without departing from the concept and the scope of the present invention. Therefore, the present invention can be implemented in various different forms, and is not limited to the exemplary embodiments described herein.

[0032] FIG. 1 is a view schematically illustrating a cheek plate for an apparatus for agglomerating reduced iron according to the exemplary embodiment of the present invention.

[0033] FIG. 2 is a view schematically illustrating the cheek plate according to the exemplary embodiment of the present invention, and FIG. 3 is a cross-sectional view taken along line A-A in FIG. 2.

[0034] As illustrated in FIGS. 1 to 3, a cheek plate 1 for an apparatus for agglomerating reduced iron is a structure that is in close contact with a lateral side of each of two rotating rollers 2 and blocks leakage of reduced iron.

[0035] The cheek plate 1 broadly includes a cover portion 10, roller close contact portions 20, and gas discharge portions 30, and serves simultaneously to prevent the reduced iron from leaking to the outside and discharge gas produced from the reduced iron to the outside in a state in which the cheek plate 1 is in close contact with the roller 2.

[0036] That is, in the cheek plate 1 for the apparatus for agglomerating reduced iron, the cover portion 10, which defines a body of the cheek plate 1 and has a fan shape, is installed at each of both sides of the pair of rollers 2 for processing the reduced iron and prevents the reduced iron from leaking to a lateral space formed between the rollers 2, and the roller close contact portions 20 protrude from inner rim portions of the cover portion 10 and are in close contact with outer portions of the rollers 2 to maintain airtightness of the space between the rollers 2.

[0037] In addition, the gas discharge portion 30 of the cheek plate 1 extends along a plate surface of the roller close contact portion 20 and discharges gas produced when processing the reduced iron.

[0038] The roller close contact portions 20 are structured to be disposed in a pair to be symmetrical to each other so that the roller close contact portions 20 are in close contact with the rollers 2. The roller close contact portions 20 have a V-shaped structure protruding in a circumferential direction of the rollers 2, and the roller close contact portion 20 of the cheek plate 1 has an arc shape having a curvature so as to be effectively in close contact with the lateral side of the rotating roller 2.

[0039] Further, the gas discharge portion 30 has one or more gas guide grooves 31 that guide the produced gas to the outside from the roller 2. The gas guide groove 31 extends along a surface of the roller close contact portion 20. The gas guide grooves 31 may be structured to be symmetrical to each other along the surfaces of the roller close contact portions 20.

[0040] That is, the gas, which is produced when compressing and molding reduced iron powder between the rollers 2, may be discharged through a portion where the roller 2 and the roller close contact portion 20 of the cheek plate 1 are in contact with each other. A contact portion between the roller 2 and the cheek plate 1 is not perfectly airtight, and as a result, a gap of several micrometers to several hundreds of nanometers is present in the contact portion, such that the gas may be discharged through the gap, but discharge resistance is increased as the contact portion is widened.

[0041] When the gas discharge portion 30 is configured by forming the multiple gas guide grooves 31 on the contact portion in order to reduce the discharge resistance, an area of the close contact portion is decreased, such that the

discharge resistance may be decreased, and the gas may be discharged along the formed gas guide grooves 31, thereby assisting in discharging the gas produced when compressing the reduced iron powder.

[0042] Therefore, it is possible to solve a problem of a limitation in supplying the reduced iron powder caused by the gas discharged from the cheek plate 1 and also prevent a loss of the reduced iron powder. Therefore, it is possible to smoothly manufacture briquettes (HCI).

[0043] In addition, a depth of the gas guide groove 31 formed in the roller close contact portion 20 may be maintained within a range from 10 mm to 40 mm. The compressed gas is discharged through the gas discharge portion 30, and an overall contact area between the roller 2 and the roller close contact portion 20 is decreased because of the gas guide groove 31 formed as described above, but close contact pressure is increased, thereby improving a sealing effect of the reduced iron.

