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(54) **A connecting system between continous mills in series in a grinding plant**

Verbindungssystem zwischen in Reihe geschalteten kontinuierlich arbeitenden Mühlen einer Mahlanlage

Système de raccordement entre des laminoirs continus en série dans un atelier de broyage

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Description

[0001] The invention relates to a grinding plant as defined by the pre-characterising portion of claim 1. The grinding plant is destined in particular, though not exclusively, to be used in the preparation of ceramic mixtures. These mixtures are generally prepared by damp comminution of the raw materials (silicon, feldspars, clay) and the addition of specific additives, up until a homogeneous slip is obtained, having the desired granulometry of the suspended powders.

[0002] As is known, a plant of this type usually comprises at least a grinding mill, which is provided with a rotating drum, internally of which the comminution process of the raw materials takes place by impact, and in any case by reciprocal action, between the raw materials themselves and a number of generally spherical grinding bodies.

[0003] Known grinding mills are subdivided into continuous mills and discontinuous mills, depending on whether the raw material loading stage into the drum and the slip unloading stage are done continuously during mill operation, or discontinuously, requiring temporary interruption of the production process and the halting of the rotating drum.

[0004] The present invention relates to a grinding plant comprising continuous mills.

[0005] In the prior art in the ceramics sector, the comminution of the raw materials comprises a process in successive stages, starting from a breaking stage and terminating with a refining stage. In the various stages, the grinding bodies exhibit different sizes, progressively diminishing in order of stages from breaking to refining; consequently, for each of the stages there is a rotating drum rotation speed such as to optimise the work operation, work times and energy consumption of the grinding mill.

[0006] For these reasons, the prior art, such as US-A-3942727, describes plants comprising a plurality of continuous grinding mills located in series, in which the rotating drum of each mill contains grinding bodies and rotates at an independent velocity from the others, in order to carry out one of above-described stages of the comminution process optimally.

[0007] A similar plant is described in detail in Italian patent application RE2003A000013, by the present applicant, to which patent application reference should be made for further details.

[0008] In particular, each rotating drum of the above-described plant is provided with a loading mouth for the material to be worked and an unloading mouth for the slip, which mouths are located on opposite sides of the drum and are arranged along the rotation axis thereof, and which mouths rotate solidly with the drum, facilitating continuous advancing of the loading raw material and the unloading slip.

[0009] Further, the unloading mouth of an intermediate rotating drum is connected to the loading mouth of the next drum, by means of a tubular connecting element, which is also associated to an in-loading device for introducing grinding bodies and special additives (for example, dyes) directly internally of the downstream drum.

[0010] A drawback of these known plants is that the tubular connecting element, differently to the unloading and loading conduits which rotate solidly with the respective rotating drums, must be solidly connected to the in-loading device and, consequently, must be fixed.

[0011] In fact the free end of the unloading mouth inserts axially for a tract thereof internally of the tubular connection, which in turn is inserted for a tract thereof internally of the free end of the loading mouth of the next mill.

[0012] With this configuration the material advancing between a rotating drum and a next rotating drum exhibits the tendency to fall accidentally from the side of the interface between the rotating drum upstream and the tubular connection and from the side of the interface between the tubular connection and the rotating drum located downstream.

[0013] This is due to the fact that the granular and abrasive nature of the slip makes the realisation of appropriate sealing devices difficult.

[0014] The object of the present invention is to obviate the above-mentioned drawback, by providing a solution which is simple, rational and inexpensive.

[0015] The object is attained by a grinding plant as defined by claim 1.

[0016] In a preferred embodiment of the invention, the means comprise a first helical body fixed to the free end of the unloading mouth of the upstream mill, such that the above-mentioned first helical body inserts internally of the connecting element, realising, in collaboration with a part of the internal surface of the connecting element, a first screw device which, during the advancing of the material, maintains the material internally of the connecting element.

