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(54) **DISTRIBUTION DEVICE FOR USE IN A CHARGING INSTALLATION OF A METALLURGICAL REACTOR**

VERTEILUNGSVORRICHTUNG ZUR VERWENDUNG IN EINER LADEINSTALLATION EINES METALLURGISCHEN REAKTORS

DISPOSITIF DE DISTRIBUTION DESTINÉ À ÊTRE UTILISÉ DANS UNE INSTALLATION DE CHARGEMENT D'UN RÉACTEUR MÉTALLURGIQUE

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Description

Technical field

[0001] The present invention generally relates to a distribution device for distributing bulk material. More specifically, the invention relates to a device of the type that rotates a distribution chute about a first essentially vertical axis and pivots the distribution chute about a second essentially horizontal axis. This type of distribution device is typically used in a charging installation of a metallurgical reactor, especially of a blast furnace, e.g. in charging installations of the well-known Bell-Less Top® type.

[0002] The present invention also relates to a corresponding distribution chute.

Background Art

[0003] An early example of the above type of distribution device with a trough-shaped rotating and pivoting distribution chute is known for example from U.S. patent no. 3'814'403.

[0004] When exposed to the typical high internal temperatures of a metallurgical reactor, e.g. in case of a blast furnace, such a distribution device usually has to be provided with an efficient cooling arrangement in order to avoid damage and, especially but not exclusively, for protecting the gear components required for tilting the chute.

[0005] European Patent EP 0 116 142 proposed a suitable cooling system, which has found widespread use in distribution devices for blast furnaces. Due to the typical configuration of the rotor, i.e. the rotating structure that supports the distribution chute, this kind of charging device comprises a certain number of horizontal surfaces that need to be cooled. In fact, the rotor of a distribution device according to EP 0 116 142 has, among others, a lower horizontal shield with an oval aperture, and an oval horizontal cover forming the upper limit of an oval cavity into which an upper portion of the chute can pivot. Obviously, horizontal surfaces are particularly exposed to heat from inside the reactor, among others due to their direct exposure to radiant heat. Accordingly, considerable cooling capacity is required on the rotor in a cooling arrangement of the above type. As opposed to stationary parts, coolant capacity on the rotor is however inherently limited by low throughput, service-life and/or cost of suitable swivel joints needed for transferring coolant onto the rotating rotor (and back). In consequence, there is a desire for reducing the total area of exposed horizontal surfaces on the rotor.

[0006] A distribution device that has a reduced amount of exposed rotating horizontal surfaces is known e.g. from PCT application WO 00/20646. This patent application proposes a distribution device especially designed for small reactors. Incidentally however, WO 00/20646 also proposes a design in which the rotor has little, if any, water-cooled horizontal surfaces.

[0007] In fact, WO 00/20646 proposes a distribution device with a stationary casing that has, at its bottom, a stationary lower shield with a central opening coaxial with the rotation axis of the chute. The stationary shield covers a certain extent of the throat opening of the furnace and, accordingly, extends outwardly from the opening. It is equipped with cooling serpentines for protecting the interior of the casing against heat. As will be understood, the shield being stationary, it can be readily cooled even at high capacity. The rotor, which is rotatably supported inside the casing and to which the distribution chute is mounted, on the other hand has a lower end with a small horizontal disc-shaped protection collar provided with insulation at its lower face. Inside the collar of the rotor, there is a cavity that is accessible from the outer edge of the collar so that coolant gas can be injected from the stationary shield. Therefore, the design of WO 00/20646 requires little if any coolant capacity on the rotor.

[0008] Compared to EP 0 116 142, in which the rotor needs to have certain horizontal surfaces so that the chute can pivot into a nearly vertical position as typically required (for central charging), the design of WO 00/20646 avoids pivoting the chute into the rotational envelope defined by the supporting rotor. This is achieved by virtue of comparatively long curved suspension arms extending from the upper portion of the trough-shaped chute body to the pivoting shafts at which the chute is pivotally mounted to the rotor. However, a main drawback of the configuration of WO 00/20646 resides in that comparatively high torque is exerted onto the pivoting gears by the chute and vice-versa. Therefore, this design is not readily suitable for modern large-diameter reactors, especially blast furnaces, which usually require long chute lengths of 3 to 5m.

[0009] Japan patent application 59 031807 relates to a shaft furnace charging apparatus equipped with a distribution chute that has a bent shape.

[0010] French patent 2230246 discloses a shaft furnace charging apparatus comprising a stationary casing, a rotor supported by the casing so as to be rotatable about a rotation axis, and a distribution chute mounted to the rotor. The stationary casing comprising a stationary lower shield having an inner border delimiting a central opening that is centered on the rotation axis, the shield extending outwardly from the central opening for protecting the interior of the casing against heat from inside the reactor. The rotor comprises a tubular support that is arranged coaxial with the rotation axis. A tilting mechanism permits the tilting of the distribution chute about a tilting axis perpendicular to the rotation axis.The distribution chute, which has a bent shape, has an upper inlet portion that is arranged in the tubular support. In order to allow the tilting of the chute, the tubular support has a relatively large diameter.

Technical problem

[0011] It is therefore an object of the present invention to provide an alternative design of a distribution device

of the initially mentioned type that allows reliable operation with reduced coolant capacity on the rotor side, i.e. on the rotatable parts of the device, not exclusively but especially when used in a large-diameter blast furnace.

[0012] This object is achieved by a device as claimed in claim 1.

General Description of the Invention

[0013] In order to overcome the above-mentioned problem, the present invention proposes a distribution device for a changing installation that has a rotating and pivoting distribution chute. The device has a casing that rotatably supports a rotatable structure (hereinafter: rotor) to which the chute is mounted. The casing has a stationary heat protection shield at its lower end. The shield has a central opening delimited by an inner border. The shield extends radially outward and protects the inside of the casing against heat. The rotor, on the other hand, has a generally tube-shaped support coaxial on its rotation axis, with tilting shafts for pivoting the chute. The tilting shafts define a tilting axis perpendicular to the rotation axis.

