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(54) Title: SINTERSTRAND-CHARGING DEVICE

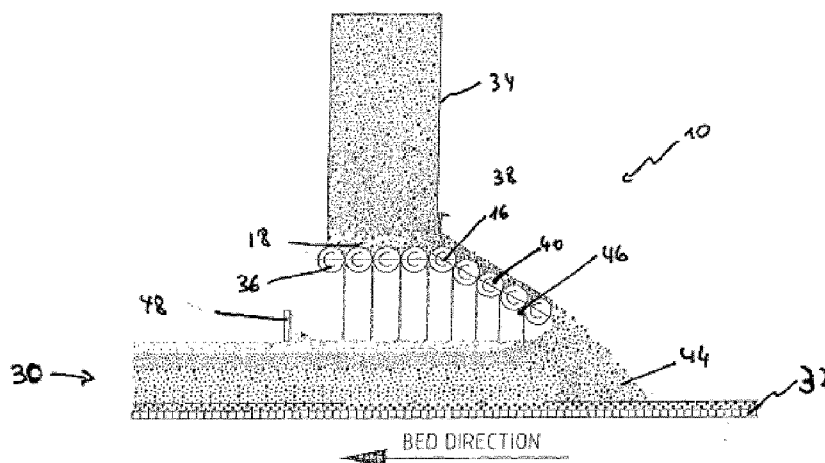


Fig. 2

(57) Abstract: The present invention concerns a sinterstrand-charging device for charging a sinter mixture on a belt-type sintering machine comprising an extraction device for feeding the material to be sintered onto a sintering belt, wherein a feeding container is provided with a discharge opening for the material to be sintered. Said extraction device machine comprises: • a plurality of extraction rollers, which cover between 5% and 50% of the discharge opening, • a plurality of segregation rollers for segregating and depositing said extracted material to be sintered onto the sintering belt, wherein said extraction rollers are situated in a first plane and said segregation rollers are situated in a second plane.

SINTERSTRAND-CHARGING DEVICE

Technical field

[0001] The present invention generally relates to a sinterstrand-charging device for charging a sinter mixture, i.e. a fine ore mixture and a fuel on a belt-type sintering machine so as to form a sinter bed.

Background Art

[0002] Making fine ores lumpy for use in blast furnaces is called sintering or agglomeration. Sintering is thus the agglomeration of fine-grained iron ores for blast furnace burden preparation. In a conventional sintering plant, a sinter mixture, i.e. a fine ore mixture and a fuel, is placed on a sintering belt, i.e. a conveyor belt designed as a grating. The sintering belt with the mixture, also called a sintering bed, passes over a large number of suction boxes. Air is drawn through the sintering bed via these suction boxes. An ignition hood located above the first suction box ignites the sinter mix. The combustion spreads from the top downwards through the sintering bed during passage over the other suction boxes. During combustion, the admixed fuel produces a temperature, which is just sufficient to soften the fine ore at its surface, so that the fine ore mixture agglomerates to form a sinter cake. The combustion gases produced during sintering are exhausted with the combustion air via the suction boxes. The sintering plants are usually equipped in such a way that the suction boxes are connected via an electrostatic filter (in some cases also a fabric filter) to a fan, which generates the required negative pressure under the sintering belt to draw the required combustion air through the sintering bed. The cleaned gas mixture is then discharged by the fan into the atmosphere via a chimneystack.

[0003] For economic reasons, the iron and steel industry is striving to keep increasing the productivity of sintering plants. For this purpose it is preferred - as one of several possibilities - to increase the thickness of the layer that is fed onto the sintering belt. This can only be achieved without reducing productivity if the

permeability of the mixture is improved and/or the negative pressure in the suction system is increased.

[0004] It is state of the art to equip existing feeding devices with classifying devices, which separate a large part of the coarse particles out of the raw sintering mixture and concentrate them in the lower region of the fed layer.

[0005] It is further known, in the case of a feeding device, to design the drum chute (segregation plate) in such a way that the mixing material segregation is achieved by the feeding operation. However, this does not allow great layer thicknesses to be achieved at the same time as good segregation.

[0006] JP 2001-227872 discloses a two-layer feed of sintering material via a feeding bunker with two discharge openings. The sintering material is charged into the feeding bunker in such a way that segregation occurs in it. Each of the discharge openings is assigned a complete system comprising a feeding device, a feeding drum and a drum chute. Disadvantages of this variant are the high maintenance costs, and also a complicated and fault-susceptible control system for two feeding drums.

[0007] US 2008/0108006 A1 describes a feeding device for a belt-type sintering machine, with a feeding container for receiving the material to be sintered, with a conveying device for filling the feeding container with material to be sintered, with a feeding drum and a drum chute for feeding the material to be sintered onto the sintering belt, wherein the feeding container is provided with two discharge openings for the material to be sintered and the first discharge opening is connected to the feeding drum and the second discharge opening is connected to a feeding chute for feeding the material to be sintered onto the sintering belt, the conveying device being arranged in such a way that it has a point of impingement of the material to be sintered which lies in the half of the feeding container that is located over the first discharge opening and the second discharge opening is arranged in the region of the slope formed by the material to be sintered.