[0017] In other embodiments the means either instead of a first helical body or further comprise a second helical body located at the downstream mill loading mouth and fixed internally thereto, the second helical body inserting internally of the loading mouth of the downstream mill and realising, in collaboration with the downstream mill loading mouth, a second screw device which prevents exit of the material from the downstream end of the connecting element.

[0018] Further characteristics and advantages of the invention will emerge from a reading of the following description, provided purely by way of non-limiting example with the aid of the enclosed figures of the drawings, in which:

- figure 1 is a schematic view of the continuous grinding plant of the invention;
- figure 2 is a detail of the connecting system between the mills of the invention.

[0019] With reference to the figures of the drawings, the grinding plant of the present invention, denoted in its entirety by 1, comprises a plurality of continuous mills 2 located in series.

[0020] Each mill 2 comprises a rotating drum 3, which is formed by a cylindrical body 4 having a horizontal axis, which body 4 is closed, at an end thereof, by a first bottom 5 provided with an axial mouth 6 for loading the material, and at an opposite end thereof, by a bottom 7 provided with an axial mouth 8 for unloading the slip.

[0021] The rotating drum 3 is supported at each end by a suitable structure 9 and is activated by a special control system 10 by means of a belt system 11.

[0022] Internally of the rotating drum 3 there is a grinding chamber, internally of which both the grinding bodies and the raw materials constituting the slip, i.e. essentially water, silicon, feldspars, clay are supplied. The grinding bodies are typically made of silicon or aluminium and during plant operation get worn, to the point that they mix in with the slip under processing.

[0023] Figure 1 shows that the upstream first mill 2 is provided with a usual loading system 18 of the raw materials, which is in itself known, and that the loading mouth 6 of the second mill, and any further mills, is connected both to the unloading mouth 8 of the preceding mill and to a in-loading conduit 20 which is associated to a further loading device 21.

[0024] The in-loading conduit 20 advantageously enables the grinding bodies to be added separately for each of the continuous mills 2, and also enables materials or water to be introduced separately, thus constantly allowing the mixture to be corrected and ensuring an optimal composition.

[0025] Each of the continuous mills 2 of the grinding plant 1, being operatively independent of the others, is of optimum size and is also optimised in terms of the geometry thereof, the dimensions of the grinding bodies and the rotation velocity, for the specific stage of comminution it is to perform, and the slip under process passes continuously from a rotatable drum 3 to a following rotatable drum 3 with no process interruption, up until the desired granulometry of the suspended powders is obtained.

[0026] The evacuation of the refined slip from the operating chamber of a rotating drum 3 is done by usual means, of known type which are not further described herein. However, for the purposes of understanding the present invention, it is stressed that although the means for evacuating advance the slip towards the rotating drum 3 located downstream, this advancing is also performed, and made efficient, by the rotation of the unloading mouth 8 and the loading mouth 6, which are solidly constrained to the respective rotating drums 3.

[0027] As previously mentioned, a fixed tubular connecting element 19 is interposed between the unloading mouths 8 and the loading mouths 6, which connecting element 19 is substantially constituted by a tube fixed to the support structure 9 by means of a rigid support 25.

[0028] The following are rotatably associated to the fixed tubular connecting element 19: on one side thereof, the unloading mouth 8, and on the other side thereof, the loading mouth 6. In detail, the free end of the unloading mouth 8 inserts axially, for a tract thereof, internally of the tubular connecting element 19, which in turn is inserted, for a tract thereof, internally of the free end of the loading mouth 6.

[0029] The unloading mouth 8 is thus smaller than the fixed connecting element 19, while the connecting element 19 is smaller than the loading mouth 6.

[0030] Suitable means for sealing can be interposed between the unloading mouth 8 and the loading mouth 6 and the tubular connecting element 19, which means for sealing can advantageously contribute to preventing leakage of material from the plant 1.

[0031] In particular, as can be seen in figure 2, a first helical body 23 is fixed to the free end of the unloading mouth 8 and to the external surface thereof, realising a first screw device according to the invention.