[0014] According to the invention, the tubular support reaches with its lower edge to the border of the opening in the shield, i.e. to the inner border of the stationary heat protection shield. Furthermore, the chute is mounted with its upper portion inside the tubular support with its inlet above the lower edge of the support. In order to enable such mounting of the chute inlet directly inside the rotor without reducing the radial charging range, the chute is provided with a bent shape. Accordingly, the chute body has an upper portion, in which material flows along a first direction, and a lower portion, in which material flows along a diverted second direction that has a less steep slope. The upper portion of the chute body comprises an annular closed mounting head that forms the inlet and has two diametrically opposite mounting members. The tilting shafts each have a respective mount cooperating with one of the mounting members. The annular closed mounting head has a first longitudinal axis and forms the inlet. The lower portion comprises a circumferentially closed jacket having a second longitudinal axis and terminating at the outlet, the longitudinal axes being arranged at an angle that corresponds approximately to the angle between the first and second directions. A recess is provided in the chute body that permits tilting the chute to a raised position, in which the lower edge of the tubular support enters the recess.

[0015] As will be appreciated, the proposed combination of casing design, rotor design and chute shape permits a considerable reduction of cooling capacity needed on the rotor while being compatible with large-site reactors, i.e. achieving sufficient distribution radius. It may also be noted that, because the upper portion of the chute reaches into the cooled section of the charging device, the thermal load of the chute is reduced. It is worthwhile noting that the recess allows the distribution chute to be pivoted to a higher angle with respect to the vertical without the chute abutting against the lower edge of the tubular support and, in particular, against the inner border of the stationary shield. Accordingly, the diameter of the opening in the stationary shield may be made smaller than in a conventional distribution device, e.g. that of FR 2230246. As it is easier to cool the stationary shield than the rotor, any reduction of the rotating horizontal surfaces directly exposed to the heat of the molten material in the metallurgical reactor is highly appreciated.

[0016] Preferred embodiments of the charging device are defined in the enclosed dependent claims.

Brief Description of the Drawings

[0017] Further details and advantages of the present invention will be apparent from the following detailed non-limiting description of a preferred embodiment with reference to the attached drawings, wherein:

Fig.1 is a first vertical cross-sectional view of a charging device schematically illustrating the charging device and a distribution chute in accordance with the invention;

Fig.2 is a second vertical cross-sectional view, taken at right angles to the plane of Fig.1, schematically illustrating pivoting mechanisms for pivoting the distribution chute;

Fig.3 is a vertical cross-sectional view corresponding to Fig.2, illustrating removal of one of the pivoting mechanisms.

[0018] Identical reference numerals are used to identify identical parts throughout the drawings.

Detailed Description with respect to the Drawings

[0019] Figs.1-3 schematically illustrate a distribution device, generally identified at 10. The distribution device is designed for use in a charging installation of a metallurgical reactor, in particular of a blast furnace. Typically, the distribution device 10 is arranged to close the top opening of the reactor, e.g. on the throat of the furnace (not shown). The distribution device 10 is fed with charge material from one or more intermediate storage hoppers, e.g. according to a configuration as disclosed in WO 2007/082633.

[0020] The distribution device 10 has a stationary casing 12 with a ring-shaped circumferential mounting flange 14 at its lower outer circumference by means of which the casing 12 is typically fixed e.g. to the brim of the furnace throat opening. Inside the casing 12, a rotor, generally identified at 16, is supported by means of roller bearings 18 on the casing 12, more specifically on the top plate of the stationary casing 12. The rotor 16 is thus rotatable about a rotation axis A that corresponds e.g. to

the blast furnace axis. As seen in Fig.1, a distribution chute, generally identified at 20, is mounted to the rotor 16 so as to rotate in unison therewith about axis A.

[0021] As further seen in Figs.1-3, the stationary casing 12 has a stationary lower shield 22 having an inner border 24 delimiting a central opening 26 that is centered on the rotation axis A. In order to shield off, i.e. protect the interior of the casing 12 against heat from inside the reactor, the shield 22 comprises a cooling circuit 28, e. g. a spiral of tubes for liquid coolant. The shield 22 extends in radial direction from the central opening 26 to the mounting flange 14 over a substantial extent. In addition, the lower side of the shield 22 may be provided with thermal insulation. Whereas other designs, e.g. a frusto-conical shape rising toward the center are not excluded, the stationary lower shield 22 is preferably substantially horizontal and disc-shaped.

[0022] Figs.1-3, further show that the rotor 16 has a tubular support 30 that is arranged coaxial with the rotation axis A. Although embodiments with a single tilting gear and two pivoting levers are not excluded, as proposed e.g. in European Patent EP 1 001 039, the rotor 16 preferably has two diametrically opposite tilting gears 32 for pivoting the chute. Each tilting gear 32 has a respective tilting shaft, schematically illustrated at 34, that passes through the tubular support 30. The tilting gears 32 are supported in cantilevered manner on the tubular support 30. Consequently, the tubular support 30 also carries the weight of the mounted chute 20. In conventional manner, the tilting shafts 34 are collinear i.e. coaxial and define a tilting axis B that is perpendicular to the rotation axis A. Each tilting shaft 34 has a respective mount, schematically illustrated at 36, that cooperates with a respective one of two mounting members (not shown) of the distribution chute 20.

[0023] As clearly seen in Fig.1, the tubular support 30 extends downwards into the opening 26 in the lower shield 22 and has a lower edge 38 that is arranged adjacent to the inner border 24 of the shield 22. As will be understood, a minimum gap between the lower edge 38 and the border 24 is ideal, irrespective of where exactly the lower edge 38 stops, shortly above the shield 22, exactly in the opening 26 or shortly below of the shield 22. The tubular support 30 has a generally circular annular upper connecting flange 40 by means of which it is mounted to the rotary race of the bearing 18. The lower edge 38 is also generally circular.

[0024] Accordingly, as seen in Figs.1-3, the tubular support 30 extends with a constant circular cylindrical cross-section from the connecting flange 40 to the circular lower edge 38. Of course, the tubular support 30 may also slightly deviate from this shape, e.g. slightly widening downwards, but it preferably presents only a minimum of heat-attack surface seen from vertically below (surface seen in bottom view). When seen from below, the major heat shielding surface is provided on the stationary shield 22. To this effect, the shield 22 presents a radial extent (i.e. radial measure from opening 26 to mounting flange 14) of at least 40% of the radius of the tubular support 30. Accordingly, the exposed surface of the shield 22 is at least 125% of any potentially exposed surface of the rotor 16 inside the tubular support 30. The radial distance, over which the lower shield 22 extends from the lower edge of the tubular support 30 towards the bottom flange 14, is preferably at least 20% of the radius of the bottom flange.

