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(54) **INCINERATION PLANT AND METHOD FOR OPERATING AN INCINERATION PLANT**

(57) The invention relates to an incineration plant for solid material having a combustion material inlet (1) through which solid material can be introduced, a feed shaft (2) in which the solid material is introduced and which leads to a combustion chamber (3) in which the solid material is combusted, a combustion grate (4) with which the solid material and combusted solid material can be conveyed through the combustion chamber (3), a primary air supply (5) below the top of the combustion grate, characterized in that the incineration plant comprises at least one adjusting device (6), wherein the adjusting device (6) is pivotably mounted and can be pivoted in a first position and a second position to alter the amount of solid material advanced from the feed shaft (2) to the combustion chamber (3).

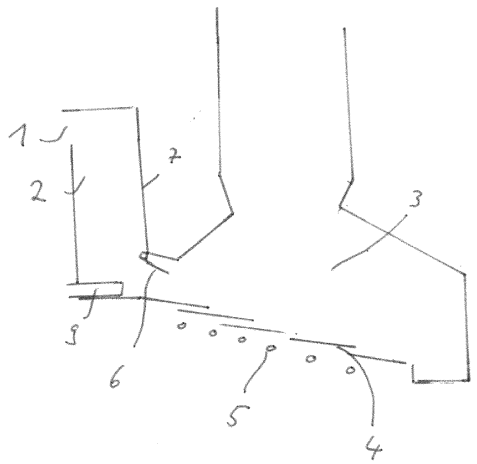

Fig. 1

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Description

[0001] The present invention relates to an incineration plant for solid material having a combustion material inlet through which solid material can be introduced, a feed shaft in which the solid material is introduced and which leads to a combustion chamber in which the solid material is combusted, a combustion grate with which the solid material and combusted solid material can be conveyed through the combustion chamber, a primary air supply below the top of the combustion grate. The invention also relates to a method for operating an incineration plant comprising the steps of introducing solid material through a combustion material inlet into a feed shaft, guiding the solid material through the feed shaft to a combustion chamber, combusting the solid material in the combustion chamber and conveying the solid material and combusted solid material on a combustion grate through the combustion chamber.

[0002] The combustion grate is usually arranged within a lower section of the combustion chamber. The solid material and combusted solid material can be conveyed by the combustion grate through the combustion chamber from an end of the combustion material feed shaft to a slag container. Primary air is supplied from below the combustion grate to the solid material arranged on the combustion grate, so that the solid material arranged on the combustion grate is combusted with the primary air.

[0003] The combustion grate is preferably embodied as reciprocating grate, but it is also possible that the combustion grate is embodied in a different way, for example as vibrating grate or roller grate.

[0004] Additionally, nozzles may be arranged above the combustion grate with which secondary air, tertiary air for afterburning or an oxygen poor carrier gas can be provided to the combustion gases.

[0005] At least one empty pass may be arranged downstream of the combustion chamber extending vertically or horizontally, wherein the flue gases flow from the combustion chamber through the at least one empty pass to a heat recovery steam generator.

[0006] A heat recovery steam generator downstream of the empty pass may be arranged (in sections) vertically and/or horizontally, wherein also an oblique orientation is possible.

[0007] The walls of the combustion chamber, the empty pass(es) and the heat generator are usually equipped with heat exchangers (i.e. tubes), wherein the heat exchange medium of the heat exchangers is in particular provided to one common boiler drum.

[0008] A flue gas purification device downstream of the heat recovery steam generator may comprise elements for dedusting, scrubbing and/or desulfurization (such as SCR or SNCR) of the flue gas. A chimney may be arranged downstream of the flue gas purification device.

[0009] In known incineration plants the throughput of solid material to be combusted is basically set by the amount of material introduced into the feed shaft. But, it is desirable that the throughput/amount of solid material to be advanced in the combustion chamber can be altered, even after the solid material is introduced into the feed shaft.

[0010] An incineration plant with the above described features is known from FR 1 417 423 A, which discloses a blocking element for piling up solid material in a dehumidifying/drying region at the front of the combustion chamber. The solid material is piled up so that it can be efficiently dried by a gas supplied from below the piled-up material. According to FR 1 417 423 A the blocking element in shape of a plate is linearly movable up and down. In particular, if unevenly distributed solid material (i.e. wood panels or the like) is supplied, the solid material may get stuck at the edge of the vertically aligned blocking element, thereby causing an undesirable further piling up of the solid material ahead of the blocking element.