[0032] In this way the first helical body 23 is turned by the rotation of the continuous mill 2, to which the unloading mouth 8 is associated.

[0033] Further, a second helical body 24 is fixed internally of the downstream loading mouth 6 of the mill, realising a second screw device of the invention.

[0034] Similarly to the first helical body 23, the second helical body 24 is turned by the rotation of the continuous mill 2, to which the loading mouth 6 is associated.

[0035] During plant 1 operation, the rotating drums 3 rotate independently of one another and, consequently, draw the unloading mouth 8 and the loading mouth 6 in rotation, while the tubular connecting element 19 remains fixed.

[0036] In this way the first helical body 23, which is joined to the unloading mouth 8, rotates internally of a first portion of the connecting element 19.

[0037] The first helical body 23, during advancement of the material, collaborates with the internal surface of the connecting element 19 and forms a first screw device which has the function of maintaining the material itself internally of the connecting element 19, also preventing the material from accidentally exiting from the upstream end of the tubular connecting element 19.

[0038] Further, the second helical body 24, which is connected to the loading mouth 6, rotates internally of the loading mouth 6 and, collaborating with the external surface of the connecting element 19, forms a second screw device which effectively contributes to preventing exit of the material from the downstream end of the tubular connecting element 19.

[0039] The properties of the present invention are advantageous also in consideration of the fact that other material flows internally of the connecting element 19 through the in-loading conduit 19.

[0040] Obviously modifications or improvements, dictated by contingent requirements or details, can be made to the plant as described without its forsaking the ambit

of the invention as it is claimed herein below.

Claims

1. A grinding plant (1), comprising a plurality of continuous mills (2) each provided with a loading mouth (6) of raw material and an unloading mouth (8) of slip, which loading mouth (6) and unloading mouth (8) are placed in series by means of a fixed connecting element (19), which connecting element (19) is associated to an in-loading device (20, 21) and connects the unloading mouth (8) of a mill to the loading mouth (6) of a contiguous mill wherein associated to the connecting element (19) are means for preventing exiting of the material from the connecting element (19) at the unloading mouth (8) and the loading mouth (6) during advancing of the material from a mill which is upstream to a mill which is downstream, **characterised in that** said means being rotated by the respective rotation of the unloading mouth (8) or of the loading mouth (6) and cooperating with the walls of the fixed connecting element (19) in the interfaces between said connecting element (19) and at least one of the unloading or of the loading mouths (8, 6) in order to advance said material.

2. The plant (1) of claim 1, **characterised in that** the means for preventing exiting of the material comprise at least a first helical body (23) associated to a free end of the unloading mouth (8) of the upstream mill, in which the first helical body (23) inserts into the connecting element (19), realising, in collaboration with the connecting element (19), a first screw device which during the advancing of the material keeps the material inside the connecting element (19).

3. The plant (1) of claim 1 or 2, **characterised in that** the means for preventing exiting of the material comprise a second helical body (24) which is associated to a free end of the loading mouth (6) of the downstream mill, in which the second helical body (24) inserts internally of the loading mouth (6) of the downstream mill, realising, in collaboration with the loading mouth (6), a second screw device which prevents exiting of the material from the downstream end of the connecting element (19).

4. The plant (1) of claim 2, **characterised in that** the first helical body (23) is fixed externally on the unloading mouth (8), such as to be turned by the rotation of the continuous mill (2) to which the unloading mouth (8) is associated.

5. The plant (1) of claim 3, **characterised in that** the second helical body (24) is fixed internally on the loading mouth (6), such as to be turned by the rotation of the continuous mill (2) to which the loading mouth (6) is associated.

6. The plant (1) of claim 1, **characterised in that** the in-loading device comprises a device (21) for loading the material, and an in-loading conduit (20) which connects the in-loading device (21) to the connecting element (19).