[0044] FIG. 4 is a view schematically illustrating another structure of the cheek plate according to the exemplary embodiment of the present invention.

[0045] FIG. 5 is a cross-sectional view taken along line A-A in FIG. 4.

[0046] FIG. 6 is a cross-sectional view taken along line B-B in FIG. 4.

[0047] As illustrated in FIGS. 4 to 6, the gas discharge portion 30 may further include one or more gas discharge grooves 32 which are formed in a horizontal direction with respect to the close contact surface of the roller close contact portion 20 and discharges gas.

[0048] In addition, the one or more gas discharge grooves 32 are formed at predetermined intervals in the horizontal direction with respect to the gas guide groove 31, and the gas discharge groove 32 and the gas guide groove 31 intersect each other. An internal cross-sectional shape of each of the gas discharge groove 32 and the gas guide groove 31 may be any one of triangular, quadrangular, and semi-circular shapes.

[0049] That is, the gas discharge groove 32 may be further formed in addition to the gas discharge portion 30 in order to more effectively discharge gas from the cheek plate 1, and the gas discharge groove 32 and the gas guide groove 31 may be shaped in various shapes.

[0050] FIG. 7 is a view schematically illustrating another structure of the gas discharge portion according to the exemplary embodiment of the present invention.

[0051] As illustrated in FIG. 7, the roller close contact portion 20 has concave-convex portions in which groove portions 21 and protruding portions 22 are alternately formed by the gas guide groove 31, and the protruding portion 22 of the concave-convex portion has a conical shape. Initial abrasion is promoted as the contact area between the roller 2 and the roller close contact portion 20 is decreased, such that the roller close contact portion 20 is in closer contact with the roller, and then an abrasion rate may be decreased by increasing the contact area.

[0052] To this end, the protruding portion 22, which is in close contact with the roller 2, is formed to have a double structure including a first contact portion 22a and a second contact portion 22b. The first contact portion 22a of the protruding portion 22 is structured to initially come into contact with the roller 2, and the second contact portion 22b of the protruding portion 22 is structured to come into contact with the roller 2 after the first contact portion 22a is abraded because of the contact with the roller 2.

[0053] That is, the close contact surface of the roller close contact portion 20, which is in contact with the roller 2, has the multiple first contact portions 22a and the multiple second contact portions 22b, thereby decreasing an abrasion rate of the roller close contact portion 20.

[0054] FIG. 8 is a view schematically illustrating another exemplary embodiment of the cheek plate according to the exemplary embodiment of the present invention.

[0055] FIG. 9 is a cross-sectional view taken along line A-A in FIG. 8.

[0056] As illustrated in FIGS. 8 and 9, as another exemplary embodiment of the gas discharge portion 30, one or more drilled holes 33 capable of guiding the discharge of the gas may be further formed at positions adjacent to the gas guide grooves 31.

[0057] The multiple drilled holes 33 are formed at predetermined intervals at the periphery of the gas guide grooves 31, thereby more effectively discharging the gas produced from the reduced iron.

[0058] Therefore, the gas produced when processing the reduced iron is effectively discharged, and as a result, it is possible to solve a problem of a limitation in supplying the reduced iron powder, prevent a loss of the reduced iron powder, and discharge the gas while increasing close contact force between the roller 2 and the cheek plate 1, thereby smoothly manufacturing briquettes (HCI) and improving quality of the produced briquettes.

[0059] While the exemplary embodiment of the present invention has been illustrated and described above, various modifications and other exemplary embodiments may be implemented by those skilled in the art. It is noted that all of the modifications and other exemplary embodiments are contemplated and included in the appended claims, and do not depart from the true purpose and the scope of the present invention.