[0025] As further seen in Figs.1-3, the stationary casing 12 further includes a feeder spout 42 that is coaxial with the rotation axis A and fixed, e.g. by means of a detachable flange, to the top plate of the casing 12 in a typical manner. In order to shield critical components against heat, in particular the roller bearings 18, the stationary casing 12 further has a stationary cooling hood 44 arranged in between the feeder spout 42 and the tubular support 30. The cooling hood 44 is shaped to widen downwards, e.g. in frusto-conical manner from a small upper radius arranged adjacent the feeder spout 42 to a comparatively large lower radius adjacent the tubular support 30. In the preferred embodiment of Figs.1-3, the cooling hood 44 has a generally cylindrical upper portion followed by a frusto-conical lower portion.

[0026] According to the invention, and as seen in Figs. 1-3, the distribution chute 20 has a chute body that has a generally bent shape in longitudinal sections. The chute 20 is preferably angled (sharply bent), but may also be curved (smoothly bent). In consequence, the chute body has an upper portion 46 and a lower portion 48 which respectively have different longitudinal axes as illustrated in Fig.1. As further illustrated in Fig.1, the upper portion 46 is shaped generally cylindrically and forms a chute inlet 50 at its upstream end. The upper portion 46 confines bulk material to flow along a first direction D1 inside the upper portion 46 after impact on the chute 20. The lower portion 48, which forms the chute outlet 52 at its downstream end, on the other hand, confines bulk material to flow from the upper portion 46 to the outlet 52, along a different second direction D2 that is, in a vertical plane, at an angle with respect to the first direction D1. More specifically, in a vertical plane, direction D2 is at a less steep angle than direction D1 with respect to the vertical (axis A) as seen in Fig.1. For sufficient effect (see below), the angle α between the first and second directions D1, D2 in a vertical plane is preferably no greater than 165°, e.g. in the range of 135-160°.

[0027] Further according to the invention, as best seen in Fig.1, the upper portion 46 of the chute body is mounted inside the tubular support 30 on the axis B of the tilting shafts 34, so that its inlet 50 is arranged above the lower edge 38 of the tubular support 30. Accordingly, the torque required to tilt the chute 20 is considerably reduced and - as will be appreciated in comparison to conventional charging devices with an oval recess in the rotor - the opening in the rotor 16, as defined by the open cross-section inside the tubular support 30, can be kept relatively small.

[0028] In order to warrant a sufficiently large radius of

charging despite the restrained tilting angle available to the upper portion 46 inside the tubular support 30, the chute 20 is provided with the aforementioned bent shape. Accordingly, even at comparatively small pivoting angles about axis B, a considerable radial deviation is achieved due to the deviation angle α between directions D1 and D2.

[0029] As another benefit, the distance of acceleration of material falling from the feeder spout 42 onto the chute 20 is reduced. In fact, as seen in Fig.1, the upper portion 46 of the chute body is preferably mounted inside the tubular support 30 so that the feeder spout 42 reaches into the inlet 50 of the chute body.

[0030] For providing mechanical rigidity to the bent chute 20, the upper portion 46 of the chute body comprises an annular closed mounting head 54 that forms the inlet 50 and has two diametrically opposite mounting members (not shown) of any suitable known shape, e.g. a duckbill shape, to permit reliable mounting of the chute 20 to the mounts 36 of the gears 32. Unimpeded and sufficient pivoting ranges have been found to be achievable in practice when the mounting head 54 has an outer diameter at the inlet 50 of approximately 65-75% of the inner diameter of the tubular support 30 and, preferably, with the feeder spout 42 having an outer diameter of 35-50% of the inner diameter of the tubular support 30. Vice-versa, the required diameter of feeder spout 42 determines suitable dimensions of the tubular support 30 and the mounting head 54.

[0031] As further seen in Fig.1, the annular closed mounting head 54 is followed by a generally cylindrical shell. Both have a first longitudinal axis, which in case of a cylindrical upper portion 46 is parallel to direction D1. The lower portion 48 in turn preferably has a circumferentially closed jacket for additional stability. As seen in Fig.1, the jacket forming the lower portion 48 is preferably tapering, e.g. in conical shape, towards the outlet 52 for additional concentration of the flow. In the latter case however, the longitudinal axis of the lower portion is not exactly parallel to the direction D2 of flow inside the lower portion 48. Nevertheless, the longitudinal axes are necessarily arranged at an angle that corresponds roughly to the angle α between the first and second directions D1, D2, as seen in Fig.1.

[0032] For enabling pivoting the chute 20 to a more inclined position (for charging to a greater radius), as illustrated in Fig.1, the chute 20 has a recess 56 which enables tilting the chute 20 to a position where the lower edge 38 of the tubular support 30 enters into the recess 56. In other words, at a position where the lower edge 38 is within either one or both envelopes of the chute portions 46, 48, the chute 20 has the recess 56.

[0033] For reasons that become apparent below, the charging device 10 is preferably configured so that the tilting axis B, as defined by the location of the gears 32 and their shafts 34, is arranged vertically above the mounting flange 14. Axis B is located e.g. at a vertical height above the mounting flange of at least 10%, more preferably at least 20% of the total height of the casing 12. In fact, as seen in Fig.1, the flat lower shield 22 is arranged above the level of the mounting flange 14. Therefore, the tilting gears 32 are provided above the level of the mounting flange 14. More specifically the mounts 36, to which the chute 20 can be mounted, are also arranged above the level of the mounting flange 14. As a beneficial consequence, best seen by comparing Fig.2 and Fig.3, each of the gears 32 can be removed or installed, e.g. during maintenance interventions, in simple manner using a rail unit 58 with substantially horizontal rails. Accordingly, each of the tilting gears 32 has associated permanently mounted or removable rollers 60 that cooperate with the rail unit 58 for removing the tilting gears 32 out of the casing 12.

[0034] In conclusion, as will be appreciated, the proposed configuration allows minimizing, or even totally avoiding, exposed horizontal surfaces on the rotor 16. Furthermore, this is achieved without increasing the nominal torque according to which the gears 32 have to be designed. On the contrary, torque is even considerably reduced by raising the upper portion 46 of the chute 20 to the height of the supporting mounts 36.