[0008] However, these systems are rather complex and therefore expensive to build and to maintain.

Technical problem

[0009] Accordingly, it is an object of the present invention to provide a sinterstrand-charging device that achieves a good segregation and with an extraction device which is easy to maintain.

[0010] This object is achieved by a sinterstrand-charging device as claimed in claim 1.

General Description of the Invention

[0011] The present invention generally relates to a sinterstrand-charging device for charging a sinter mixture on a belt-type sintering machine so as to form a sinter bed as set out in the pre-characterizing portion of claim 1.

[0012] In order to overcome the above-mentioned problem, the present invention proposes a sinterstrand-charging device for charging a sinter mixture on a belt-type sintering machine so as to form a sinter bed, said charging device comprising a feeding container for receiving the material to be sintered, a conveying device for filling the feeding container with material to be sintered, an extraction device for feeding the material to be sintered onto the sintering belt, wherein the feeding container is provided with a discharge opening for the material to be sintered. Said extraction device comprises a plurality of extraction rollers, situated underneath the discharge opening, for extracting said material to be sintered from the feeding container, said extraction rollers are rotating around a central axis and each have a diameter, which covers between 5 and 50% of the discharge opening, a plurality of segregation rollers for segregating and depositing said extracted material to be sintered onto the sintering belt, wherein said extraction rollers are situated in a first plane and said segregation rollers are situated in a second plane.

[0013] The above described sinterstrand-charging device for charging a sinter mixture on a belt-type sintering machine is less complex and easier to maintain than the described prior art devices and nevertheless achieves a good segregation of the materials to be charged on the sinter belt.

[0014] A first notable difference with the prior art is that no feeder drum is used in the present invention. Instead of the feeder drum, it is proposed to use a series of extraction rollers, which rotate around their central axis.

[0015] The axis of the extraction rollers and said segregation rollers are perpendicular to the direction of advancement of the sintering belt

[0016] These extraction rollers are placed in a plane underneath the discharge opening of the feeding container and, through their rotation, transport the material to be sintered out of the feeding container through an adjustable discharge gate. These rollers have a much smaller diameter than the traditional feeder drum so that between two and twenty extraction rollers can be placed underneath the discharge opening of the feeder container.

[0017] Since there is a gap between each of the rollers, finer grained material falls through these gaps on top of the sinter bed whereas coarser material is transported over the entire length of the extraction rollers and segregation rollers and is deposited in the lower region of the sinter bed. Indeed, since the sinter belt advances underneath the sinterstrand-charging device, the coarse material is deposited first so as to form the lower regions of the sinter bed. Since the sinter bed is already partially formed when the sinter bed advances underneath the rollers, the finer grained material falling between the gaps of the rollers, falls on top the coarse material already charged on the sinter bed. A good segregation of the material is thus reliably achieved.

[0018] Said extraction rollers each have a diameter, which covers preferably between 10% and 45% of the discharge opening, more preferably between 15% and 40% of the discharge opening, most preferably between 18% and 35% of the discharge opening.

[0019] Said extraction rollers and/or said segregation rollers may have minimum diameter of at least 50 mm. These rollers preferably have a maximum diameter of less than 500 mm. Preferably, the diameter said extraction rollers and/or said segregation rollers is at least 100 mm and less than 350 mm.

[0020] Preferably, all the extraction rollers have the same diameter. Preferably, all the segregation rollers have the same diameter. More preferably all the rollers have the same diameter.

[0021] In a preferred embodiment, the diameter of the extraction rollers is between 1,2 and 5 times greater than the diameter of the segregation rollers.

[0022] The discharge opening preferably measures between 800 mm and 2000 mm. This means that 11 rollers of a diameter of about 80 mm in diameter with a gap of about 4 mm between the rollers can be placed underneath a discharge opening of about 800 mm knowing that the axes of the first roller is substantially aligned with the first wall of the feeding container.

[0023] The rotational speed of the extraction rollers and said segregation rollers is individually adjustable and is preferably less than 100 rpm but at least 5 rpm, preferably, the rotational speed of the extraction rollers and said segregation rollers less than 80 rpm but at least 10 rpm, more preferably less than 60 rpm but at least 12 rpm and most preferably than less 50 rpm but at least 15 rpm. The extraction rollers respectively the segregation rollers may be driven by a single motor or individual electrical motors may drive each roller. In the latter case, the speed of the rollers is individually adjustable.

[0024] In a preferred embodiment, the rotational speed of the extraction rollers is lower than the rotational speed of the segregation rollers.