<Description of symbols>

1: Cheek plate	2: Roller
10: Cover portion	20: Roller close contact portion
21: Groove portion	22: Protruding portion
22a: First contact portion	22b: Second contact portion
30: Gas discharge portion	31: Gas guide groove
32: Gas discharge groove	33: Drilled hole

Claims

1. An apparatus for agglomerating reduced iron, the apparatus comprising:

a pair of rollers (2) for processing the reduced iron; and
a cheek plate (1) positioned between the pair of rollers (2),
wherein the cheek plate (1) comprises:
a cover portion (10) which has a fan shape and is installed at each of both sides of a pair of rollers (2) for processing the reduced iron to prevent the reduced iron from leaking to a lateral space formed between the rollers (2);
roller close contact portions (20) which protrude from inner rim portions of the cover portion (10) and are in close contact with outer portions of the rollers to maintain airtightness of the space between the rollers (2); and
gas discharge portions (30) which extend along plate surfaces of the roller close contact portions (20) at a contact portion between the roller and the cheek plate (1), and discharge gas produced when processing the reduced iron,
characterized in that:
the gas discharge portion (30) includes one or more gas guide grooves (31) which guide the produced gas to the outside from the roller (2).

2. The apparatus of claim 1, wherein:
the roller close contact portions (20) are formed in a pair to be symmetrical to each other so that the roller close contact portions (20) are in close contact with the rollers (2).

3. The apparatus of claim 1, wherein:
the roller close contact portions (20) have a V shape protruding in a circumferential direction of the rollers (2).

4. The apparatus of claim 1, wherein:
the gas guide groove (31) extends along a surface of the roller close contact portion (20).

5. The apparatus of claim 1, wherein:
the gas discharge portion (30) further includes one or more gas discharge grooves (32) which are formed in a horizontal direction with respect to a close contact surface of the roller close contact portion (20) and discharge gas.

6. The apparatus of claim 5, wherein:
the one or more gas discharge grooves (32) are formed at predetermined intervals in the horizontal direction with respect to the gas guide groove (31).

7. The apparatus of claim 6, wherein:
the gas discharge groove (32) and the gas guide groove (31) intersect each other.

8. The apparatus of claim 6, wherein:
an internal cross-sectional shape of each of the gas discharge groove (32) and the gas guide groove (31) is any one of triangular, quadrangular, and semi-circular shapes.

9. The apparatus of claim 1, wherein:
the roller close contact portion (20) has a concave-convex portion in which a groove portion (21) and a protruding portion (22) are alternately formed by the gas guide groove (31).

10. The apparatus of claim 9, wherein:
the protruding portion (22) of the concave-convex portion has a conical shape.

11. The apparatus of claim 9, wherein:
the protruding portion (22), which is in close contact with the roller (2), has a double structure including a first contact portion (22a) and a second contact portion.

12. The apparatus of claim 11, wherein:
the first contact portion (22a) of the protruding portion (22) is structured to initially come into contact with the roller (2).

13. The apparatus of claim 11, wherein:
the second contact portion of the protruding portion (22) is structured to come into contact with the roller (2) after the first contact portion (22a) is abraded because of the contact with the roller (2).

14. The apparatus of claim 1, further comprising:
one or more drilled holes (33) which are formed at positions adjacent to the gas guide grooves (31) and guide discharge of gas.

Patentansprüche

1. Vorrichtung zum Agglomerieren von reduziertem Eisen, wobei die Vorrichtung umfasst:

ein Paar von Walzen (2) zum Bearbeiten des reduzierten Eisens; und
eine Wangenplatte (1), die zwischen dem Paar von Walzen (2) angeordnet ist,
wobei die Wangenplatte (1) umfasst:

einen Abdeckabschnitt (10), der eine Fächerform hat und jeweils auf beiden Seiten eines Paars von Walzen (2) zum Bearbeiten des reduzierten Eisens installiert ist, um zu verhindern, dass das reduzierte Eisen in einen zwischen den Walzen (2) gebildeten seitlichen Raum austritt;
Walzenengkontaktabschnitte (20), die von inneren Randabschnitten des Abdeckabschnitts (10) vorstehen und in engem Kontakt mit Außenabschnitten der Walzen stehen, um eine Luftdichtigkeit des Raums zwischen den Walzen (2) aufrechtzuerhalten; und
Gasausleitungsabschnitte (30), die sich entlang den Plattenoberflächen der Walzenengkontaktabschnitte (20) an einem Kontaktabschnitt zwischen der Walze und der Wangenplatte (1) erstrecken und Gas ausleiten, das beim Bearbeiten des reduzierten Eisens entsteht,
dadurch gekennzeichnet, dass:
der Gasausleitungsabschnitt (30) eine oder mehrere Gasleitungsrille/n (31) aufweist, die das entstandene Gas von der Walze (2) nach außen leitet bzw. leiten.

2. Vorrichtung nach Anspruch 1, wobei:
die Walzenengkontaktabschnitte (20) in einem Paar zueinander symmetrisch so ausgebildet sind, dass die Walzenengkontaktabschnitte (20) in engem Kontakt mit den Walzen (2) stehen.

3. Vorrichtung nach Anspruch 1, wobei:
die Walzenengkontaktabschnitte (20) eine V-Form haben, die in einer Umfangsrichtung der Walzen (2) vorsteht.

4. Vorrichtung nach Anspruch 1, wobei:
sich die Gasleitungsrille (31) entlang einer Oberfläche des Walzenengkontaktabschnitts (20) erstreckt.

5. Vorrichtung nach Anspruch 1, wobei:
der Gasausleitungsabschnitt (30) darüber hinaus eine oder mehrere Gasausleitungsrille/n (32) aufweist, die in einer horizontalen Richtung im Hinblick auf eine Engkontaktfläche des Walzenengkontaktabschnitts (20) ausgebildet ist bzw. sind und Gas ausleitet bzw. ausleiten.

6. Vorrichtung nach Anspruch 5, wobei:
die eine oder die mehreren Gasausleitungsrille/n (32) in vorbestimmten Abständen in der horizontalen Richtung um Hinblick auf die Gasleitungsrille (31) ausgebildet ist bzw. sind.

7. Vorrichtung nach Anspruch 6, wobei:
die Gasausleitungsrille (32) und die Gasleitungsrille (31) einander schneiden.

8. Vorrichtung nach Anspruch 6, wobei:
die Innenquerschnittsform jeweils der Gasausleitungsrille (32) und der Gasleitungsrille (31) irgendeine von dreieckigen, quadratischen und halbkreisförmigen Formen ist.

9. Vorrichtung nach Anspruch 1, wobei:
der Walzenengkontaktabschnitt (20) einen konkav-konvexen Abschnitt hat, in dem ein Rillenabschnitt (21) und ein vorstehender Abschnitt (22) abwechselnd durch die Gasleitungsrille (31) gebildet sind.

10. Vorrichtung nach Anspruch 9, wobei:
der vorstehende Abschnitt (22) des konkav-konvexen Abschnitts eine konische Form hat.

11. Vorrichtung nach Anspruch 9, wobei:
der vorstehende Abschnitt (22), der in engem Kontakt mit der Walze (2) steht, eine Doppelstruktur hat, die einen ersten Kontaktabschnitt (22a) und einen zweiten Kontaktabschnitt aufweist.

12. Vorrichtung nach Anspruch 11, wobei:
der erste Kontaktabschnitt (22a) des vorstehenden Abschnitts (22) so strukturiert ist, dass er zuerst mit der Walze (2) in Kontakt kommt.

13. Vorrichtung nach Anspruch 11, wobei:
der zweite Kontaktabschnitt des vorstehenden Abschnitts (22) so strukturiert ist, dass er mit der Walze (2) in Kontakt kommt, nachdem der erste Kontaktabschnitt (22a) wegen des Kontakts mit der Walze (2) abgerieben wurde.

14. Vorrichtung nach Anspruch 1, darüber hinaus umfassend:
ein Bohrloch oder mehrere Bohrlöcher (33), die an Positionen angrenzend an die Gasleitungsrillen (31) ausgebildet sind und die Ausleitung von Gas leiten.