Legend:

[0035]

10	distribution device
12	stationary casing
14	mounting flange
16	rotor
18	roller bearings
20	distribution chute
22	stationary lower shield
24	inner border
26	central opening
28	cooling circuit
30	tubular support
32	tilting gears
34	tilting shaft
36	mount
38	lower edge
40	connecting flange
42	feeder spout
44	cooling hood
46	upper portion
48	lower portion
50	inlet
52	outlet
54	mounting head
56	recess
58	dismantling rail unit
60	rollers

Claims

1. A distribution device (10) for use in a charging installation of a metallurgical reactor, in particular of a blast furnace, said device (10) being configured for rotating and pivoting a distribution chute (20) and said device (10) comprising:

   a stationary casing (12), a rotor (16) supported by said casing (12) so as to be rotatable about a rotation axis, and a distribution chute (20) mounted to said rotor (16);
   said stationary casing (12) comprising a stationary lower shield (22) having an inner border (24) delimiting a central opening (26) that is centered on said rotation axis, said shield (22) extending outwardly from said central opening (26) for protecting the interior of said casing (12) against heat from inside said reactor;
   said rotor (16) comprising a tubular support (30) that is arranged coaxial with said rotation axis and has at least one tilting gear (32) and two tilting shafts (34) passing through said support (30) and defining a tilting axis perpendicular to said rotation axis; wherein

   - said tubular support (30) extends downwards to said lower shield (22) and has a lower edge (38) arranged at said inner border (24) of said lower shield (22);
   - said chute body (20) has a bent shape and comprises

     an upper portion (46) that has an inlet (50) and confines bulk material to flow along a first direction, and
     a lower portion (48) that has an outlet (52) and confines bulk material to flow along a second direction that is, in a vertical plane, at an angle with respect to said first direction;

   - said upper portion (46) of said chute body is mounted inside said tubular support (30) to said tilting shafts (34) with its inlet (50) arranged above said lower edge (38) of said tubular support (30);
   - said upper portion (46) of said chute body comprises an annular closed mounting head (54) that forms said inlet (50) and has two diametrically opposite mounting members;
   - said tilting shafts (34) each have a respective mount (36) cooperating with one of said mounting members;
   - said annular closed mounting head (54) has a first longitudinal axis and forms said inlet (50),
   - said lower portion (48) comprises a circumferentially closed jacket having a second longitudinal axis and terminating at said outlet (52), said longitudinal axes being arranged at an angle that corresponds approximately to said angle between said first and second directions;
   and
   - a recess (56) is provided in said chute body that permits tilting said chute (20) to a raised position, in which said lower edge (38) of said tubular support (30) enters said recess (56).

2. The distribution device according to claim 1, **characterized in that** said tubular support (30) has an annular upper connecting flange (40), a circular lower edge (38) and extends cylindrically from said connecting flange (40) to said circular lower edge (38).

3. The distribution device according to claim 1, **characterized in that** said stationary casing (12) comprises a feeder spout (42) arranged coaxial with said rotation axis inside said tubular support (30) for feeding charge material onto said distribution chute (20), said upper portion (46) of said chute body being mounted inside said tubular support (30) so that said feeder spout (42) reaches into said inlet (50) of said chute body.

4. The distribution device according to claim 3, **characterized in that** said stationary casing (12) comprises a stationary cooling hood (44) arranged in between said feeder spout (42) and said tubular support (30) and shaped to widen in a downwards direction from adjacent said feeder spout (42) to adjacent said tubular support (30).

5. The distribution device according to any one of claims 1 to 4, **characterized in that** said annular closed mounting head (54) has an outer diameter at said inlet (50) of approximately 65-75% of the inner diameter of said tubular support (30).

6. The distribution device according to claim 5, **characterized in that** said feeder spout (42) has an outer diameter of 35-50% of the inner diameter of said tubular support (30).

7. The distribution device according to any one of claims 1 to 6, **characterized in that** said mounting head (54) is substantially cylindrical and said circumferentially closed jacket is substantially conical so as to taper toward said outlet (52).

8. The distribution device according to any one of the preceding claims, **characterized in that** said angle between said first and second directions is in a ver-

tical plane no greater than 165°.

9. The distribution device according to any one of the preceding claims, **characterized in that** said stationary lower shield (22) is substantially horizontal and disc-shaped, and comprises a cooling circuit (28).

10. The distribution device according to claim 9, **characterized in that** said stationary lower shield (22) has a radial extent of at least 40% of the radial extent of said tubular support (30).

11. The distribution device according to any one of the preceding claims, **characterized in that** said casing (12) has a circular bottom flange (14) for mounting said casing (12) to a top opening of a metallurgical reactor, in particular to the throat of a blast furnace, and **in that** said tilting axis is arranged vertically above said mounting flange (14).

12. The distribution device according claim 11, **characterized in that** said tilting axis is arranged at a vertical height above said mounting flange (14) of at least 10%. of the total height of said casing (12).

13. The distribution device according claim 11, **characterized in that** said tilting axis is arranged at a vertical height above said mounting flange (14) of at least 20%. of the total height of said casing (12).

14. The distribution device according to claim 11, **characterized in that** said lower shield (22) is arranged above said mounting flange (14) and **in that** said rotor (16) has two tilting gears (32), each gear (32) having a respective tilting shaft (34) with a mount (36), which cooperates with a mounting member of said chute body, said gears (32) being supported on said tubular support (30) above said lower shield (22) so that said mounts (36) are arranged above said mounting flange (14).

15. The distribution device according to claim 14, **characterized in that** each of said tilting gears (32) comprises rollers (60) for removing said tilting gears (32) out of said casing (12) on substantially horizontal rails (58).

16. The distribution device according to any one of claims 11 to 15, **characterized in that** said lower shield (22) extends from said lower edge (38) of said tubular support (30) towards said bottom flange (14).

17. The distribution device according to claim 16, **characterized in that** said lower shield (22) extends from said lower edge (38) of said tubular support (30) towards said bottom flange (14) over a radial extent of at least 20% of the radius of said bottom flange (14).