[0025] If the rotational speed of the last extraction roller n_x at the discharge gate of the feeding container is 100%, the rotational speed of the rollers n_{x-1} , n_{x-2} etc diminishes. In a preferred embodiment, the rotational speed of n_1 (the extraction roller on the opposite side of the discharge gate is about 10 %, preferably about 6% and most preferably 2% of the rotational speed of n_x . The difference of rotational speed between one roller n_{n+1} is about 5%, preferably about 8% and most preferably about 10 % higher than the rotational speed of the roller n_n , next to it.

[0026] The plane of the extraction rollers preferably forms an angle of between 0 and +45 degrees with the horizontal. More preferably, the angle of the extraction rolls with the horizontal is between 0 degrees and 20 degrees.

[0027] The plane of the segregation rollers preferably forms an angle of between 0 and -70 degrees with the horizontal. More preferably, the angle of the segregation rolls with the horizontal is between 0 degrees and -40 degrees.

[0028] According to a preferred embodiment, the extraction rollers and the segregation rollers are in the same plane, i.e. the first and the second plane are identical.

[0029] Preferably, there is a gap of at least 1 mm between each of the rollers. This gap may be the same for all the extraction rollers respectively the same for all the segregation rollers. In a preferred embodiment, the gap between the extraction rollers may be individually adjusted. The gap between each roller is preferably not larger than 10 mm. More preferably, the gap between each roller is preferably is between 2 and 8 mm.

[0030] A further advantage of the present charging device is that a different form of feeder container may be used. Indeed with the prior art feeder drum, feeder containers with a funnel shape lower part must be used whereas in the present case, straight wall feeder containers may be used. Because of the extraction rollers, the feeder container will be emptied "en masse" which means that the upper level of the material in the feeder container will remain substantially level: no funnels will be formed in the material during the emptying of the feeder container with the extraction rollers. As a consequence, larger capacity feeder containers may be used or the device can be made more compact.

[0031] The risk that accretions will be formed inside the feeder container is minimized since a feeder container with straight walls may be used,

[0032] As will be understood, while not being limited thereto, the proposed installation is especially suitable for a blast furnace plant as well as for a non ferrous metal processing plant.

Brief Description of the Drawings

[0033] Further details and advantages of the present invention will be apparent from the following detailed description of several not limiting embodiments with reference to the attached drawings, wherein:

FIG. 1 is a schematic view of a first prior art sinterstrand-charging device.

FIG. 2 illustrates a first embodiment of a sinterstrand-charging device according to the invention,

FIG. 3 illustrates a second embodiment of a sinterstrand-charging device according to the invention,

Fig. 3A shows the extraction rollers of Fig. 3 in more detail,

FIG. 4 illustrates a third embodiment of a sinterstrand-charging device according to the invention,

FIG. 5 illustrates a fourth embodiment of a sinterstrand-charging device according to the invention,

[0034] Identical reference signs are used throughout the drawings to identify structurally or functionally similar elements.

Description of Preferred Embodiments

[0035] A first traditional design of a sinterstrand-charging device 10 is depicted at Fig. 1. Below a hopper 12 (silo, feeding container) is installed a relatively large feeder drum 14, which rotates around its central axis 16 and thereby extracts material from the hopper 12. It has to be noted that in this type of charging devices 10 only one feeder drum 14 is used per hopper 12 and that the diameter of said feeder drum 14 is much larger than the discharge opening 18 of the hopper 12. The extracted material 20 falls on a segregation plate 22, which is situated below the feeder drum 14 and serves to deviate the fall of the extracted material 20 before it drops on the sintering belt (not shown).

[0036] A similar sinterstrand-charging device is known from JP 2005 226113 A. Below a hopper 12 (silo, feeding container) is installed a single, relatively large

feeder drum, which rotates around its central axis and thereby extracts material from the hopper. The extracted material falls – in one embodiment as depicted in Fig. 1 of JP 2005 226113 A on a segregation plate, which is situated below the feeder drum and serves to deviate the fall of the extracted material before it drops on the sintering belt. In a second embodiment, as depicted in Fig. 2 of JP 2005 226113 A, the extracted material falls on a series of segregation rollers, which are situated below the feeder drum and serve to deviate the fall of the extracted material and to segregate the material according to its size before it drops on the sintering belt. The circumferential speed of each roller or roller group is controlled so that the speed on the upstream side is higher than the speed on the downstream side.

