

(19)



(11)

EP 3 489 371 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.05.2019 Bulletin 2019/22

(51) Int Cl.:
C22B 1/16 (2006.01) **C22B 1/20** (2006.01)
F27B 21/00 (2006.01) **F27D 25/00** (2010.01)

(21) Application number: **17203633.7**

(22) Date of filing: **24.11.2017**

(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
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **VAN DER WAL, Marinus Jakob**
1970 CA Ijmuiden (NL)
• **DE GRAAF, Gerard**
1970 CA Ijmuiden (NL)

(74) Representative: **Blauw, Frans Gerard**
Tata Steel Nederland Technology B.V.
Group Intellectual Property Services - 3G.37
P.O. Box 10000
1970 CA IJmuiden (NL)

(71) Applicant: **Tata Steel IJmuiden B.V.**
1951 JZ Velsen-Noord (NL)

(54) SCRAPER DEVICE

(57) The invention relates to a scraper device for scraping a segregation plate in a sinterfeed assembly, wherein the feed assembly comprises a support structure, a feed bunker for a sinter feed material, wherein the feed bunker is provided with an inlet and an outlet, and a feed roller at the outlet of the feed bunker, wherein the

scraper device is mounted in the support structure and the segregation plate is mounted movable in the support structure such that with the movement of the segregation plate at least part of the side of the segregation plate facing the feed roller is scraped by the scraper device.

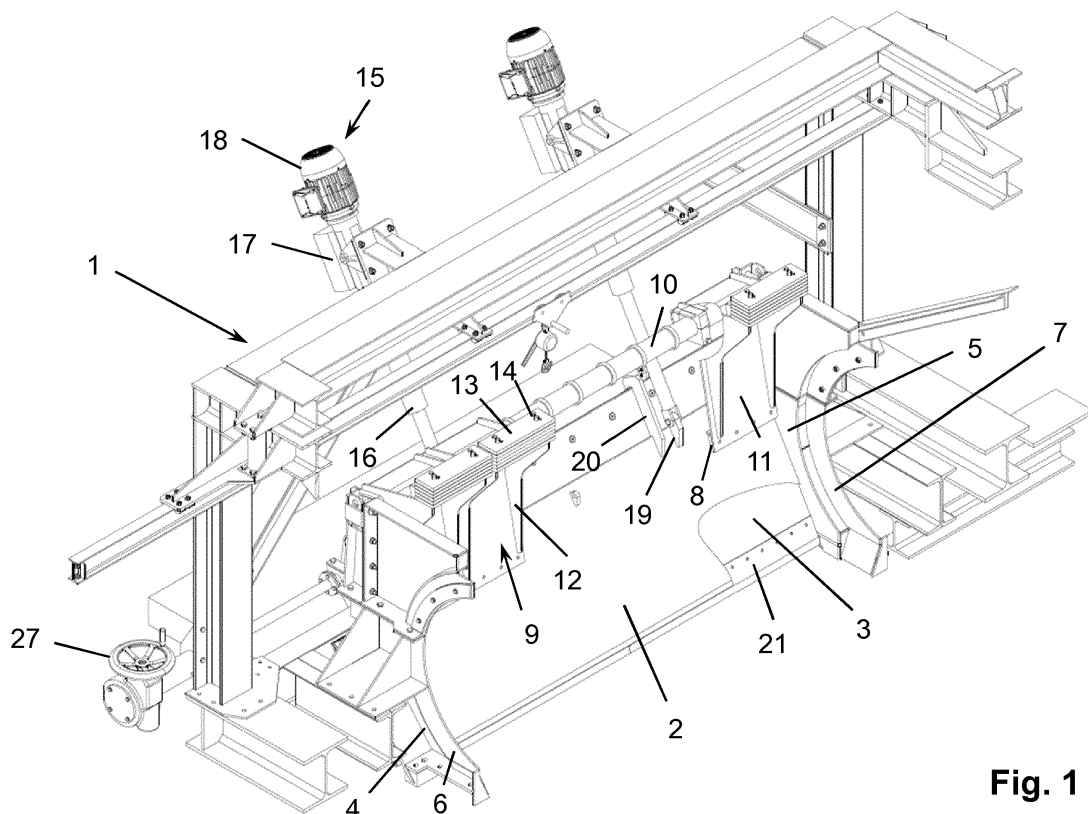


Fig. 1

EP 3 489 371 A1

Description

Field of the invention

[0001] The invention relates to a scraper device, more in particular a scraper device for a segregation plate in a sinter feed assembly of a sinter plant. In such a sinter plant iron containing nodules are made for use in a blast furnace process.