7. The plant (1) of claim 1, **characterised in that** means for sealing are interposed between each of the unloading mouths (8) and the loading mouths (6) and the connecting element (19).

Patentansprüche

1. Eine Mahlanlage (1) einschließlich einer Vielzahl an kontinuierlich arbeitenden Mühlen (2), von denen jede mit einer Aufnahmeöffnung (6) für das Rohmaterial und einer Entladeöffnung (8) für Schlicker ausgestattet ist, wobei die Aufnahmeöffnung (6) und die Entladeöffnung (8) durch ein festes Verbindungselement (19) in Reihe geschaltet sind, wobei das Verbindungselement (19) einer Beschickungsvorrichtung (20, 21) zugeordnet ist und die Entladeöffnung (8) einer Mühle mit der Aufnahmeöffnung (6) einer nachgeschalteten Mühle verbindet, wobei dem Verbindungselement (19) Mittel zum Verhindern eines Austretens des Materials aus dem Verbindungselement (19) bei der Entladeöffnung (8) und der Aufnahmeöffnung (6) bei der Beförderung des Materials von einer vorgeschalteten zu einer nachgeschalteten Mühle zugeordnet sind, **dadurch gekennzeichnet, dass** die Mittel durch die entsprechende Rotation der Entladeöffnung (8) oder der Aufnahmeöffnung (6) gedreht werden und mit den Wänden des festen Verbindungselements (19) an den Schnittstellen zwischen dem Verbindungselement (19) und wenigstens einer der Entlade- oder Aufnahmeöffnungen (8, 6) zusammenwirken, damit das Material vorwärts bewegt wird.

2. Die Mahlanlage (1) nach Patentanspruch 1, **dadurch gekennzeichnet, dass** die Mittel zum Verhindern eines Austretens des Materials wenigstens einen ersten spiralförmigen Körper (23) beinhalten, der einem freien Ende der Entladeöffnung (8) der vorgeschalteten Mühle zugeordnet ist, in welcher der erste spiralförmige Körper (23) in das Verbindungselement (19) eindringt und in Zusammenarbeit mit dem Verbindungselement (19) eine erste Gewindevorrichtung entsteht, die bei der Vorwärtsbewegung des Materials das Material in dem Verbindungselement (19) hält.

3. Die Mahlanlage (1) nach Patentanspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Mittel zum Verhindern eines Austretens des Materials einen zwei-

ten spiralförmigen Körper (24) beinhalten, der einem freien Ende der Aufnahmeöffnung (6) der nachgeschalteten Mühle zugeordnet ist, in welcher der zweite spiralförmige Körper (24) in die Aufnahmeöffnung (6) der nachgeschalteten Mühle eindringt und in Zusammenarbeit mit der Aufnahmeöffnung (6) eine zweite Gewindevorrichtung entsteht, die ein Austreten des Materials aus dem nachgelagerten Ende des Verbindungselements (19) verhindert.

4. Die Mahlanlage (1) nach Patentanspruch 2, **dadurch gekennzeichnet, dass** der erste spiralförmige Körper (23) von außen an der Entladeöffnung (8) befestigt ist, so dass er durch die Rotation der kontinuierlich arbeitenden Mühle (2) gedreht wird, der die Entladeöffnung (8) zugeordnet ist.

5. Die Mahlanlage (1) nach Patentanspruch 3, **dadurch gekennzeichnet, dass** der zweite spiralförmige Körper (24) von innen an der Aufnahmeöffnung (6) befestigt ist, so dass er durch die Rotation der kontinuierlich arbeitenden Mühle (2) gedreht wird, der die Aufnahmeöffnung (6) zugeordnet ist.

6. Die Mahlanlage (1) nach Patentanspruch 1, **dadurch gekennzeichnet, dass** die Beschickungsvorrichtung eine Vorrichtung (21) zum Beschicken des Materials und ein Beschickungsrohr (20) beinhaltet, welches die Beschickungsvorrichtung (21) mit dem Verbindungselement (19) verbindet.