[0037] These traditional devices have several drawbacks:

1. The diameter of the hopper 12 is not constant over its entire height but is funnel shaped at its lower end. Because of this funnel shaped lower end 24, material tends to stick to the walls of the hopper 12 at the border region between the funnel shaped lower end and the vertical, upper part 26 of the hopper and form accretions 28 at this place. This further reduces the useful diameter of the discharge opening 18 of the hopper 12 and the throughput of material changes over time. Costly maintenance works are therefore regularly required to eliminate the accretions 28 from the hopper 12.
2. The material extracted from the hopper 12 may also stick to the feeder drum 14 which therefore must be scraped clean of any such material before a complete revolution of the feeder drum 14 has occurred. This scraping of the feeder drum 14 will cause wear and the drum must eventually be replaced or repaired.
3. The material extracted from the hopper 12 first impacts the segregation plate 22 or segregation rollers before falling on the sintering belt. If the feed contains pellets, the pellets may break during the impact on the segregation plate/rollers and therefore lead to a lower quality of the sinter bed. Accretions (not shown) may also form on the segregation plate/rollers

and especially at the point of impact, which will eventually require stopping the charging to eliminate these accretions. Costly maintenance and/or loss of performance are the consequence.

[0038] For illustrating a first embodiment of the present invention, FIG.2 shows a diagrammatic view of a belt-type sintering machine 10 with a feeding device designed for sintering feed for a blast furnace plant (the blast furnace plant not being shown). As seen in FIG. 2, a sintering belt machine is depicted under reference No 30. Above the sintering belt 32, there is a feeding container 34 for the material to be sintered, comprising a discharge opening 18 and an extraction device for feeding the material to be sintered onto the sintering belt 32.

[0039] Said extraction device comprises in this particular embodiment four extraction rollers 36, situated underneath the discharge opening 18, for extracting said material to be sintered from the feeding container 34. These extraction rollers 36 rotate around their central axis 16 and thus transport the material out of the feeding container via an adjustable discharge gate 38.

[0040] After having left the adjustable discharge gate 38, the material to be sintered is taken up by a second series of rollers, the five segregation rollers 40 and is deposited on the sintering belt 32 so as to form the sinter bed 44.

[0041] It is interesting to note that the material does not hit any segregation plate but it deposited smoothly onto the sintering belt. Thus the pellets contained in the feed will not be broken on impact so that a better quality of the sinter bed can be achieved.

[0042] Another noteworthy feature of the device is that some of the material passes vertically through the gaps 46 between the extraction rollers 36 and segregation rollers 40. This fine-grained material will thus fall on top the sinter bed 44 that has already been deposited on the sintering belt 32, which advances underneath the feeding container 34. The quantity and the grain size of the material that falls on the sinter bed 44 through the gaps 46 between the rollers 36, 40 depends on the size of gaps 46 between the rollers 36, 40, the rotational speed

the rollers 36, 40 and the relative rotational speed of the rollers 36, 40 between each other.

[0043] Another feature of the device is that the rollers 36, 40 are self-cleaning. Indeed, there is no need to install a scrapper to scrap of any attached material from the rollers since they clean themselves. Indeed any accretions formed on a roller will be removed by the rotation of an adjacent roller.

[0044] A scrapper 48, installed downstream from the feeding container 34 flattens the sinter bed 44 and scrapes of any surplus material so as to obtain a sinter bed 44 of a predetermined height and with a level surface.

[0045] Fig. 3 shows a further embodiment of a sinterstrand-charging device 10, wherein seven extraction rollers 36 are used and are numbered n_1 , n_2 , n_3 , to n_x . In this particular embodiment, the rotational speed of the extraction rollers 36 is not the same, but the extraction roller n_1 , situated at the left hand side of Fig 3 revolves slower than the roller n_2 , situated on the right side, next to it. Roller n_2 rotates slower than roller n_3 and so on, so that the rotational speed of the rollers increases from the left hand side of Fig. 3 i.e. the downstream side relative to the sinter belt to the right hands side of Fig. 3, i.e. the upstream side relative to the sinter belt. The speed of the roller $n_{n+1} \geq n_n$. This allows to evacuate the material to be sintered smoothly from the feeding the container.

[0046] In this particular embodiment as depicted on Fig. 3, the extraction rollers are situated in a first plane 50 whereas the segregation rollers are situated in a second plane 52. The first plane 50 of the extraction rollers 36 is horizontal whereas the second plane 52 of the segregation rollers 40 is at an angle of about -45° in relation to the horizontal. A particularity of this design of a sinterstrand-charging device 10 consists in the fact that the angle of the second plane 52 in which the segregation rollers 40 are situated is adjustable. As a consequence of the variation of the angle of the segregation rollers, the quality of the segregation can be influenced.

[0047] Fig. 3A shows the extraction rollers n_1 , n_2 and n_3 of Fig 3 in more detail and in particular shows the gaps D1, D2 and D3 between the rollers. The gap of

$D1 \leq D2 \leq D3$ etc. The fact that the size of the gaps may increase from the left to right side of Fig.3 i.e. from the first extraction roller and the last extraction roller close to the discharge gate allows to deposit finer grained material on the top of the sinter which travels below the feeding container from the right hand side to the left hand side. Good quality segregation on the sinter bed may thus be obtained.