Background of the invention

[0002] In a sinter plant a mix is made comprising iron ore fines, coke fines and flux fines to which secondary materials are added such as sinter fines, iron dust collected from plant de-dusting systems and plant wastes. These components are mixed with water in predefined weight percentages in a rotary drum to form sinter feed material comprising nodules of varying size.

[0003] The sinter feed material is applied on a sinter machine with a roll feeder, which distributes the sinter feed material with a certain size distribution on an already provided first layer of previous sintered material on the grates of the sinter machine. The upper layer is smoothed using a leveller to get a layer of uniform thickness.

[0004] The sinter feed material on the sinter machine enters a furnace part in the sinter plant where it is ignited from above while air is sucked through the sinter-feed material from beneath. The combustion zone propagates from above downward therewith sintering the sinter-feed material till it reaches the first layer of already sintered material. It is of great importance that the air is sucked evenly through the sinter feed material and that the combustion zone propagates downward such that all sinter-feed is sintered. In order to realize that the sinter feed material has to be distributed evenly over the area of the sinter machine such that the air permeability of the bed is everywhere the same. To that end a segregation plate is used to apply the sinter feed material on the sinter machine.

[0005] From the roll feeder the sinter-feed first arrives on the segregation plate, an inclined plate over which the sinter-feed is conveyed by gravity and is distributed on the sinter machine. The segregation plate provides that the coarser sinter feed material is applied first on the sinter machine followed by the smaller sized sinter feed material. This size distribution is important in order to keep the amount of air sucked through the bed at a predefined level while the combustion zone is propagating in downward direction.

[0006] The feed roller is adjusted to deliver the right amount of sinter-feed to which end the amount of the sinter-feed on segregation plate is monitored. This can be done by monitoring the thickness of the sinter-feed conveyed by gravity over the segregation plate for instance by means of ultrasonic measurement of the distance between the sinter-feed on the segregation plate and the known position of the ultrasonic measuring de-

vice.

[0007] However, part of the sinter feed material will adhere to the segregation plate forming a layer on the segregation plate. The accretion of the sinter feed material on the segregation plate will result in a false measurement of the amount of sinter feed material conveyed over the segregation plate. In turn this could lead to a wrong adjustment of the feed roller, resulting in too little sinter feed material being conveyed to the sinter machine.

[0008] As this is well known the sinter feed material that has accumulated on the segregation plate is scraped off at regular intervals. Often this is done by hand using for instance a spade to be sure that all accumulated sinter feed material is removed. The environment in which this has to be done is hot and dusty, more often than not there is only limited space to do the job and it has to be repeated every hour or every two hours. It goes without saying that such circumstances are far from ideal and can only be done with adequate protective clothing.

[0009] Also systems are known wherein a scraper is moved over the segregation plate by means of chains, either from side to side or up and down. All these systems have the drawback that not the complete working area of the segregation plate can be scraped and moreover, that a lot of maintenance is required leading to a lot of down time.

Objectives of the invention

[0010] It is an objective of the present invention to provide a scraper device which can be remotely operated.

[0011] It is another objective of the present invention to provide a scraper device which can be operated automatically.

[0012] It is another objective of the present invention to provide a scraper device which scrapes the whole surface area of the segregation plate used to convey the sinter feed material.

[0013] It is another objective of the present invention to provide a scraper device which allows to continue the feed of the sinter feed material while scraping the segregation plate.

[0014] It is still another objective of the present invention to provide a scraper device of a reliable and easy maintainable construction.

Description of the invention

[0015] The invention relates to a scraper device for a segregation plate in a sinter feed assembly of a sinter plant as defined in claims 1-15.

[0016] One or more of the objectives of the invention are realized by providing a scraper device for scraping a segregation plate in a sinter feed assembly, wherein the feed assembly comprises a support structure, a feed bunker for a sinter feed material, wherein the feed bunker is provided with an inlet and an outlet, and a feed roller at the outlet of the feed bunker, wherein the scraper device

is mounted in the support structure and the segregation plate is mounted movable in the support structure such that with the movement of the segregation plate at least part of the side of the segregation plate facing the feed roller is scraped by the scraper device.