18. A blast furnace comprising the distribution device according to any one of the preceding claims.

Patentansprüche

1. Verteilervorrichtung (10) zur Verwendung in einer Beschickungsanlage eines metallurgischen Reaktors, insbesondere eines Hochofens, wobei die Vorrichtung (10) für das Drehen und Schwenken einer Verteilerschurre (20) konfiguriert ist und die Vorrichtung (10) Folgendes umfasst:

ein feststehendes Gehäuse (12), einen Rotor (16), der derart von dem Gehäuse (12) getragen ist, dass er um eine Drehachse drehbar ist, und eine am Rotor (16) angebrachte Verteilerschurre (20); wobei das feststehende Gehäuse (12) einen feststehenden unteren Schild (22) umfasst, der einen Innenrand (24) aufweist, der eine mittige Öffnung (26) abgrenzt, die auf die Drehachse zentriert ist, wobei sich der Schild (22) von der mittigen Öffnung (26) aus nach außen erstreckt, um den Innenraum des Gehäuses (12) vor Wärme aus dem Innenraum des Reaktors zu schützen;
wobei der Rotor (16) einen rohrförmigen Träger (30) umfasst, der koaxial zu der Drehachse angeordnet ist und mindestens ein Kippgetriebe (32) und
zwei Kippwellen (34), die durch den Träger (30) verlaufen und eine senkrecht zu der Drehachse verlaufende Kippachse definieren, aufweist;
wobei

- der rohrförmige Träger (30) sich nach unten zum unteren Schild (22) erstreckt und eine am Innenrand (24) des unteren Schilds (22) angeordnete Unterkante (38) aufweist;
- der Schurrenkörper (20) eine gekrümmte Form aufweist und Folgendes umfasst:

einen oberen Abschnitt (46), der einen Einlass (50) aufweist und Schüttgut derart einschränkt, dass es entlang einer ersten Richtung fließt, und
einen unteren Abschnitt (48), der einen Auslass (52) aufweist und Schüttgut derart einschränkt, dass es entlang einer zweiten Richtung fließt, die sich in einer vertikalen Ebene in einem Winkel zu der ersten Richtung befindet;

- der obere Abschnitt (46) des Schurrenkörpers innerhalb des rohrförmigen Trägers (30) an den Kippwellen (34) angebracht ist, wobei sein Einlass (50) über der Unterkante (38) des rohrförmigen Trägers (30) ange-

ordnet ist;
- der obere Abschnitt (46) des Schurrenkörpers einen ringförmigen geschlossenen Montagekopf (54) umfasst, der den Einlass (50) bildet und zwei sich diametral gegenüberliegende Montageelemente bildet;
- die Kippwellen (34) jeweils eine jeweilige Halterung (36) aufweisen, die mit einem der Montageelemente zusammenwirkt;
- der ringförmige geschlossene Montagekopf (54) eine erste Längsachse aufweist und den Einlass (50) bildet;
- der untere Abschnitt (48) einen umfänglich geschlossenen Mantel umfasst, der eine zweite Längsachse aufweist und am Auslass (52) endet, wobei die Längsachsen in einem Winkel angeordnet sind, der ungefähr dem Winkel zwischen der ersten und zweiten Richtung entspricht; und
- eine Vertiefung (56) in dem Schurrenkörper vorgesehen ist, die das Kippen der Schurre (20) bis zu einer erhöhten Position gestattet, bei welcher die Unterkante (38) des rohrförmigen Trägers (30) in die Vertiefung (56) eintritt.

2. Verteilervorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der rohrförmige Träger (30) einen ringförmigen oberen Verbindungsflansch (40) und eine kreisförmige Unterkante (38) aufweist und sich zylindrisch vom Verbindungsflansch (40) zu der kreisförmigen Unterkante (38) erstreckt.

3. Verteilervorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** das feststehende Gehäuse (12) eine Aufgabeöffnung (42) umfasst, die koaxial zu der Drehachse innerhalb des rohrförmigen Trägers (30) angeordnet ist, um Einsatzmaterial auf die Verteilerschurre (20) zu leiten, wobei der obere Abschnitt (46) des Schurrenkörpers derart innerhalb des rohrförmigen Trägers (30) angebracht ist, dass die Aufgabeöffnung (42) in den Einlass (50) des Schurrenkörpers hineinreicht.

4. Verteilervorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** das feststehende Gehäuse (12) eine feststehende Kühlhaube (44) umfasst, die zwischen der Aufgabeöffnung (42) und dem rohrförmigen Träger (30) angeordnet ist und derart geformt ist, dass sie in Abwärtsrichtung von der Angrenzung an die Aufgabeöffnung (42) zu der Angrenzung an den rohrförmigen Träger (30) breiter wird.

5. Verteilervorrichtung nach irgendeinem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** der ringförmige geschlossene Montagekopf (54) am Einlass (50) einen Außendurchmesser von ungefähr 65-75 % des Innendurchmessers des rohrförmigen Trägers (30) aufweist.

6. Verteilervorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** die Aufgabeöffnung (42) einen Außendurchmesser von 35-50 % des Innendurchmessers des rohrförmigen Trägers (30) aufweist.

7. Verteilervorrichtung nach irgendeinem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** der Montagekopf (54) im Wesentlichen zylindrisch ist und der umfänglich geschlossene Mantel im Wesentlichen derart kegelförmig ist, dass er sich zum Auslass (52) hin verjüngt.

8. Verteilervorrichtung nach irgendeinem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Winkel zwischen der ersten und zweiten Richtung in einer vertikalen Ebene nicht größer als 165 ° ist.

9. Verteilervorrichtung nach irgendeinem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der feststehende untere Schild (22) im Wesentlichen horizontal und scheibenförmig ist und einen Kühlkreislauf (28) umfasst

10. Verteilervorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** der feststehende untere Schild (22) eine radiale Erstreckung von mindestens 40 % der radialen Erstreckung des rohrförmigen Trägers (30) aufweist.

11. Verteilervorrichtung nach irgendeinem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das Gehäuse (12) einen kreisförmigen unteren Flansch (14) zum Anbringen des Gehäuses (12) an einer oberen Öffnung eines metallurgischen Reaktors, insbesondere an der Gicht eines Hochofens, aufweist und dass die Kippachse vertikal über dem Montageflansch (14) angeordnet ist.

12. Verteilervorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** die Kippachse in einer vertikalen Höhe von mindestens 10 % der Gesamthöhe des Gehäuses (12) über dem Montageflansch (14) angeordnet ist.

13. Verteilervorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** die Kippachse in einer vertikalen Höhe von mindestens 20 % der Gesamthöhe des Gehäuses (12) über dem Montageflansch (14) angeordnet ist.

14. Verteilervorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** der untere Schild (22) über dem Montageflansch (14) angeordnet ist und dass der Rotor (16) zwei Kippgetriebe (32) aufweist, wobei jedes Getriebe (32) eine jeweilige Kippwelle (34)

mit einer Halterung (36) aufweist, welche mit einem Montageelement des Schurrenkörpers zusammenwirkt, wobei die Getriebe (32) derart auf dem rohrförmigen Träger (30) über dem unteren Schild (22) getragen sind, dass die Halterungen (36) über dem Montageflansch (14) angeordnet sind.

15. Verteilervorrichtung nach Anspruch 14, **dadurch gekennzeichnet, dass** jedes der Kippgetriebe (32) Rollen (60) zum Entfernen der Kippgetriebe (32) aus dem Gehäuse (12) auf im Wesentlichen horizontalen Schienen (58) umfasst.

16. Verteilervorrichtung nach irgendeinem der Ansprüche 11 bis 15, **dadurch gekennzeichnet, dass** sich der untere Schild (22) von der Unterkante (38) des rohrförmigen Trägers (30) zum unteren Flansch (14) hin erstreckt.

17. Verteilervorrichtung nach Anspruch 16, **dadurch gekennzeichnet, dass** sich der untere Schild (22) von der Unterkante (38) des rohrförmigen Trägers (30) über eine radiale Erstreckung von mindestens 20 % des Radius des unteren Flansches (14) zum unteren Flansch (14) hin erstreckt.

18. Hochofen umfassend die Verteilervorrichtung nach irgendeinem der vorangehenden Ansprüche.

Revendications

1. Dispositif (10) de distribution destiné à une utilisation dans une installation de chargement d'un réacteur métallurgique, en particulier d'un haut-fourneau, ledit dispositif (10) étant configuré pour faire tourner et pivoter une goulotte (20) de distribution et ledit dispositif (10) comprenant :

un carter (12) fixe, un rotor (16) supporté par ledit carter (12) de façon à être rotatif autour d'un axe de rotation, et une goulotte (20) de distribution montée sur ledit rotor (16) ;
ledit carter (12) fixe comprenant un écran de protection (22) inférieur fixe ayant un bord (24) intérieur délimitant une ouverture (26) centrale qui est centrée sur ledit axe de rotation, ledit écran de protection (22) s'étendant vers l'extérieur à partir de ladite ouverture (26) centrale pour protéger l'intérieur dudit carter (12) de la chaleur provenant de l'intérieur dudit réacteur ;
ledit rotor (16) comprenant un support (30) tubulaire qui est agencé coaxialement avec ledit axe de rotation et a au moins un engrenage (32) de basculement et deux arbres (34) de basculement passant à travers ledit support (30) et définissant un axe de basculement perpendiculaire audit axe de rotation ; dans lequel

- ledit support (30) tubulaire s'étend vers le bas jusqu'audit écran de protection (22) inférieur et a un bord (38) inférieur agencé au niveau dudit bord (24) intérieur dudit écran de protection (22) inférieur ;
- ledit corps de goulotte (20) a une forme incurvée et comprend

une partie supérieure (46) qui a une entrée (50) et confine une matière en vrac pour qu'elle s'écoule dans un premier sens, et
une partie inférieure (48) qui a une sortie (52) et confine une matière en vrac pour qu'elle s'écoule dans un deuxième sens qui décrit, dans un plan vertical, un angle par rapport audit premier sens ;

- ladite partie supérieure (46) dudit corps de goulotte est montée à l'intérieur dudit support (30) tubulaire sur lesdits arbres (34) de basculement avec son entrée (50) agencée au-dessus dudit bord (38) inférieur dudit support (30) tubulaire :
- ladite partie supérieure (46) dudit corps de goulotte comprend une tête (54) de montage fermée annulaire qui forme ladite entrée (50) et a deux éléments de montage diamétralement opposés ;
- lesdits arbres (34) de basculement ont chacun une monture (36) respective coopérant avec l'un desdits éléments de montage ;
- ladite tête (54) de montage fermée annulaire a un premier axe longitudinal et forme ladite entrée (50),
- ladite partie inférieure (48) comprend une enveloppe circonférentiellement fermée ayant un deuxième axe longitudinal et se terminant à ladite sortie (52), lesdits axes longitudinaux étant agencés selon un angle qui correspond approximativement audit angle entre lesdits premier et deuxième sens ; et
- un creux (56) est prévu dans ledit corps de goulotte qui permet le basculement de ladite goulotte (20) jusqu'à une position relevée, où ledit bord inférieur (38) dudit support (30) tubulaire pénètre dans ledit creux (56).

2. Dispositif de distribution selon la revendication 1, **caractérisé en ce que** ledit support (30) tubulaire a une bride (40) de connexion supérieure annulaire, un bord (38) inférieur circulaire et s'étend cylindriquement de ladite bride (40) de connexion jusqu'audit bord (38) inférieur circulaire.

3. Dispositif de distribution selon la revendication 1, **caractérisé en ce que** ledit carter (12) fixe comprend une bouche (42) cylindrique agencée coaxialement avec ledit axe de rotation à l'intérieur dudit support (30) tubulaire pour amener une matière de charge sur ladite goulotte (20) de distribution, ladite partie supérieure (46) dudit corps de goulotte étant montée à l'intérieur dudit support (30) tubulaire de telle sorte que ladite bouche (42) cylindrique parvient jusque dans ladite entrée (50) dudit corps de goulotte.

4. Dispositif de distribution selon la revendication 3, **caractérisé en ce que** ledit carter (12) fixe comprend un capot (44) de refroidissement fixe agencé entre ladite bouche (42) cylindrique et ledit support (30) tubulaire et formé de façon à s'élargir dans une direction vers le bas à partir d'une position adjacente à ladite bouche (42) cylindrique jusqu'à une position adjacente audit support (30) tubulaire.

5. Dispositif de distribution selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** ladite tête (54) de montage fermée annulaire a un diamètre extérieur à ladite entrée (50) d'approximativement 65 à 75% du diamètre intérieur dudit support (30) tubulaire.

6. Dispositif de distribution selon la revendication 5, **caractérisé en ce que** ladite bouche (42) cylindrique a un diamètre extérieur de 35 à 50% du diamètre intérieur dudit support (30) tubulaire.