Revendications

1. Appareil pour agglomérer du fer réduit, l'appareil comprenant :

une paire de galets (2) pour traiter le fer réduit ; et
une joue (1) positionnée entre la paire de galets (2),
sachant que la joue (1) comprend :

une partie couvercle (10) qui a une forme d'éventail et est installée de chacun des deux côtés d'une paire de galets (2) pour traiter le fer réduit afin d'empêcher le fer réduit de s'échapper vers un espace latéral formé entre les galets (2) ;
des parties de contact étroit de galet (20) qui font saillie par rapport à des parties de bord intérieures de la partie couvercle (10) et sont en contact étroit avec des parties extérieures des galets pour maintenir une étanchéité à l'air de l'espace entre les galets (2) ; et
des parties d'évacuation de gaz (30) qui s'étendent le long de surfaces de plaque des parties de contact étroit de galet (20) au niveau d'une partie de contact entre le galet et la joue (1), et évacuent du gaz produit lors du traitement du fer réduit,
caractérisé en ce que :
la partie d'évacuation de gaz (30) inclut une ou plusieurs rainures de guidage de gaz (31) qui guident le gaz produit vers l'extérieur depuis le galet (2).

2. L'appareil de la revendication 1, sachant que :
les parties de contact étroit de galet (20) sont formées en paire pour être symétriques l'une à l'autre de sorte que les parties de contact étroit de galet (20) soient en contact étroit avec les galets (2).

3. L'appareil de la revendication 1, sachant que :
les parties de contact étroit de galet (20) ont une forme en V qui fait saillie dans une direction circonférentielle des

galets (2).

4. L'appareil de la revendication 1, sachant que :
la rainure de guidage de gaz (31) s'étend le long d'une surface de la partie de contact étroit de galet (20).

5. L'appareil de la revendication 1, sachant que :
la partie d'évacuation de gaz (30) inclut en outre une ou plusieurs rainures d'évacuation de gaz (32) qui sont formées dans une direction horizontale par rapport à une surface de contact étroit de la partie de contact étroit de galet (20) et évacuent du gaz.

6. L'appareil de la revendication 5, sachant que :
l'une ou les plusieurs rainures d'évacuation de gaz (32) sont formées à des intervalles prédéterminés dans la direction horizontale par rapport à la rainure de guidage de gaz (31).

7. L'appareil de la revendication 6, sachant que :
la rainure d'évacuation de gaz (32) et la rainure de guidage de gaz (31) se croisent l'une l'autre.

8. L'appareil de la revendication 6, sachant que :
une forme de section transversale interne de chacune de la rainure d'évacuation de gaz (32) et de la rainure de guidage de gaz (31) est l'une quelconque parmi une forme triangulaire, quadrangulaire, et semicirculaire.

9. L'appareil de la revendication 1, sachant que :
la partie de contact étroit de galet (20) comporte une partie concave-convexe dans laquelle une partie rainure (21) et une partie en saillie (22) sont formées en alternance par la rainure de guidage de gaz (31).

10. L'appareil de la revendication 9, sachant que :
la partie en saillie (22) de la partie concave-convexe a une forme conique.

11. L'appareil de la revendication 9, sachant que :
la partie en saillie (22), qui est en contact étroit avec le galet (2), a une structure double incluant une première partie de contact (22a) et une deuxième partie de contact.

12. L'appareil de la revendication 11, sachant que :
la première partie de contact (22a) de la partie en saillie (22) est structurée pour entrer initialement en contact avec le galet (2).

13. L'appareil de la revendication 11, sachant que :
la deuxième partie de contact de la partie en saillie (22) est structurée pour entrer en contact avec le galet (2) après que la première partie de contact (22a) soit abrasée en raison du contact avec le galet (2).