[0048] In the embodiment depicted on Fig. 4, the angle of the first plane 50, i.e. the plane in which the extraction rollers 36 are situated, and the angle of the second plane 52, i.e. the plane in which the segregation rollers 40 are situated, are both adjustable and may be varied independently. A better extraction of the material from the feeding container may thus be accomplished.

[0049] In the embodiment of Fig. 5, the diameter of the extraction rollers 36 is larger than the diameter of the segregation rollers 40, whereas in the embodiments of the other Figs, the diameter of all the rollers 36, 40 are the same.

[0050] In the embodiment of Fig. 6, the first plane 50 of the extraction rollers 36 and the second plane 52 of the segregation rollers 40 are both horizontal.

[0051] In all the Figures. 2 to Fig. 6, the feeding container 34 has straight vertical walls 54 and does not require to a funnel shaped lower part as is the case in the traditional hoppers using a drum feeder. The problems with accretions that is seen in the traditional hoppers is thus avoided since in the present configuration, the feed descends "en masse" and the upper surface 56 of the feeding material in the feeding container 34 remains level.

[0052] In conclusion, it will be appreciated that the present invention not only enables an important increase in operational efficiency of a sinterstrand-charging device, especially for blast furnace and non-ferrous operations, but also permits reliable operation at lower capital and operating expenditure.

Legend:

10	Sinterstrand-charging device	32	sintering belt
12	hopper	34	feeding container
14	feeder drum	36	extraction rollers
16	central axis	38	adjustable discharge gate
18	discharge opening	40	segregation rollers
20	extracted material	44	sinter bed
22	segregation plate	46	gaps
24	funnel shaped lower end of the hopper	48	scraper
26	vertical, upper part of the hopper	50	first plane
28	accretions	52	second plane
30	sintering belt machine	54	vertical walls
		56	upper surface

Claims

1. Sinterstrand-charging device for charging a sinter mixture on a belt-type sintering machine so as to form a sinter bed, said charging device comprising a feeding container for receiving the material to be sintered, a conveying device for filling the feeding container with material to be sintered, an extraction device for feeding the material to be sintered onto the sintering belt, wherein the feeding container is provided with a discharge opening for the material to be sintered **characterized in that** the extraction device comprises:
 - a plurality of extraction rollers, situated underneath the discharge opening, for extracting said material to be sintered from the feeding container, said extraction rollers are rotating around a central axis and each have a diameter , which covers between 5% and 50% of the discharge opening,
 - a plurality of segregation rollers for segregating and depositing said extracted material to be sintered onto the sintering belt,wherein said extraction rollers are situated in a first plane and said segregation rollers are situated in a second plane.
2. The feeding device for a belt-type sintering machine as claimed in claim 1, characterized in that the axis of the extraction rollers and said segregation rollers are perpendicular to the direction of advancement of the sintering belt.
3. The feeding device for a belt-type sintering machine as claimed in any of claims 1 or 2, characterized in that said extraction rollers and said segregation rollers have diameter of at least 50 mm.
4. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that said extraction rollers and said segregation rollers have diameter of less than 500 mm.
5. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that the diameter of the extraction rollers is between 1,2 and 5 times greater than the diameter of the segregation rollers
6. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that said extraction rollers and/or said segregation rollers have rotational speed of at least 5 rpm.

7. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that said extraction rollers and/or said segregation rollers have rotational speed of less than 100 rpm.
8. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that the rotational speed of said extraction rollers and said segregation rollers is individually adjustable.
9. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that said the plane of the extraction rollers forms an angle of between 0 degrees and +45 degrees with the horizontal.
10. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that the plane of the segregation rollers forms an angle of between 0 degrees and - 70 degrees with the horizontal.
11. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that there is a gap of at least 1 mm between each of the rollers.
12. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that there is a gap of less than 10 mm between each of the rollers.
13. The feeding device for a belt-type sintering machine as claimed in claim 10, characterized in that the gap is the same for all the extraction rollers.
14. The feeding device for a belt-type sintering machine as claimed in claim 10, characterized in that the gap is the same for all the segregation rollers.
15. The feeding device for a belt-type sintering machine as claimed in any of the preceding claims, characterized in that said feeding container has vertical walls.