7. Dispositif de distribution selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** ladite tête (54) de montage est substantiellement cylindrique et ladite enveloppe circonférentiellement fermée est substantiellement conique à diamètre diminuant vers ladite sortie (52).

8. Dispositif de distribution selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit angle entre lesdits premier et deuxième sens est dans un plan vertical non supérieur à 165°.

9. Dispositif de distribution selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit écran de protection (22) inférieur fixe est substantiellement horizontal et en forme de disque, et comprend un circuit (28) de refroidissement.

10. Dispositif de distribution selon la revendication 9, **caractérisé en ce que** ledit écran de protection (22) inférieur fixe a une extension radiale d'au moins 40% de l'extension radiale dudit support (30) tubulaire.

11. Dispositif de distribution selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit carter (12) a une bride (14) inférieure circulaire pour le montage dudit carter (12) sur une ouverture supérieure d'un réacteur métallurgique, en particulier sur le gueulard d'un haut-fourneau, et **en ce que** ledit axe de basculement est agencé verticalement au-dessus de ladite bride (14) de montage.

12. Dispositif de distribution selon la revendication 11, **caractérisé en ce que** ledit axe de basculement est agencé à une hauteur verticale au-dessus de ladite bride (14) de montage d'au moins 10% de la hauteur totale dudit carter (12).

13. Dispositif de distribution selon la revendication 11, **caractérisé en ce que** ledit axe de basculement est agencé à une hauteur verticale au-dessus de ladite bride (14) de montage d'au moins 20% de la hauteur totale dudit carter (12).

14. Dispositif de distribution selon la revendication 11, **caractérisé en ce que** ledit écran de protection (22) inférieur est agencé au-dessus de ladite bride (14) de montage et **en ce que** ledit rotor (16) a deux engrenages (32) de basculement, chaque engrenage (32) ayant un arbre (34) de basculement respectif avec une monture (36), qui coopère avec un élément de montage dudit corps de goulotte, lesdits engrenages (32) étant supportés sur ledit support (30) tubulaire au-dessus dudit écran de protection (22) inférieur de telle sorte que lesdites montures (36) sont agencées au-dessus de ladite bride (14) de montage.

15. Dispositif de distribution selon la revendication 14, **caractérisé en ce que** chacun desdits engrenages (32) de basculement comprend des rouleaux (60) pour faire sortir lesdits engrenages (32) de basculement au dehors dudit carter (12) sur des rails (58) substantiellement horizontaux.

16. Dispositif de distribution selon l'une quelconque des revendications 11 à 15, **caractérisé en ce que** ledit écran de protection (22) inférieur s'étend dudit bord (38) inférieur dudit support (30) tubulaire vers ladite bride (14) inférieure.

17. Dispositif de distribution selon la revendication 16, **caractérisé en ce que** ledit écran de protection (22) inférieur s'étend dudit bord (38) inférieur dudit support (30) tubulaire vers ladite bride (14) inférieure sur une extension radiale d'au moins 20% du rayon de ladite bride (14) inférieure.