7. Die Mahlanlage (1) nach Patentanspruch 1, **dadurch gekennzeichnet, dass** Abdichtungsmittel zwischen jeder Entladeöffnung (8) und Aufnahmeöffnung (6) und dem Verbindungselement (19) zwischengeschaltet sind.

Revendications

1. Un atelier de broyage (1) comprenant une multitude de laminoirs continus (2) étant chacun doté d'un orifice de chargement (6) du matériau brut et un orifice de déchargement (8) de la barbotine, lesdits orifices de chargement (6) et de déchargement (8) étant placé en série au moyen d'un élément de raccordement fixe (19), ledit élément de raccordement (19) étant associé à un dispositif de chargement (20, 21) et raccordant l'orifice de déchargement (8) d'un laminoir à l'orifice de chargement (6) d'un laminoir contigu, où l'élément de raccordement (19) est associé à un dispositif pour empêcher la sortie du matériau de l'élément de raccordement (19) à l'orifice de déchargement (8) et l'orifice de chargement (6) durant l'avancée du matériau entre un laminoir se trouvant en amont et un laminoir se trouvant en aval, **caractérisé par le fait que** ledit dispositif pivote grâce à la rotation respective de l'orifice de déchargement (8) ou de l'orifice de chargement (6) et coopérant avec les parois de l'élément de raccordement fixe (19) dans les interfaces entre ledit élément de raccordement (19) et au moins l'un des orifices de déchargement ou de chargement (8, 6) afin de faire avancer ledit matériau.

2. L'atelier (1) selon la revendication 1, **caractérisé par le fait que** le dispositif pour empêcher la sortie du matériau comprend au moins un premier corps hélicoïdal (23) associé à une extrémité libre de l'orifice de déchargement (8) du laminoir en amont, dans lequel le premier corps hélicoïdal (23) s'introduit dans l'élément de raccordement (19), réalisant en collaboration avec l'élément de raccordement (19), un premier dispositif à vis qui conserve le matériau à l'intérieur de l'élément de raccordement (19) durant l'avancée du matériau.

3. L'atelier (1) selon la revendication 1 ou 2, **caractérisé par le fait que** le dispositif pour empêcher la sortie du matériau comprend un deuxième corps hélicoïdal (24) qui est associé à une extrémité libre de l'orifice de chargement (6) du laminoir en aval, dans lequel le deuxième corps hélicoïdal (24) s'introduit à l'intérieur de l'orifice de chargement (6) du laminoir en aval, réalisant en collaboration avec l'orifice de chargement (6), un deuxième dispositif à vis qui empêche la sortie du matériau par l'extrémité en aval de l'élément de raccordement (19).

4. L'atelier (1) selon la revendication 2, **caractérisé par le fait que** le premier corps hélicoïdal (23) est fixé à l'extérieur de l'orifice de déchargement (8), de manière à pivoter grâce à la rotation du laminoir continu (2) auquel l'orifice de déchargement (8) est associé.

5. L'atelier (1) selon la revendication 3, **caractérisé par le fait que** le deuxième corps hélicoïdal (24) est fixé à l'intérieur de l'orifice de chargement (6), de manière à pivoter grâce à la rotation du laminoir continu (2) auquel l'orifice de chargement (6) est associé.

6. L'atelier (1) selon la revendication 1, **caractérisé par le fait que** le dispositif de chargement comprend un dispositif (21) pour charger le matériau et un conduit de chargement (20) qui raccorde le dispositif de chargement (21) à l'élément de raccordement (19).

7. L'atelier (1) selon la revendication 1, **caractérisé par le fait que** des dispositifs de scellage sont intercalés entre chacun des orifices de déchargement (8) et des orifices de chargement (6) et l'élément de raccordement (19).