14. L'appareil de la revendication 11, comprenant en outre :
un ou plusieurs trous forés (33) qui sont formés dans des positions adjacentes aux rainures de guidage de gaz (31) et guident l'évacuation de gaz.

FIG. 1

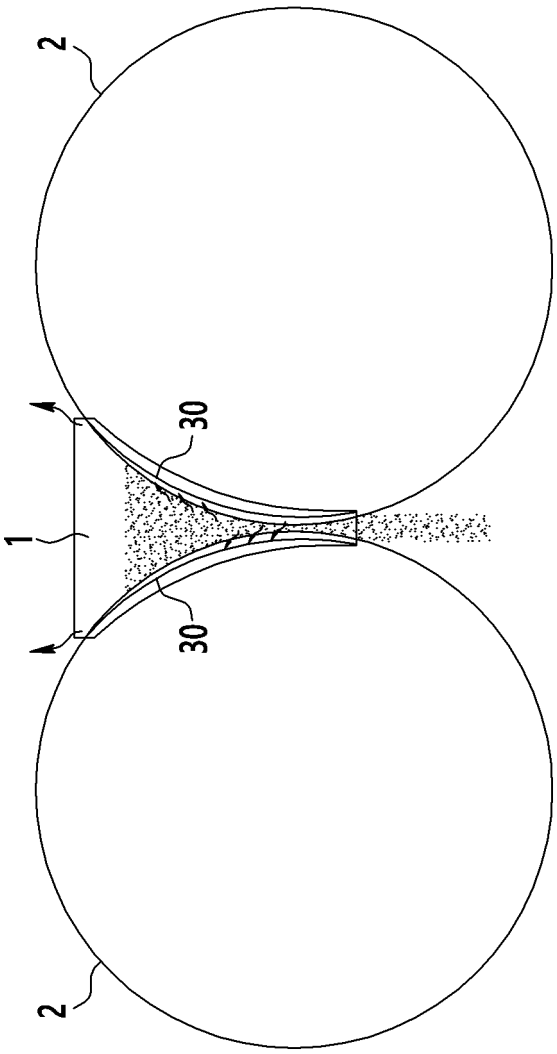


FIG. 2