[0011] Accordingly, it is an object of the present invention to overcome the drawbacks of the prior art and in particular to provide an incineration plant and a method for operating an incineration plant, with which the amount of solid material advanced from the feed shaft to the combustion chamber can be reliably altered.

[0012] This object is achieved with an incineration plant and a method according to the respective independent claim. Preferred embodiments of the incineration plant and the method are disclosed in the subclaims and in the description, wherein single features of the preferred embodiments can be combined with each other in a technical meaningful manner. In particular, the features disclosed with regard to the incineration plant can be applied to the method and vice versa.

[0013] The object is in particular achieved with an incineration plant as described above, wherein the incineration plant comprises an adjusting device and wherein the adjusting device is pivotably mounted and can be pivoted in a first position and a second position to alter the amount of solid material advanced from the feed shaft to the combustion grate.

[0014] The object is also achieved with the method as described above, wherein the amount of solid material advanced from the feed shaft to the combustion grate can be altered by pivoting an adjusting device.

[0015] By mounting the adjusting element in a pivotable manner, the adjusting element can extend along the direction of travel of the solid material between the feed shaft and the combustion chamber, while at the same time the free cross section delimited by the adjusting device can be altered. With other word, the free cross section delimited by the adjusting device is constantly decreasing along the direction of travel of the solid material. This way it is avoided that any solid material gets stucked when being advanced along the adjusting device. By pivoting the adjusting device the angle of the adjusting device and therefore the free cross section delimited by the adjusting device is altered, so that more (with a greater free cross section) or less (with a lesser free cross section) amount of solid material can be advanced from the

feed shaft to the combustion chamber.

[0016] The adjusting device may be pivoted between a minimum deflection and a maximum deflection, wherein the first position and the second position may be any position between the maximum deflection and the minimum deflection. In the minimum deflection, the free cross section is the greatest possible free cross section and in the maximum deflection the free cross section is the lowest. The adjusting device is preferably embodied such, that in the maximum deflection there remains a free cross section of at least one third of the free cross section at the minimum deflection. This way it is ensured that even at the maximum deflection solid material can be advanced from the feed shaft to the combustion chamber.

[0017] A pivot axis of the adjusting device is preferably arranged in a horizontal manner, so that the height of the free cross section can be altered. Preferably, there is exactly one adjusting device, for example embodied in a plate like manner. The adjusting device is preferably connected to a drive, which can be actuated hydraulically, pneumatically or electrically. For example, a lever connected to the adjusting device and arranged outside a wall of the feed shaft/combustion chamber can be actuated by a hydraulic piston.

[0018] Accordingly, it is suggested that the free height (in German: Maulhöhe) can be altered during operation of the incineration plant.

[0019] In a preferred embodiment, the adjusting device is arranged at a lower end of a feed shaft wall above a transition region between the feed shaft and the combustion chamber so that the free height ("Maulhöhe") of the transition region can be altered by pivoting the adjusting device from the first position to the second position. By such an arrangement the supply of the solid material through the feed shaft is not directly affected, while the amount of solid material advanced from the feed shaft into the combustion chamber can be altered reliably by pivoting the adjusting device.

[0020] In this regard, the pivot axis of the adjusting device may be arranged in a horizontal direction in front of the feed shaft wall, directly below the feed shaft wall or slightly displaced behind the feed shaft wall.

[0021] In order to actively advance the solid material from the bottom of the feed shaft into the combustion chamber at least one pusher may be arranged below the feed shaft. The pusher may be embodied as separate element to be actuated independent of the combustion grate. Alternatively, the pusher may be the first element of a reciprocating grate. In any case, the pusher is moved back and force for advancing the solid material into the combustion chamber, thereby having a position with minimum stroke and a position with maximum stroke. The adjusting device is preferably arranged in such a way, that it is located in a horizontal direction behind the location of maximum stroke of the pusher. Of course, the adjusting device may be arranged in a vertical direction above the pusher, as long as it is displaced in the horizontal direction behind the place of maximum stroke. This way it is made sure that there is no interference between the pusher and the adjusting device.

[0022] In one embodiment, the adjusting device is cooled and preferably water cooled. The air/water used for cooling the adjusting device may be connected to a heat exchanger for using the withdrawn thermal energy.