[0017] With the scraper device according to the invention the segregation plate is moved with respect to the scraper device which has the advantage that the complete working area of the segregation plate is scraped. The movement of the segregation plate from its working position along the scraper device and back again can be done quickly and safely and without that an operator has to enter the dangerous environment around the sinter feed assembly. The working area of the segregation plate will mean the part of the segregation plate which receives sinter feed material from the feed roller and/or along which the sinter feed material is conveyed to the sinter machine.

[0018] According to a further aspect guiding means are provided in the support structure to guide the segregation plate when it is moved. These guiding means for the segregation plate can be quite straightforward as opposed to guiding means that would be needed for a system with a fixed segregation plate and a scraper which is moved over the segregation plate by means of chains or the like.

[0019] Since the segregation plate is to convey the sinter feed material by gravity to the sinter machine the segregation plate is at an angle to the vertical in order to realize a certain conveying speed and at the same time realise the segregation of the coarser and finer particles landing on the first layer of previously sintered material on the grates of the moving sinter machine. In the most straightforward embodiment wherein the segregation plate is a flat plate, the plate is guided along a path at an angle to the vertical wherein the path is in a flat plane. In another embodiment with a segregation plate with a curvature the guiding means are in conformity with the curvature of the segregation plate. In the latter embodiment the curvature of the segregation plate is typically a curvature with a constant radius to allow for practical guiding means.

[0020] According to a further aspect of the invention the guiding means comprise a support plate supporting at least part of the segregation plate. It is further provided that the support plate has at least partly the shape of the segregation plate as seen with the segregation plate in its working position. Typically it is provided that the support plate has at least partially a shape corresponding to the shape of the working area of the segregation plate. In practice the use of a flat segregation plate and a flat support plate have given very good results. With the support plate supporting the segregation plate the guiding means only need a guide to keep the movement of the segregation plate in a straight path, which could be provided with guides at the sides of the segregation plate or by any other means that guide the movement of the segregation plate in a straight path.

[0021] A support plate corresponding to at least the

working area of the segregation plate has the advantage that the action of receiving sinter feed material from the feed roller and conveying the material to the sinter machine does not have to be interrupted. The support plate takes over the function of the segregation plate when the segregation plate is moved in upward direction past the scraper device. Any material adhered in the meantime to the support plate will automatically be removed when the segregation plate is moved back to its operating position.

[0022] According to a further aspect drive means are provided to move the segregation plate with respect to the scraper while in contact with the scraper device. Various different drive means can be used to move the support plate from its working position and back again, wherein the drive means can include further guiding means to keep the movement of the segregation plate in straight path either over a flat or curved support plate.

[0023] It is further provided that the drive means comprise at least one linear actuator. With a straight segregation plate and a straight support plate the linear actuator drives the segregation plate in a straight line over the support plate without the need for further guides to keep the movement of the segregation plate in a straight line. Also slightly curved segregation and support plates can be driven with at least one linear actuator as long as it is provided that the at least one linear actuator is pivotably mounted and has a connection with the segregation plate that also allows rotation with the movement of the segregation plate.

[0024] Typically the at least one linear actuator comprises a driven spindle. Such a driven spindle allows for a very precise control of the distance over which the segregation plate is moved. This is in particular important if more than one actuator is used. With more than one actuator also the movement of the linear actuators with respect to each other need to be controlled very precisely to prevent that movement of the segregation plate gets out of alignment.

[0025] According to a further aspect it is provided that the drive means comprise a hydraulic drive system. Such a hydraulic drive system comprises a hydraulic pump and a hydraulic motor, wherein hydraulic pump is driven by for instance an electromotor. The hydraulic motor in its turn is used to drive the linear actuator. With such a hydraulic drive system variations in the load of the single actuator or between actuators when more than one linear actuator is used can easily be monitored. A deviation in the load could be indication of some kind of obstruction in the path of the segregation plate and can be used as a safety switch to stop the drive means.

[0026] The scraper device comprises a scraper frame provided with a scraper knife, wherein means are provided to force the scraper knife against the segregation plate. As part of those means it is provided that the scraper frame is mounted rotatable around an axis mounted in the support structure. The axis allows for a certain movement of the scraper knife and therewith the possi-

bility to force the scraper knife against the segregation plate with a certain predefined force. According to a straightforward embodiment the axis is oriented transverse to the segregation plate with the scraper knife mounted to the scraper frame also transverse to the segregation plate. The term "transverse" means transverse to the direction of movement of the segregation plate when moved by the at least one actuator. The scraper knife should be forced against the segregation plate to be sure that with the movement of the segregation plate against the scraper knife all or at least most of the adhered sinter feed material is removed from the segregation plate. The necessary force could be supplied by spring loading means between the scraper frame and the support structure or hydraulic loading means.