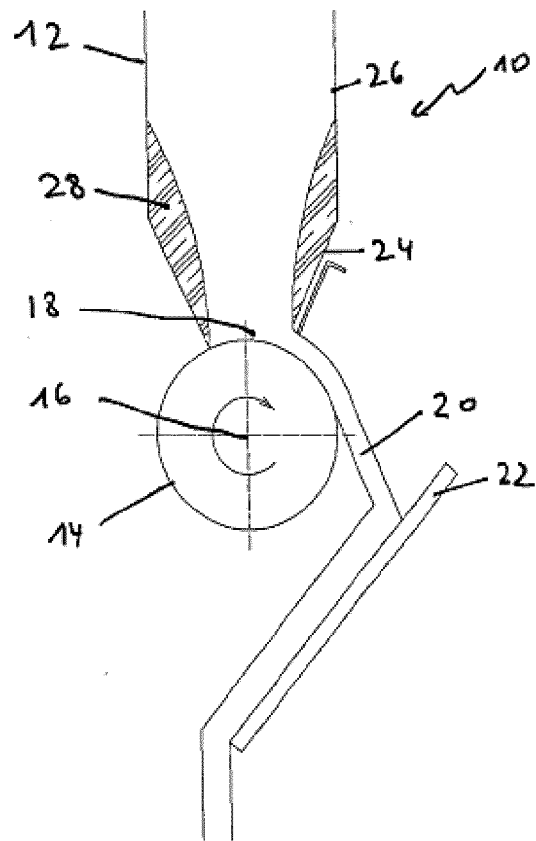


Fig. 1

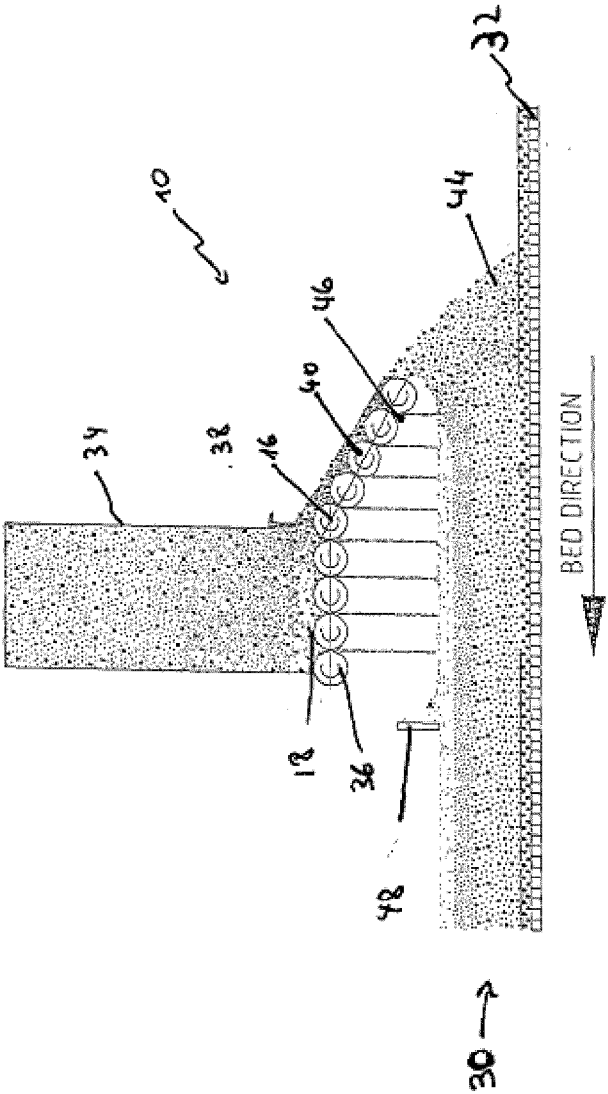


Fig. 2

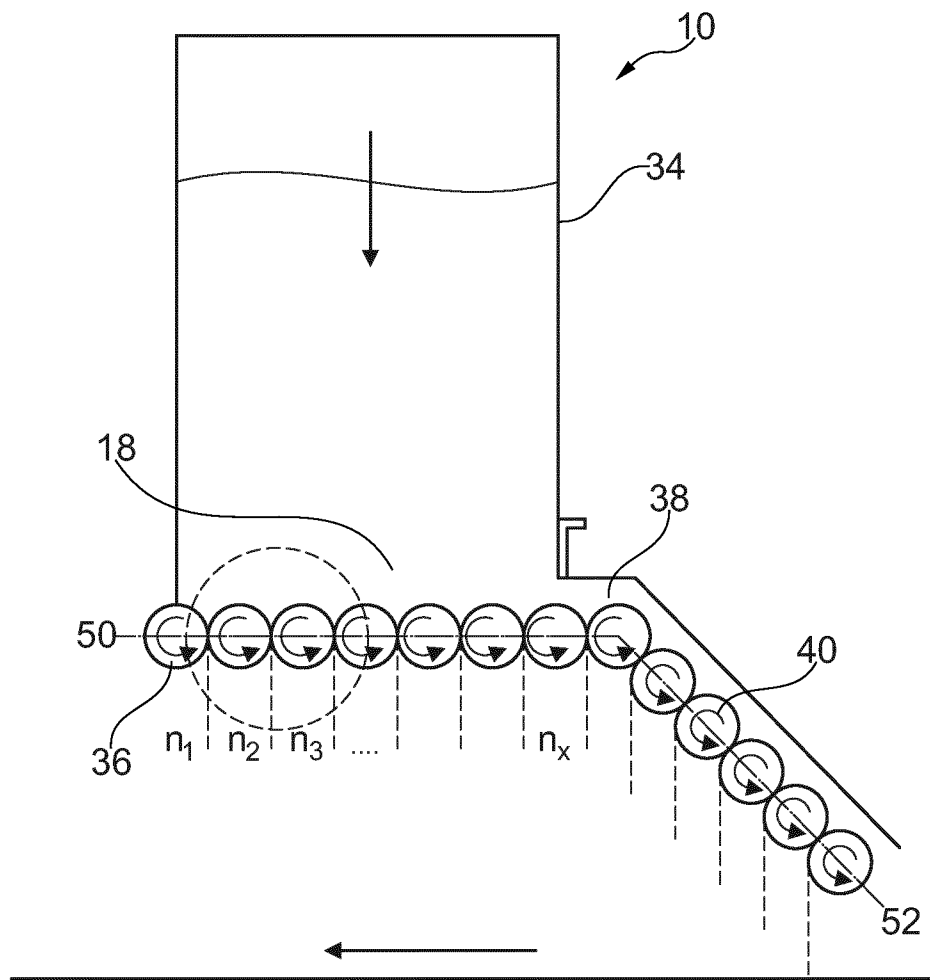


Fig. 3

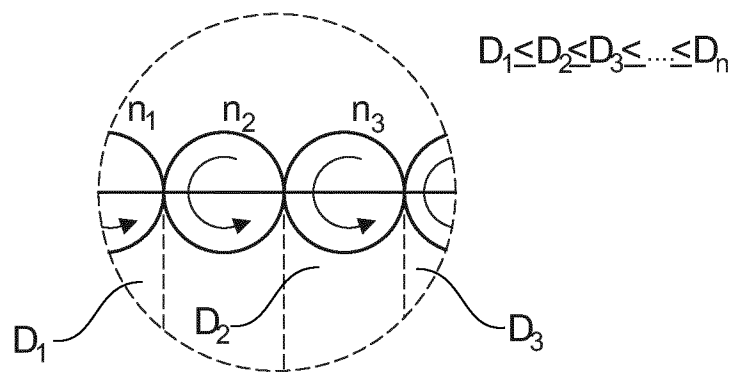


Fig. 3A

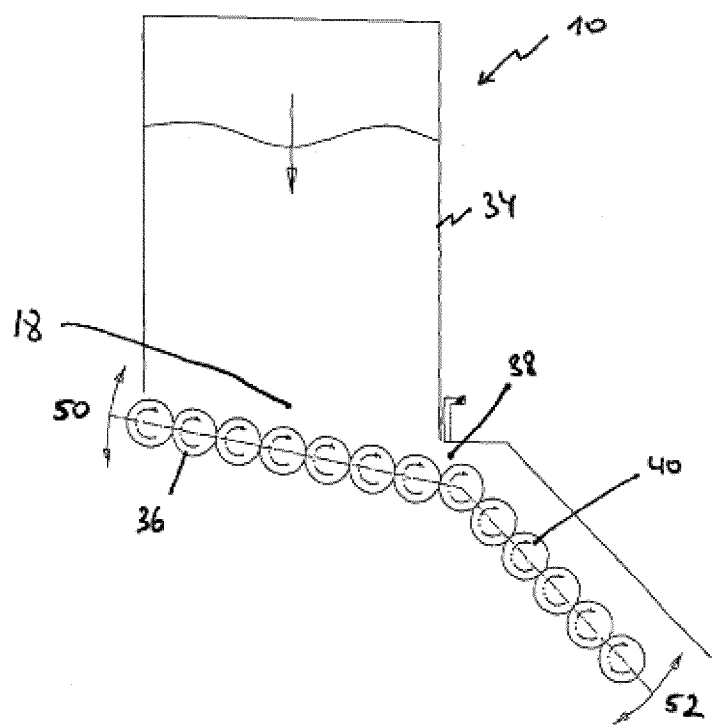


Fig. 4

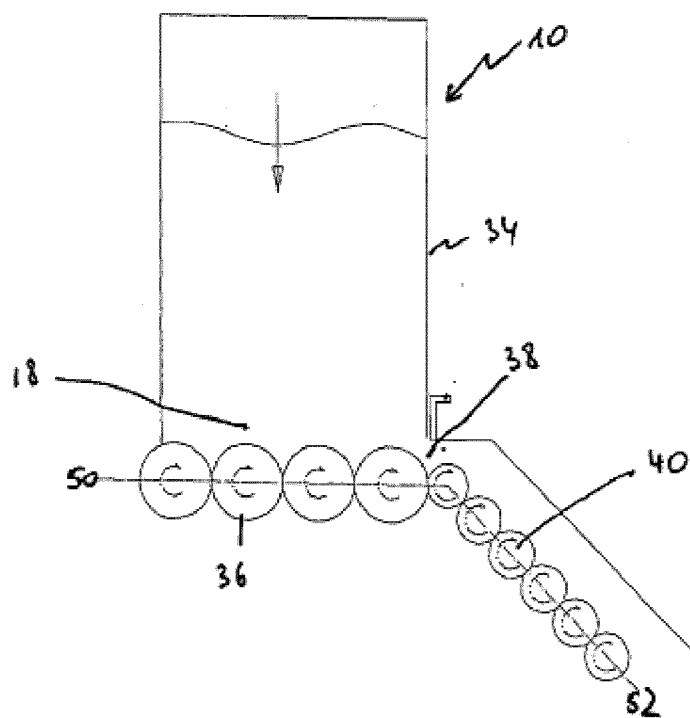


Fig. 5

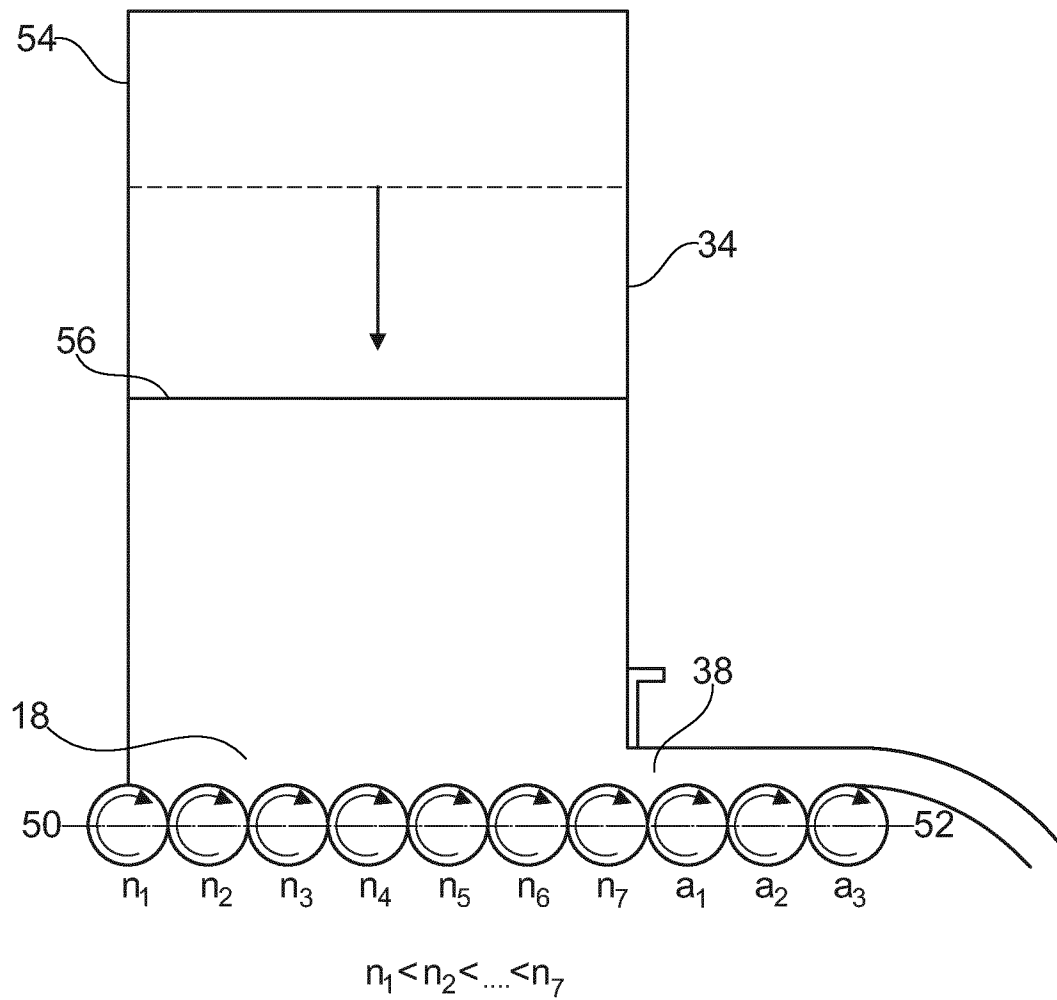


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/064763

A. CLASSIFICATION OF SUBJECT MATTER
INV. F27B21/06 F27B21/10
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F27B F27D B65G C22B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2005 226113 A (KOBE STEEL LTD) 25 August 2005 (2005-08-25) paragraph [0002] - paragraph [0003]; figure 2 paragraph [0005] paragraph [0013] paragraph [0016] - paragraph [0024]; claims 1-4	1-15
A	JP S49 56104 U (N.A.) 17 May 1974 (1974-05-17) the whole document	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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Information on patent family members

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