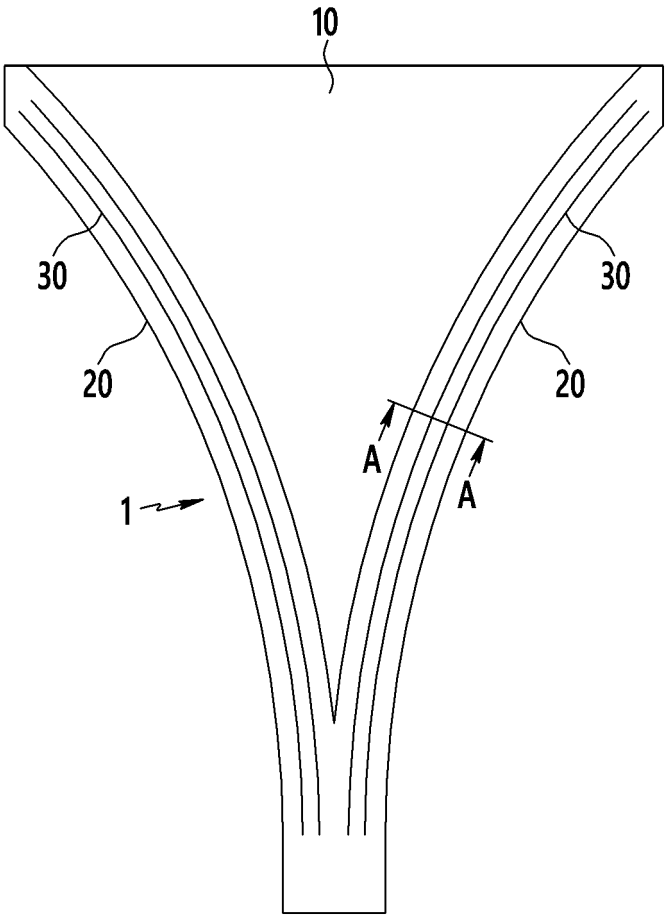


FIG. 3

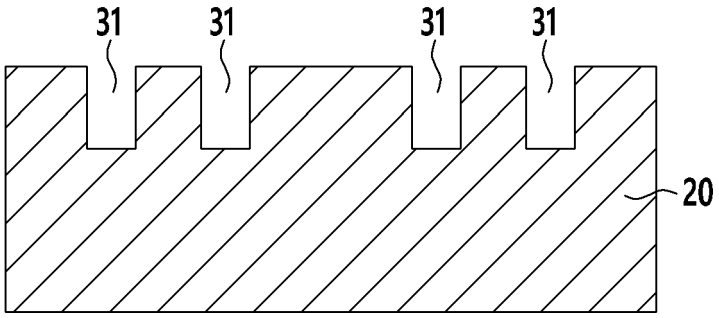


FIG. 4

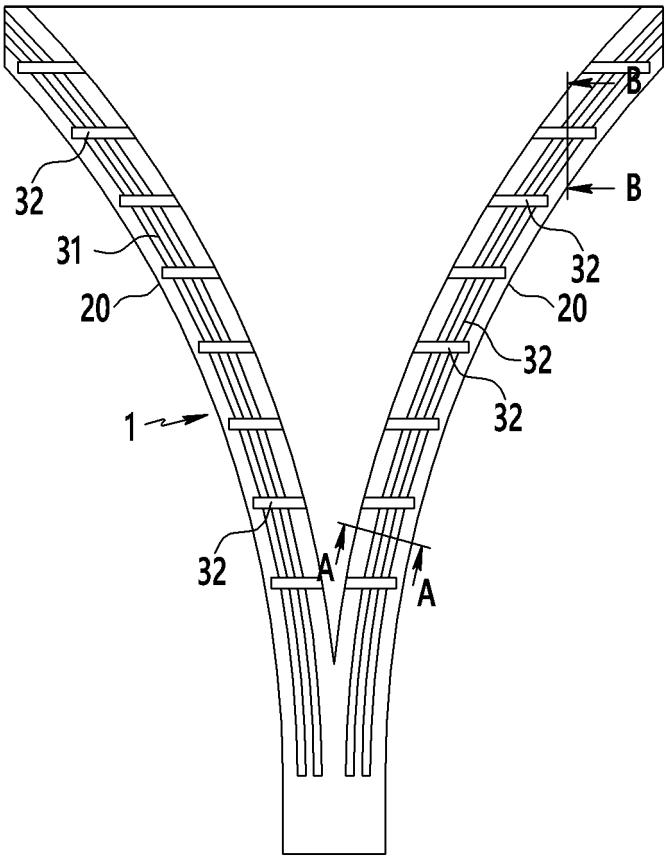


FIG. 5

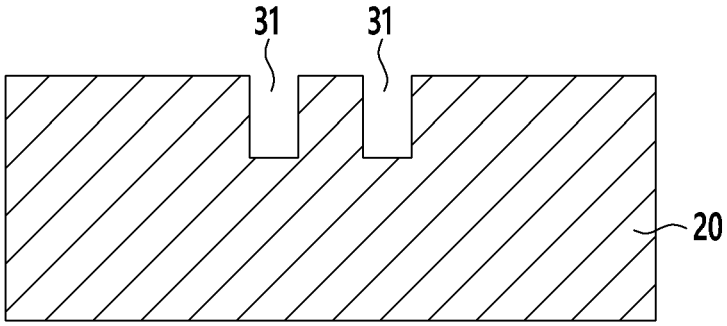


FIG. 6

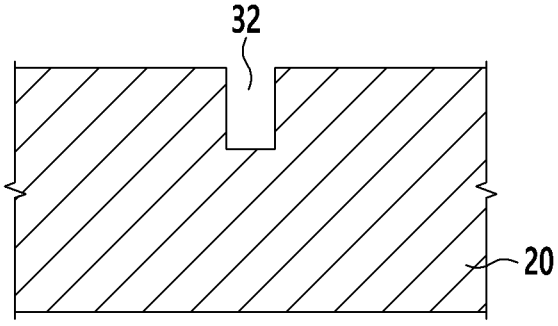


FIG. 7

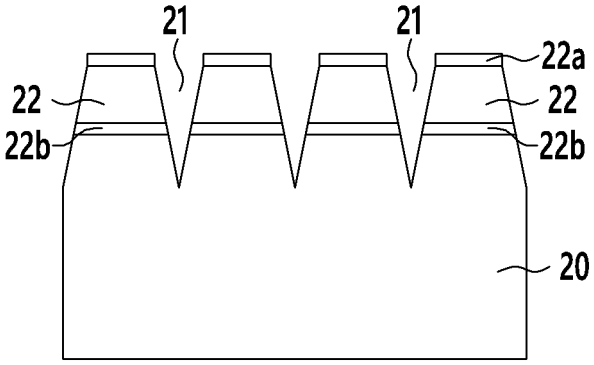