[0027] Because of the harsh environment wherein maintenance is difficult a simple and reliable embodiment is preferred. In line with that the scraper frame is provided with a weight at a distance from the axis such that the scraper knife is forced against the segregation plate. In practice good results were obtained with the weight distributed over the length of the scraper frame such that the scraper knife is forced over its length against the segregation plate with an evenly distributed load. Such weight can be provided as a stack or multiple stacks of separate weights which can easily be adjusted and tuned to the desired weight.

[0028] As a safety measure the segregation plate is provided with at least one hook that embraces part of the support structure or the support plate with the segregation plate in its operating position. The term "embraces" means that the hook is in direct engagement with the support structure or the support plate or that hook is not yet in direct engagement with the support structure or the support plate but that it will be when the segregation plate would be lowered with respect of its operating position over a certain distance. Since the segregation plate is only connected to the support structure by means of the drive means the at least one hook provides a simple and reliable safety measure.

[0029] A segregation plate that is only connected to the support structure or support plate by the drive means and the at least one hook has the further advantage that it can be replaced quite easily and in a short time when needed.

[0030] The sinter feed assembly is further provided with a trim knife, wherein the trim knife is mounted in the plane of the support plate. The trim knife is used to trim the height or thickness of the sinter feed material bed to a predefined height or thickness over the width of the bed and by that also over the length of the bed on the moving sinter machine. With the position of the trim knife in the plane of the support plate and at least partly against the segregation plate it is prevented that any sinter feed material will end up between the trim knife and the segregation plate.

[0031] Guiding means and adjusting means are provided for the trim knife to adjust the position of the trim

knife in the plane of the support plate in order to realise the predefined height or thickness of the sinter feed material bed.

[0032] The whole system with segregation plate and drive means for the segregation plate is very suitable for automatic operation, wherein the segregation plate is moved past the scraper knife at regular intervals.

Brief description of the drawings

[0033] The invention will be further explained by means of the example shown in the drawing, in which:

fig. 1 shows a perspective view of part of a sinter feed assembly, and

fig. 2 shows a section of the sinter feed assembly.

Detailed description of the drawings

[0034] The perspective view of part of a feed assembly in fig.1 shows part of a support structure 1 and mounted within support structure 1 a segregation plate 2, supported by a support plate 3. Guide means 4, 5 are provided at opposite sides of segregation plate 2. These lateral guide means 4, 5 are provided with arc shaped rims 6, 7 that serve to enclose part of the outer ends of a feed roller 22 (see fig. 2).

[0035] A scraper knife 8 is provided which is mounted on a scraper frame 9. Scraper frame 9 is mounted rotatably around an axis 10 mounted in support structure 1. Scraper frame 9 comprises a plate 11 over the length of the of the scraper knife 8 which is over the width of segregation plate 1. In the figure only part of plate 11 is shown in order to also show some construction details behind the plate. Plate 11 is connected to axis 10 and is provided with a number of reinforcement ribs 12. These ribs 12 serve as supports for a number of weights 13 to which end ribs 12 are provided with pins 14 to hold the weights 13. These weights 13 are stacked flat plates which allows for fine tuning the force with which the scraper knife 8 is engaging the segregation plate 2.

[0036] The segregation plate 2, guide means 4, 5 and plate 11 together provide that all sinter feed material coming from feed roller 22 will be conveyed to the sinter machine, indicated in general with 30 in fig.2.

[0037] Drive means 15 are provided to move segregation plate 2 up from its operating position past the scraper knife therewith removing all sinter feed material adhered to the segregation plate 2 and back again to its operating position. The drive means 15 comprise a spindle 16, hydraulic pump and motor 17 and an electromotor 18 to drive the hydraulic pump. The spindle 16 is connected to segregation plate 2 via connecting piece 19 secured to segregation plate 2.

[0038] As a safety measure the segregation plate 2 is provided with hooks 20 which fit over the rim of support plate 3. In case the connection between the drive means 15 and segregation plate 2 would fail, the hooks prevent

that segregation plate 2 would fall on the sinter machine.

[0039] A trim knife 21 is provided at the outer end of and in the plane of the support plate 3.