[0023] For example, the adjusting device may comprise a hollow shaft embodying the pivot axis of the adjusting device, so that the adjusting device can be pivoted by turning the hollow shaft. In this case water or air may be supplied through the hollow shaft in order to cool the adjusting device.

[0024] One or multiple plate(s) may be connected to the hollow shaft so that the adjusting device is made of the hollow shaft and the plate like structure connected to the hollow shaft.

[0025] The adjusting device preferably comprises a two-dimensional flat structure, extending over the whole widths of the transition region between the feed shaft and the combustion chamber. With minimum deflection the flat structure extends along the direction of travel of the solid material in the transition region between the feed shaft and the combustion chamber.

[0026] In operation, the pivot position of the adjusting device may be altered depending on at least one of the following parameters:

- temperature within the combustion chamber, in which case the free cross section may be raised, if the temperature is low, and the free cross section may reduced when the temperature is high,
- calorific value of the solid material, in which case the free cross section may reduced, if the calorific value of the solid material is high, and the free cross section may be reduced, if the calorific value is low,
- humidity of the solid material, in which case the free cross section may be raised, if the humidity of the solid material is high, and the free cross section may be reduced, if the humidity of the solid material is low.

[0027] The invention and the technical background are now described with regard to the figures. The figures show schematically

Figure 1: an incineration plant,
Figure 2: a transition region between a feed shaft and a combustion chamber with an adjusting device according to a first embodiment,
Figure 3: the transition region with an adjusting device according to a second embodiment and
Figure 4: the transition region with an adjusting device according to a third embodiment.

[0028] The incineration plant depicted in figure 1 comprises a feed shaft 2 with a combustion material inlet 1, wherein the feed shaft 2 has a feed shaft wall 7.

[0029] The incineration plant further comprises a combustion chamber 3, in which a reciprocating combustion

grate 4 is arranged. Primary air supplies 5 are arranged below the top of the combustion grate 4.

[0030] At the lower bottom of the feed shaft 2 a pusher 9 is arranged for advancing solid material from the feed shaft 2 into the combustion chamber 3.

[0031] In the transition region between the feed shaft 2 and the combustion chamber 3 an adjusting device 6 is pivotably mounted.

[0032] As can be seen in figures 2 to 4 the adjustment device 6 comprises a hollow shaft 10 defining the pivot axis of the adjusting device 6. A not shown drive can be connected to the hollow shaft 10 for pivoting the adjusting device 6. In operation water is supplied through the hollow shaft 10 in order to cool the adjusting device 6.

[0033] In each of the figures 2 to 4 two positions of the adjusting device 6 are depicted, wherein the adjusting device 6 can be pivoted between these two positions. In each of the positions the adjusting device 6 defines a free height 8 within the transition region.

[0034] When the free height 8 of the transition region is reduced, a lesser amount of solid material can be advanced from the feed shaft 2 into the combustion chamber 3. As the free height 8 decreases constantly along the direction of travel of the solid material due to the pivotably mounted adjusting device 6, there is no risk that a member of the solid material is blocked by the adjusting device 6 completely.

Reference signs

[0035]

1	combustion material inlet
2	feed shaft
3	combustion chamber
4	combustion grate
5	primary air supply
6	adjusting device
7	feed shaft wall
8	free height
9	pusher
10	hollow shaft

Claims

1. Incineration plant for solid material having

- a combustion material inlet (1) through which solid material can be introduced,
- a feed shaft (2) in which the solid material is introduced and which leads to
- a combustion chamber (3) in which the solid material is combusted,
- a combustion grate (4) with which the solid material and combusted solid material can be conveyed through the combustion chamber (3),
- a primary air supply (5) below the top of the combustion grate,

characterized in that

the incineration plant comprises at least one adjusting device (6), wherein the adjusting device (6) is pivotably mounted and can be pivoted in a first position and a second position to alter the amount of solid material advanced from the feed shaft (2) to the combustion chamber.

2. Incineration plant according to 1, wherein the adjusting device (6) is arranged at a lower end of a feed shaft wall (7) above a transition region between the feed shaft (2) and the combustion chamber (3), so that a free height (8) of the transition region can be altered by pivoting the adjusting device (6) from the first position to the second position.