FIG. 8

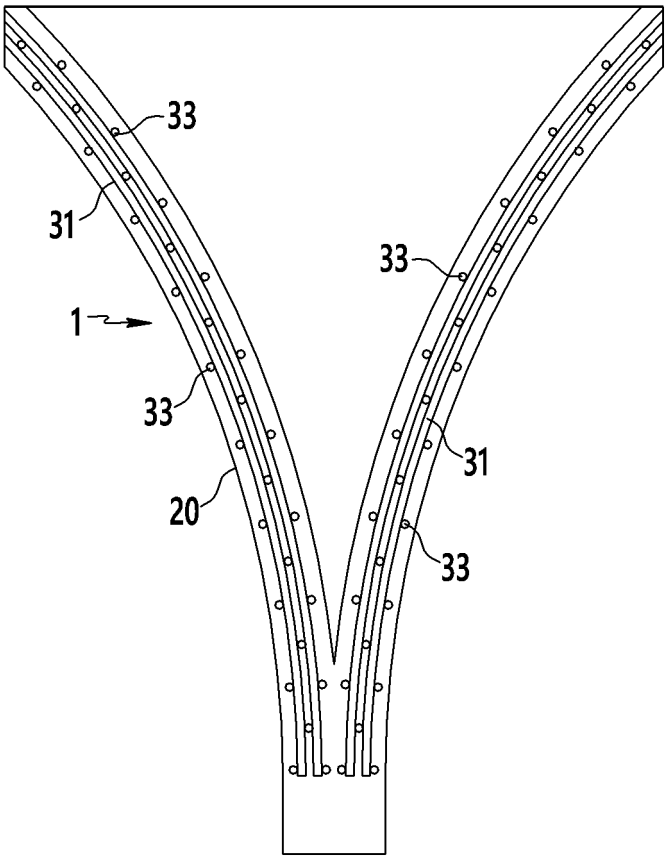
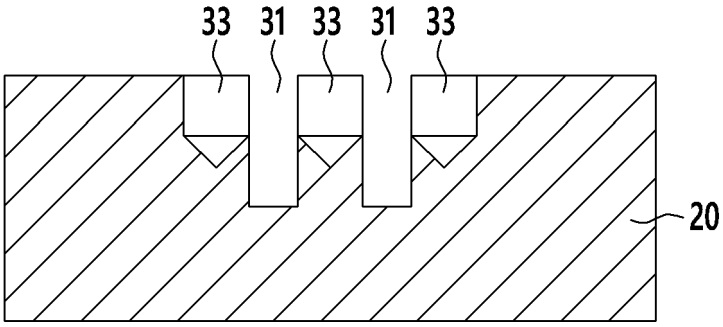


FIG. 9



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Patent documents cited in the description

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