[0040] Fig. 2 is a section through part of the assembly shown in fig. 1. In this section part of the feed roller 22 is shown and how it fits to lateral guide means 4. As can be seen in the drawing the segregation plate 2 and the support plate 3 are both flat plates and scraper knife 8 is at an angle to the segregation plate 2 for an optimal scraping operation.

[0041] The scraper knife 8 is attached to plate 11 which is rotatable around axis 10 and is forced against segregation plate 2 by means of the lever formed by weights 13 and reinforcement ribs 12.

[0042] Trim knife 21 is adjustable in height with respect of the sinter machine by means of a lever system 23 with lever arms 24, 25 which are controlled by means of axis 26 and adjustment wheel 27 (see fig. 1). Trim knife 21 is adjustable in the plane of the support plate 3 guided by guide plate 28 and further guide means 29. Guide plate 28 and further guide means 29 keep the movement of the trim knife 21 in the plane of the support plate 3.

Claims

1. Scraper device for scraping a segregation plate in a sinter feed assembly, wherein the feed assembly comprises a support structure, a feed bunker for a sinter feed material, wherein the feed bunker is provided with an inlet and an outlet, and a feed roller at the outlet of the feed bunker, **characterised in that** the scraper device is mounted in the support structure and the segregation plate is mounted movable in the support structure such that with the movement of the segregation plate at least part of the side of the segregation plate facing the feed roller is scraped by the scraper device.
2. Scraper device according to claim 1, wherein guiding means are provided in the support structure to guide the segregation plate when it is moved.
3. Scraper device according to claim 1 or 2, wherein the segregation plate is guided along a path at an angle to the vertical.
4. Scraper device according to claim 2 or 3, wherein the guiding means comprise a support plate supporting at least part of the segregation plate.
5. Scraper device according to one or more of the previous claims, wherein drive means are provided to move the segregation plate with respect to the scraper while in contact with the scraper device.
6. Scraper device according to claim 5, wherein the drive means comprise at least one linear actuator.

7. Scraper device according to claim 6, wherein the at least one linear actuator comprises a driven spindle.
8. Scraper device according to claim 7, wherein the drive means comprise a hydraulic drive system.
9. Scraper device according to one or more of the previous claims, wherein the scraper device comprises a scraper frame provided with a scraper knife, wherein means are provided to force the scraper knife against the segregation plate.
10. Scraper device according to claim 9, wherein the scraper frame is mounted rotatably around an axis mounted in the support structure.
11. Scraper device according to claim 10, wherein the scraper frame is provided with a weight at a distance from the axis such that the scraper knife is forced against the segregation plate.
12. Scraper device according to claim 11, wherein the weight is distributed over the length of the scraper frame such that the scraper knife is forced over its length against the segregation plate with an evenly distributed load.
13. Scraper device according to one or more of the previous claims, wherein the segregation plate is provided with at least one hook that embraces part of the support structure or the support plate with the segregation plate in its operating position.
14. Scraper device according to one or more of the previous claims provided with a trim knife, wherein the trim knife is mounted in the plane of the support plate.
15. Scraper device according to claim 14, wherein guiding means and adjusting means are provided to adjust the position of the trim knife in the plane of the support plate.