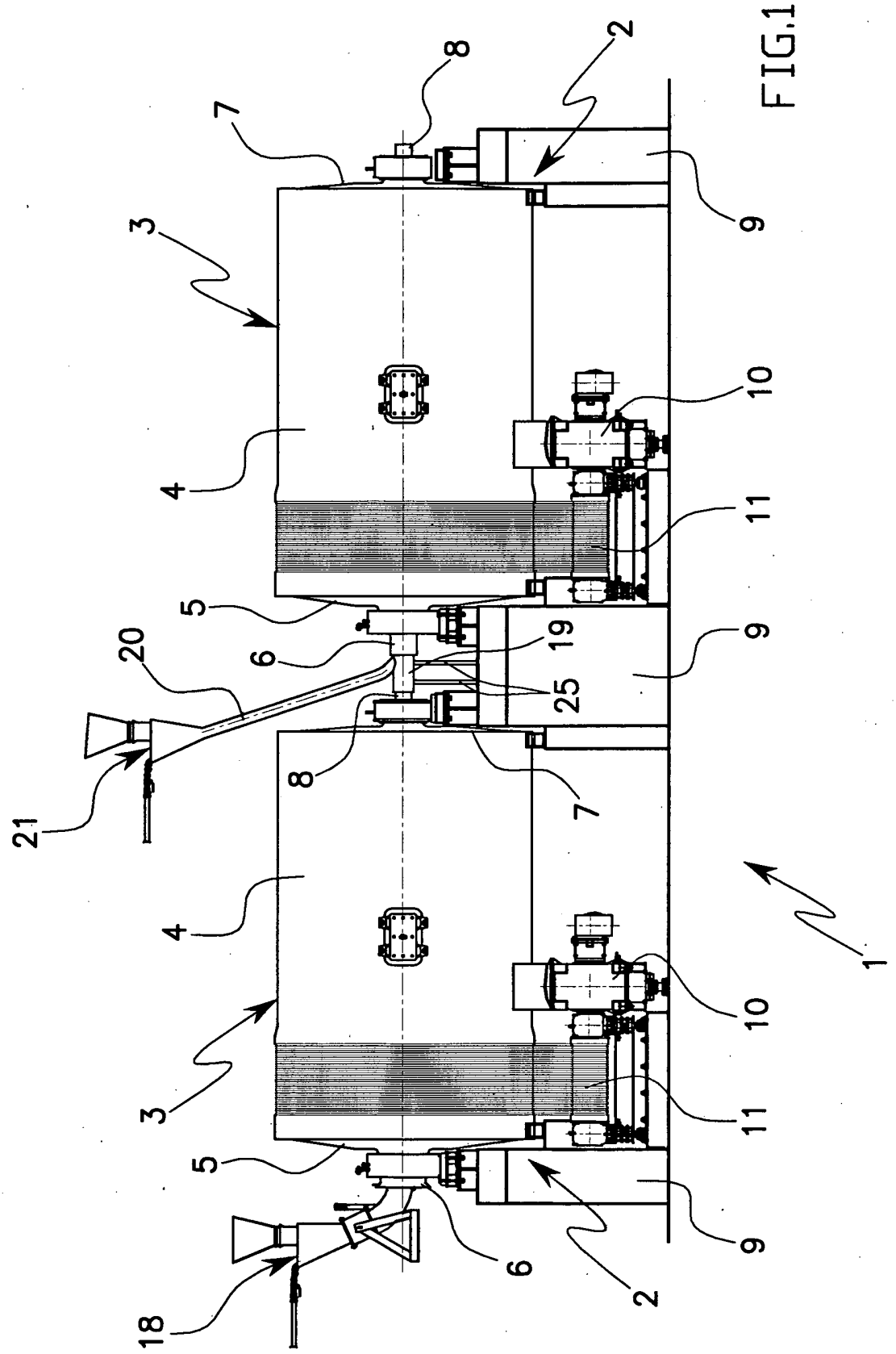

FIG.1

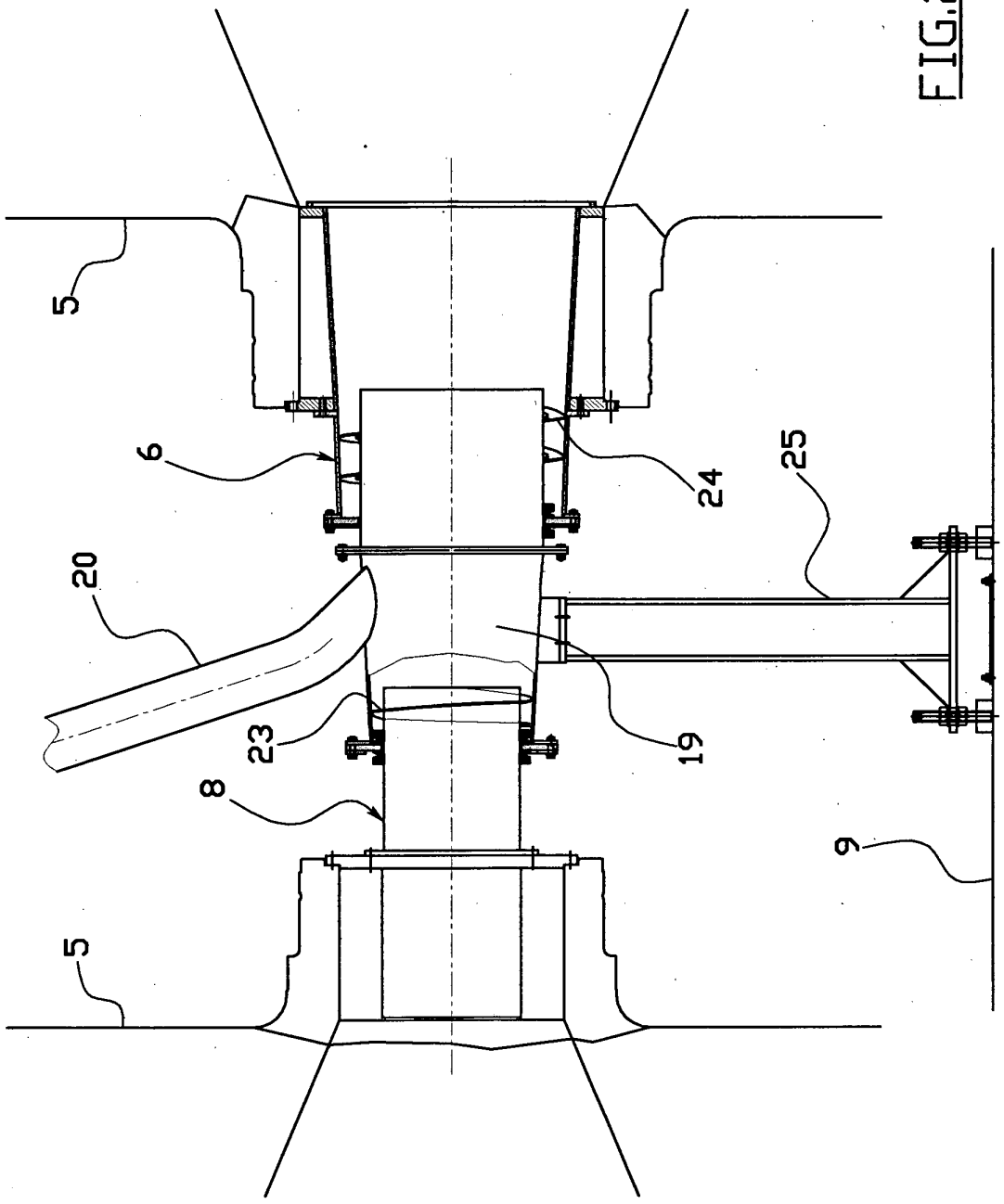

FIG.2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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