3. Incineration plant according to one of the preceding claims, wherein at least one pusher (9) is arranged below the feed shaft (2) for advancing the solid material to the combustion chamber (3), the at least one pusher (9) having a maximum stroke, wherein the adjusting device (6) is arranged in horizontal direction behind the location of the maximum stroke.

4. Incineration plant according to one of the preceding claims, wherein the adjusting device (6) is water cooled.

5. Incineration plant according to one of the preceding claims, wherein the adjusting device (6) comprises a hollow shaft (10) to pivot the adjusting device (6), wherein the hollow shaft (10) is water cooled.

6. Incineration plant according to one of the preceding claims, wherein the incineration plant comprises a control unit, which control unit is connected to a drive of the adjusting device (6) and which is embodied to operate the incineration plant according to a method according one of claims 7 to 9.

7. Method for operating an incineration plant, in particular an incineration plant according to one of the preceding claims, comprising the following steps:

- Introducing solid material through a combustion material inlet (1) into a feed shaft (2),
- Guiding the solid material through the feed shaft (2) to a combustion chamber (3),
- Combusting the solid material in the combustion chamber (3),
- Conveying the solid material and combusted solid material on a combustion grate (4) through the combustion chamber (3), **characterized in that**

the amount of solid material advanced from the feed

shaft (2) to the combustion chamber (3) is altered by pivoting an adjusting device (6).

8. Method according to claim 6, wherein the pivot position of the adjusting device (6) is altered depending on at least one of the following parameters:

- temperature within the combustion chamber (3),
- calorific value of the solid material,
- humidity of the solid material.

9. Method according to claim 6 or 7, wherein solid material is advanced by a pusher (9) from the lower bottom of the feed shaft (2) to the combustion chamber (3).