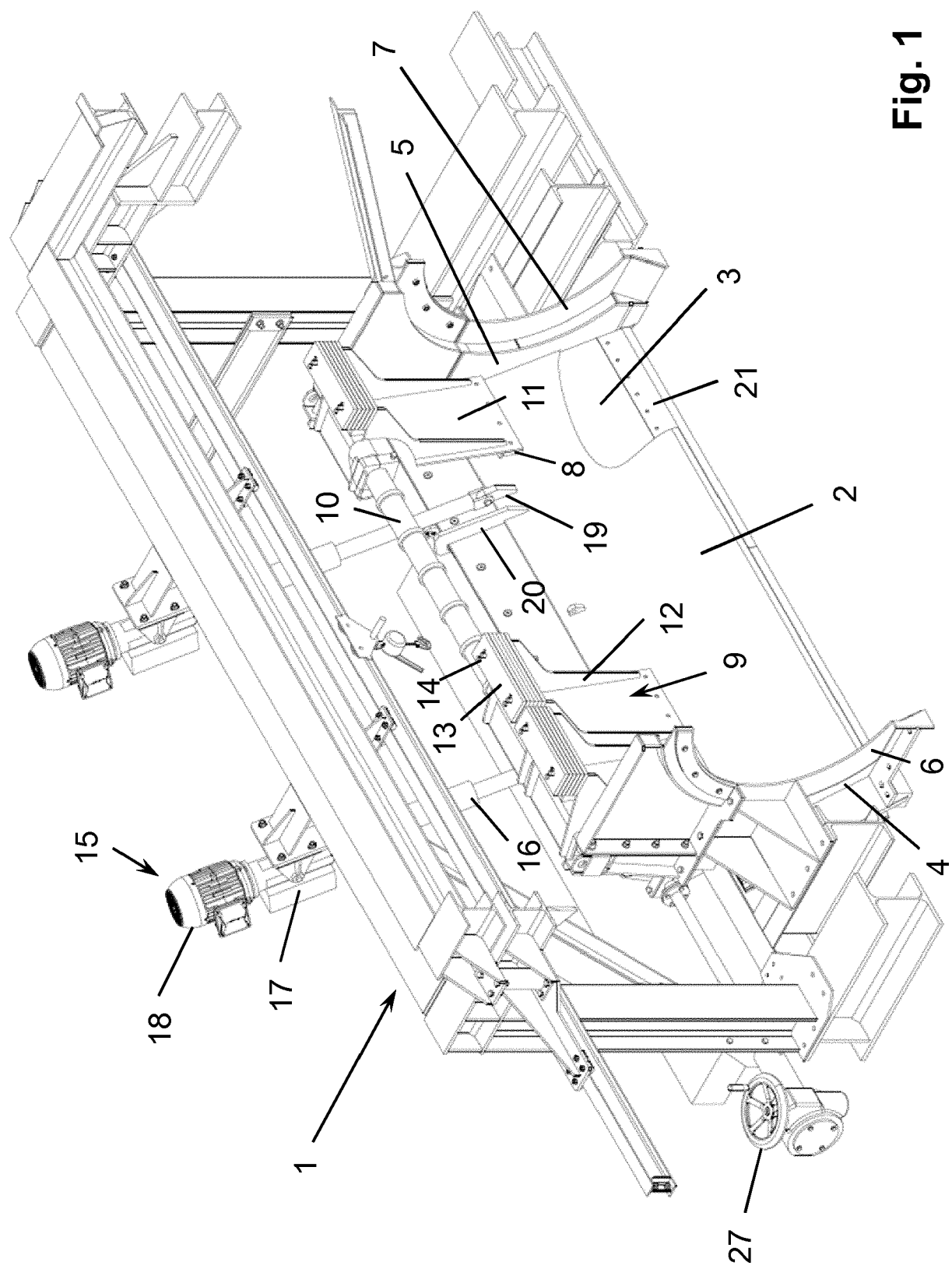


Fig. 1

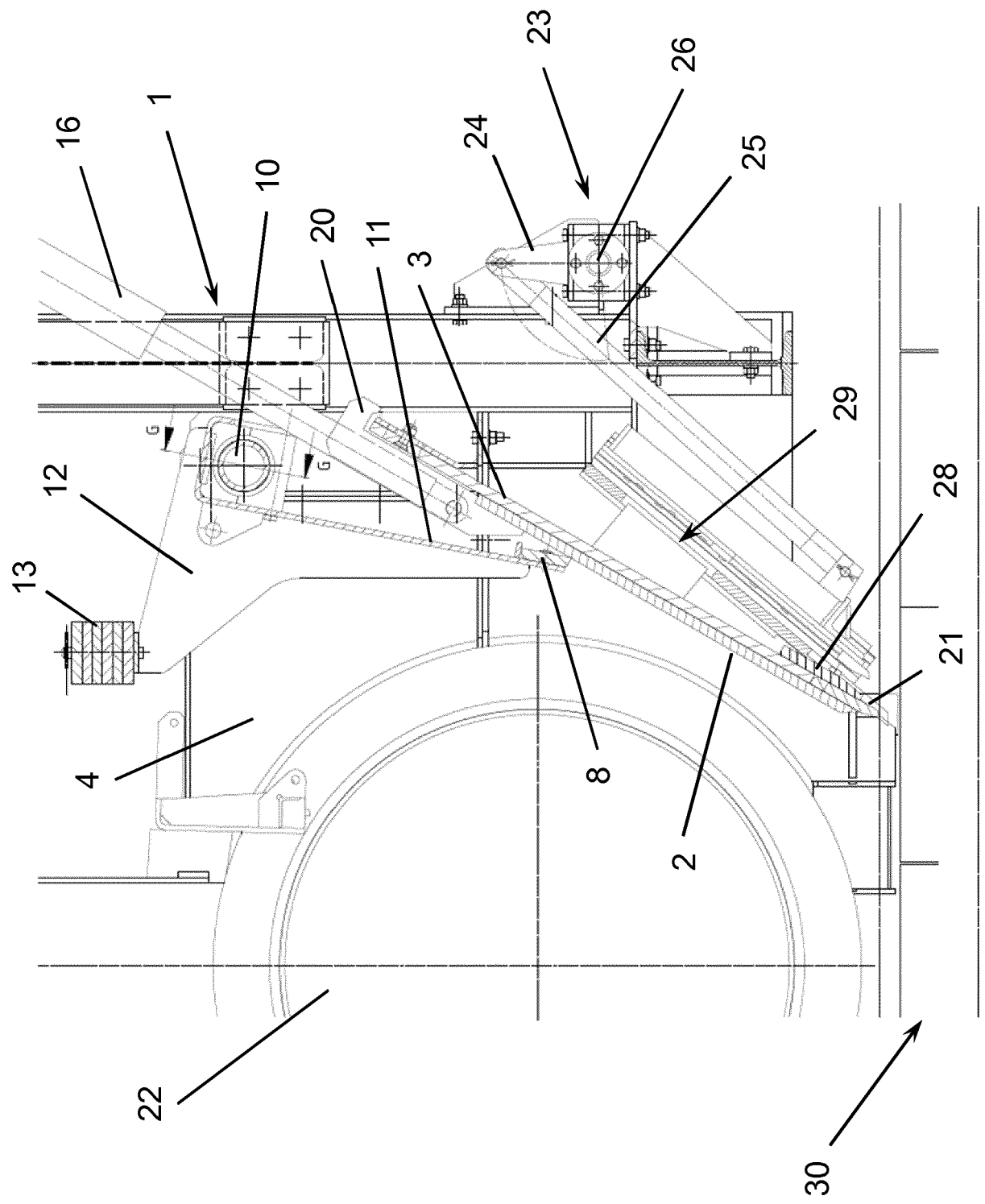


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 17 20 3633

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2011/111735 A1 (NIPPON STEEL CORP [JP]; FUKAKURA YUJI [JP]; TSUBONE YOHEI [JP]; SHINOH) 15 September 2011 (2011-09-15) * paragraphs [0001] - [0005], [0011], [0013], [0014], [0018], [0025] - [0027], [0031] - [0033], [0043] * * claims 1-4 * * figure 2 *	1-15	INV. C22B1/16 C22B1/20 F27B21/00 F27D25/00
X	JP 2005 195301 A (SUMITOMO METAL IND) 21 July 2005 (2005-07-21) * abstract *	1	
A	* paragraphs [0004], [0008] - [0022] * * claims 1-3 *	2-15	
A	EP 2 311 997 A1 (JP STEEL PLANTECH CO [JP]) 20 April 2011 (2011-04-20) * the whole document *	1-15	
A	EP 0 787 809 A1 (NIPPON KOKAN KK [JP]) 6 August 1997 (1997-08-06) * the whole document *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			C22B F27B F27D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 April 2018	Examiner Riederer, Florian
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 20 3633

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-04-2018

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011111735 A1	15-09-2011	BR 112012022663 A2	26-07-2016
		CN 102792113 A	21-11-2012
		JP 4943562 B2	30-05-2012
		JP WO2011111735 A1	27-06-2013
		KR 20120113807 A	15-10-2012
		WO 2011111735 A1	15-09-2011

JP 2005195301 A	21-07-2005	NONE	

EP 2311997 A1	20-04-2011	CN 102027143 A	20-04-2011
		EP 2311997 A1	20-04-2011
		JP 2010043328 A	25-02-2010
		KR 20100122956 A	23-11-2010
		WO 2010018804 A1	18-02-2010

EP 0787809 A1	06-08-1997	AU 693730 B2	02-07-1998
		BR 9700827 A	07-07-1998
		DE 69700535 D1	28-10-1999
		DE 69700535 T2	03-02-2000
		EP 0787809 A1	06-08-1997
		IN 191111 B	20-09-2003
		JP 3336848 B2	21-10-2002
		JP H09210566 A	12-08-1997
		TW 347465 B	11-12-1998