18. Haut-fourneau comprenant le dispositif de distribution selon l'une quelconque des revendications précédentes.

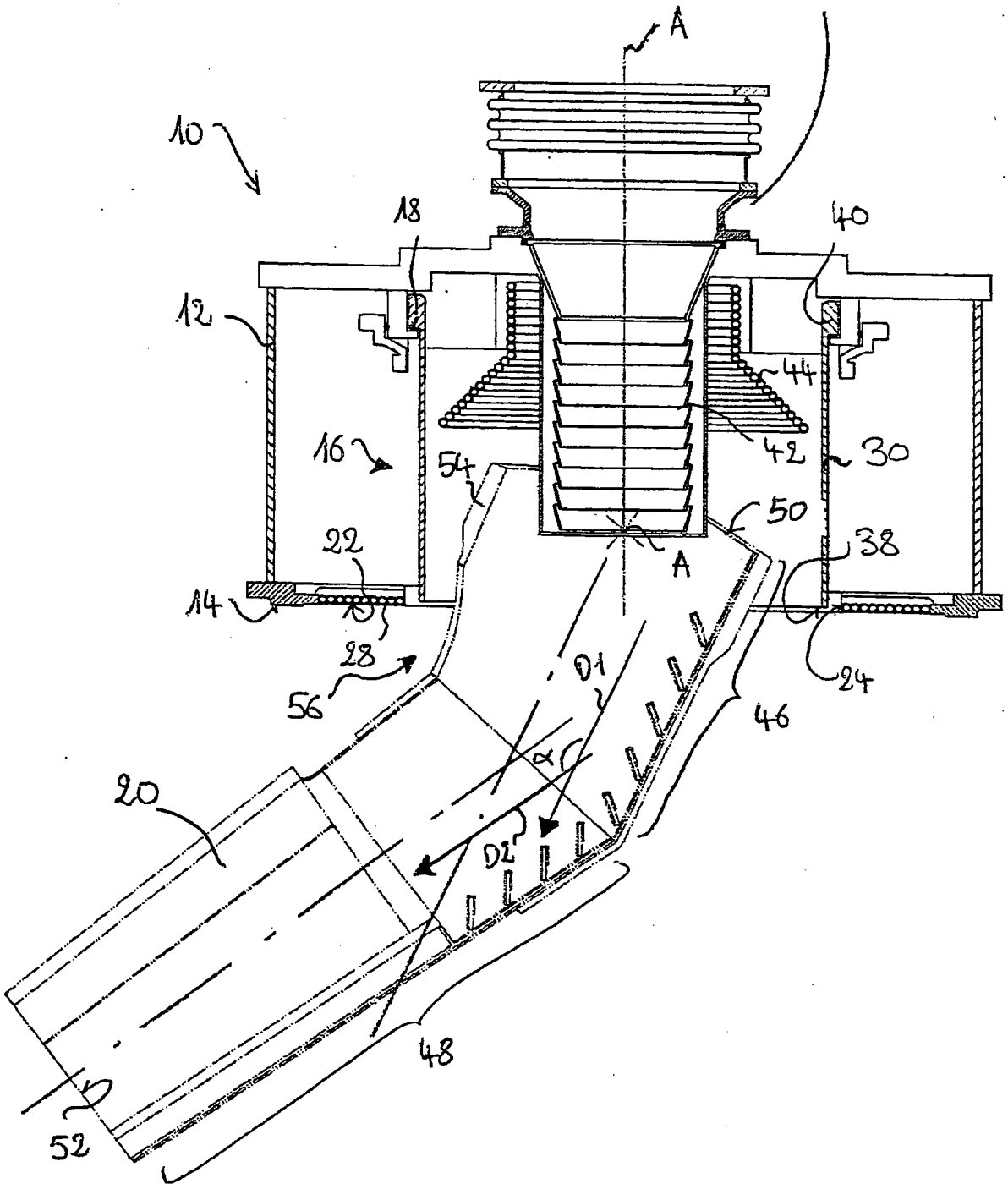

FIG.1

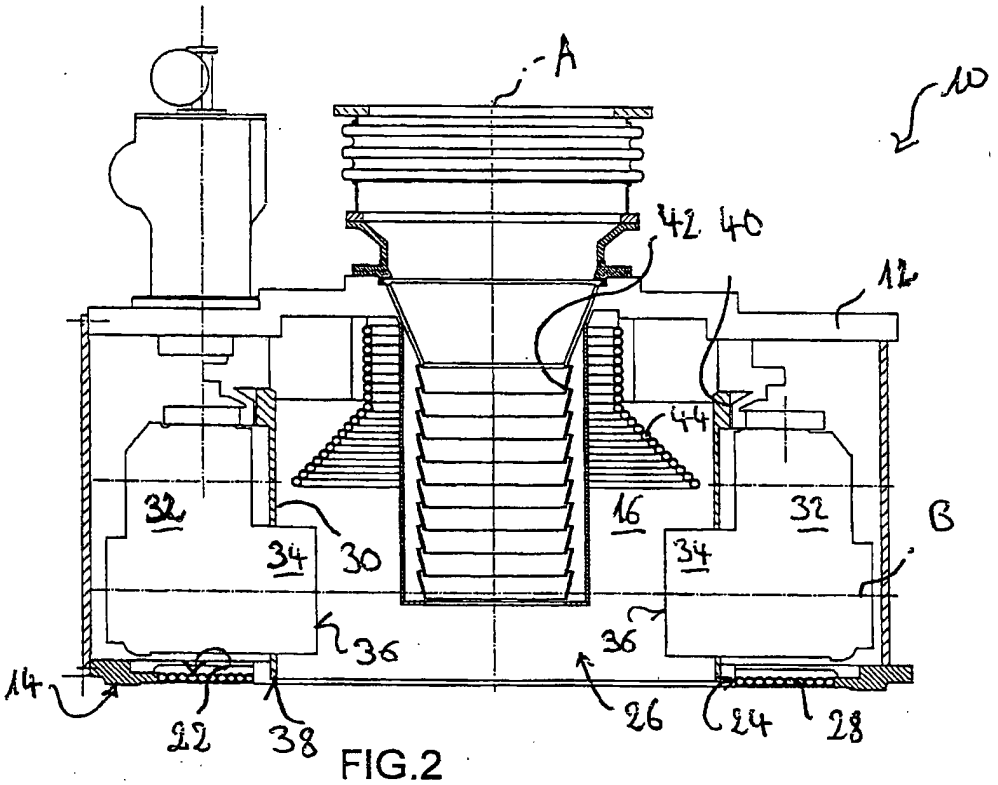
A
10
42
40
12
44
32
16
32
B
34
30
34
36
36
14
22
38
26
24
28

FIG.2

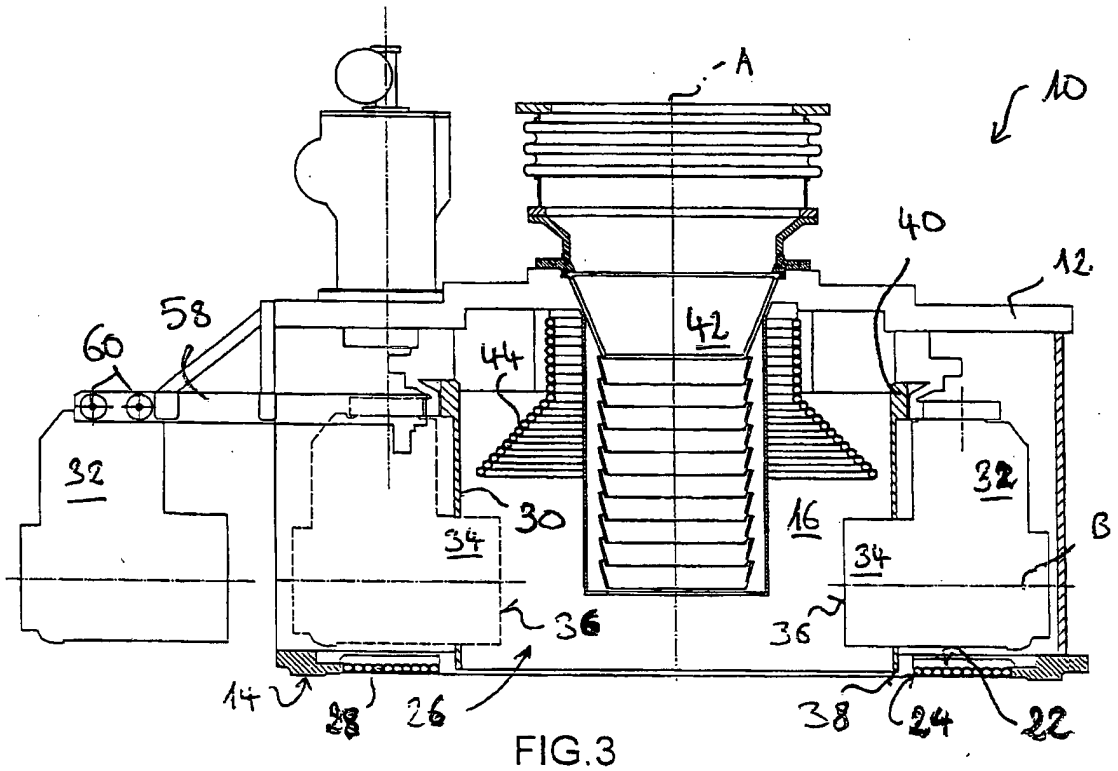
A
10
40
12
58
60
42
44
32
32
30
16
B
34
34
36
36
14
28
26
38
24
22

FIG.3

REFERENCES CITED IN THE DESCRIPTION

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