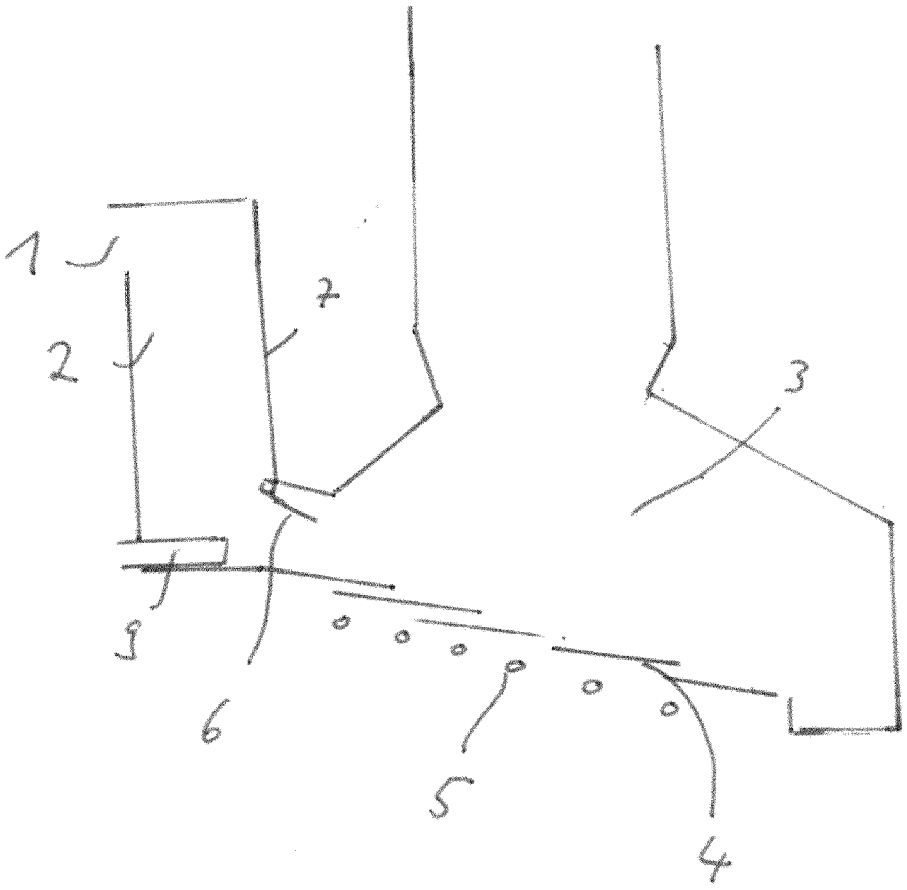

Fig. 1

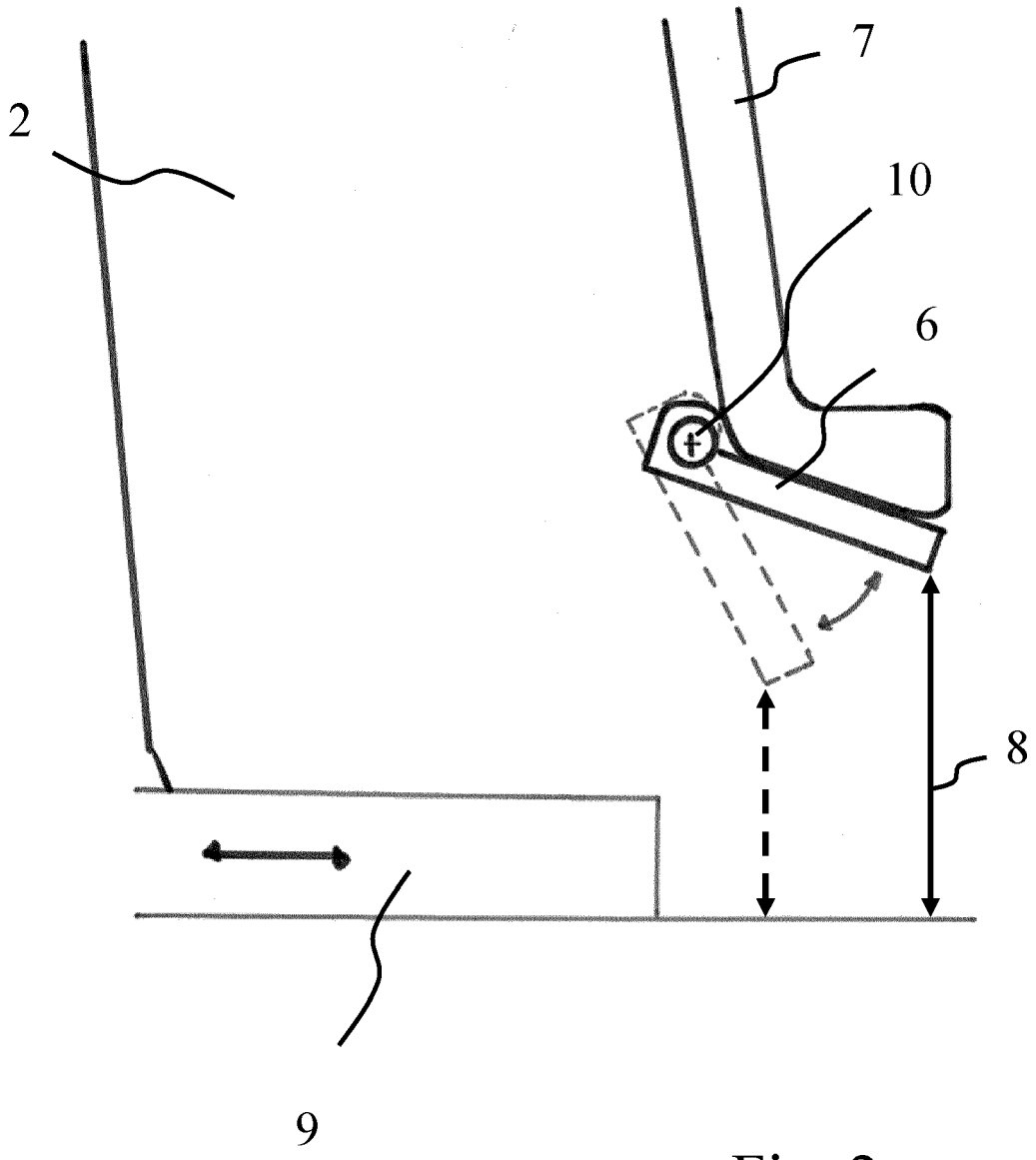

Fig. 2

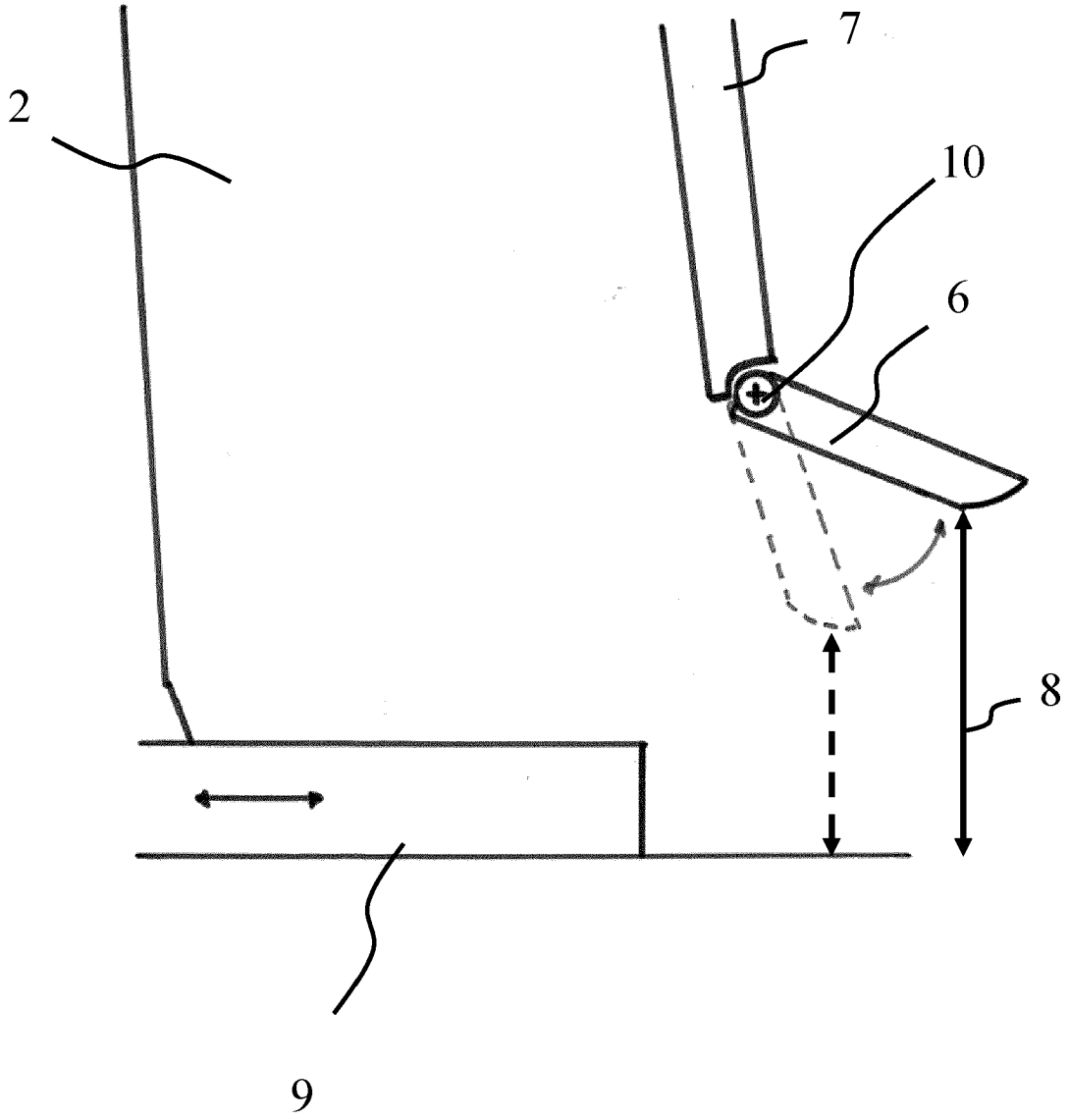

Fig. 3

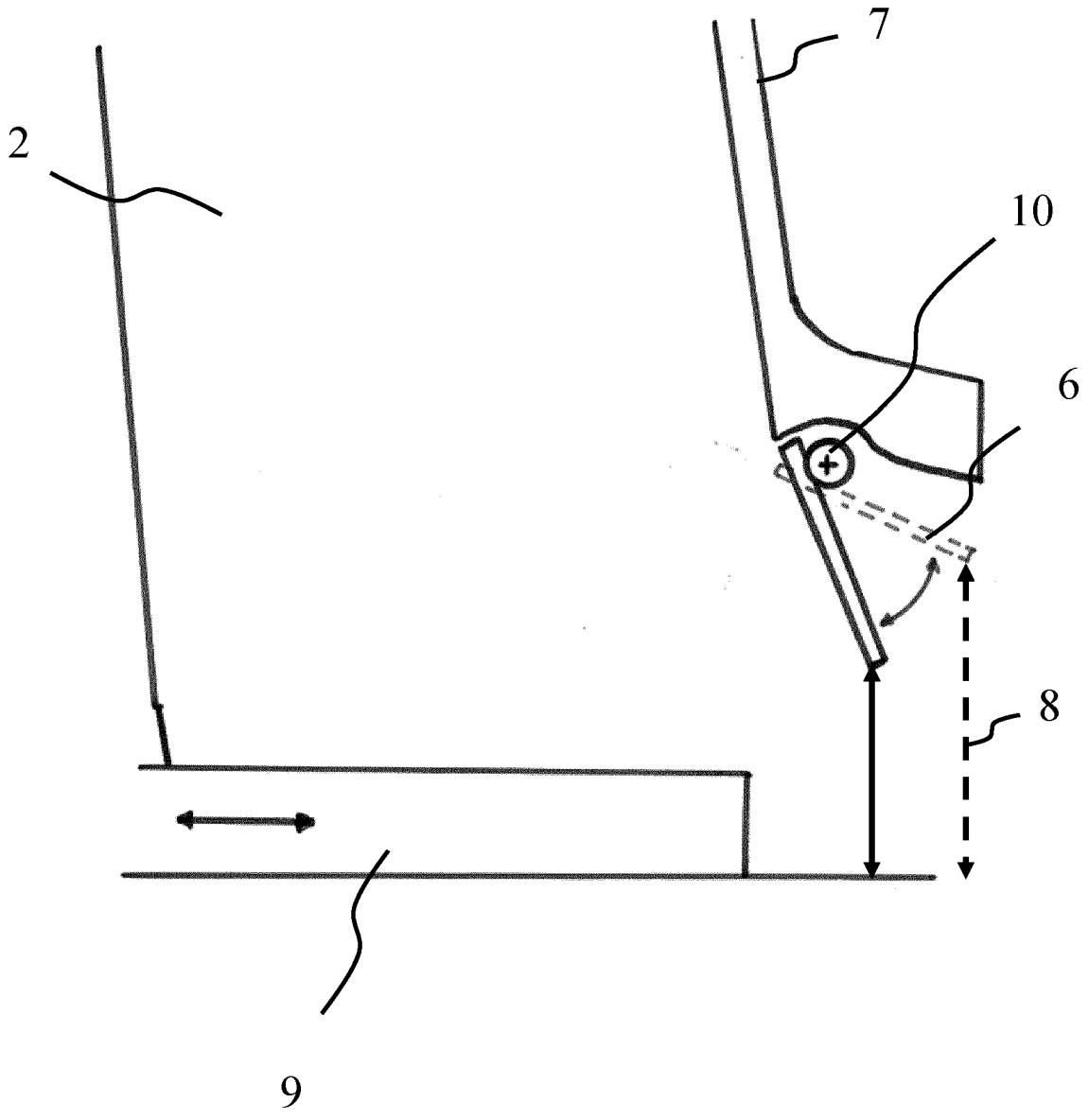

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 8461

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 Y	JP S53 25171 U (N.N.) 3 March 1978 (1978-03-03) * claim 1; figures 1-3 and relating passages of the description *	1,2,6-8 1,3-5,7, 9	INV. F23B40/06 F23G5/44 F23G5/50 F23K3/22
X	DE 514 665 C (STREICHER FA M) 16 December 1930 (1930-12-16) * the whole document *	1,2,7	
Y	DE 197 11 495 A1 (HERHOF UMWELTTECHNIK GMBH [DE]) 24 September 1998 (1998-09-24) * column 2, line 42 - column 3, line 38 * * figure 1 *	1,3-5,7, 9	
A	CN 2 222 298 Y (XINYU IRON AND STEEL CO LTD [CN]) 13 March 1996 (1996-03-13) * figure 1 and the relating passage of the description *	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

F23B
F23G
F23K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 May 2021	Rudolf, Andreas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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20-05-2021

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DE 514665 C	16-12-1930	NONE	
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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