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(54) Crusher rotor arrangement

(57) The invention relates to a crusher rotor arrangement that comprises a crusher rotor (1) that crushes material and a counter blade assembly (2) arranged in cooperation therewith, whereby the crusher rotor comprises a crusher blade structure (3) fastened to its circumference and extending in its lateral direction, and the counter blade assembly (2) comprises the actual counter blade structure (4) that crushes and cuts material together with the crusher blade structure of the crusher rotor, and a spring structure (7, 9) of the counter blade structure, the counter blade structure (4) and its body (5) being divided in the axial direction of the crusher rotor into several portions each with their own spring means (7, 9). In addition a fixed guide (10) in cooperation with the counter blade structure is mounted on the reverse side of the counter blade structure (4) in the rotation direction of the crusher rotor, between the crusher rotor (1) and counter blade assembly (2) to divide the space between the counter blade assembly and crusher rotor into separate routes for the accepted and rejected material.

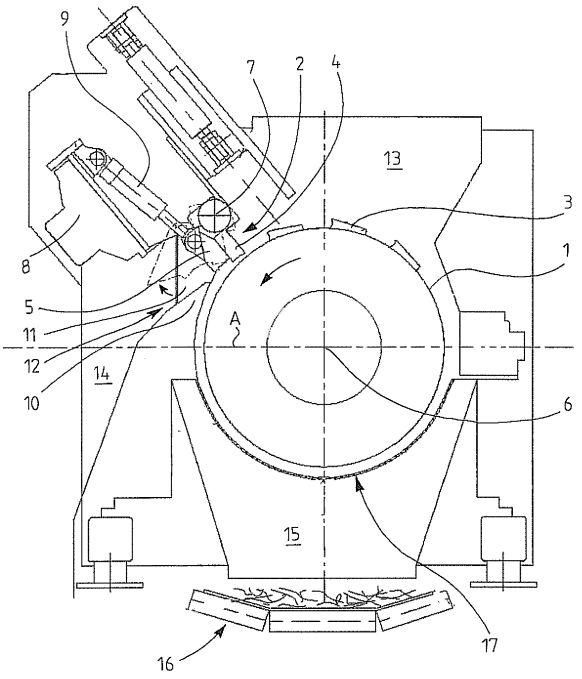

FIG. 1

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Description

BACKGROUND OF THE INVENTION

[0001] The invention relates to a crusher rotor arrangement that comprises a crusher rotor that crushes material and a counter blade assembly arranged in cooperation therewith, whereby the crusher rotor comprises a crusher blade structure extending in its axial direction and fastened to its circumference, and the counter blade assembly comprises the actual counter blade structure that crushes and cuts material together with the crusher blade structure of the crusher rotor, and a spring structure of the counter blade structure, the counter blade structure and its body being divided in the axial direction of the rotor into several portions each with their own spring means.

[0002] A crusher rotor arrangement of the above-mentioned type is typical when processing for instance recyclable waste into a desired piece size to obtain re-utilizable material. In spite of possible sorting and prior conveyors, the material contains hard fractions that cannot be crushed and often cause disturbances, damage, and even stoppages in the crushing process.

[0003] Advanced, known crusher rotor arrangements have counter blade structures equipped with load-detecting spring means. In an overload situation, the spring means yield, and the foreign fraction exits into the amount of crushed material on the discharge side of the crusher. These known structures are described in US patent 3 952 957 and FI utility model 6753, for instance. Spring means are typically springs that may be mechanical or hydraulic springs. The most advanced solutions are based on hydraulics having a suitably selected counterpressure.

[0004] A drawback with the known yielding counter blade assemblies is that in the yield situation the particle causing the disturbance is allowed to go among the crushed material, and when the particle is removed, accepted finished crushed material also need to be removed. Naturally it is possible to leave the particle among the crushed material. This then reduces the quality of the crushed material. In certain cases, a batch of finished crushed material is ruined. Finding the particle from the discharged material is typically done by hand. After the particle is removed, the remaining material is run through the crushing process again. When problem particles occur often, the manual search becomes arduous.

SUMMARY OF THE INVENTION

[0005] It is thus an object of the invention to eliminate the above-mentioned drawbacks. This object is achieved with the crusher rotor arrangement of the invention that is characterised in that, between the crusher rotor and counter blade assembly, on the reverse side of the counter blade structure in the rotation direction of the crusher rotor, a fixed guide cooperating with the counter blade structure is mounted to divide the space between the counter blade assembly and crusher rotor into separate routes for the accepted and rejected material.

[0006] When the counter blade yields into a certain release position, a discharge chute then opens between the fixed guide and counter blade structure and directs the particle that caused the release of the counter blade to a different space than where the finished crushed material exiting the crusher goes.

[0007] When a hard particle hits the counter blade structure, the counter blade portion at that location yields and preferably lets the particle into an oblique chute-like discharge opening by utilising the thrust of the rotor and earth's gravity. The crusher rotor stops as quickly as possible after the release and starts again when the released counter blade portion has returned to the basic position used during crushing. The rest of the counter blade structure remains in the crushing position and, at the same time, keeps the material to be crushed in the crushing space as well as possible. This type of arrangement improves the homogeneity of the crushed material and also removes very little material to be crushed with the problem material. At the same time, the arrangement protects the structures of the crusher rotor and counter blade assembly better than before, because the effect of the foreign particle spreads on a smaller area in the structures. This way, the loads from damaging impacts and normal run can be better differentiated. The structure of the invention is especially well suited for use in secondary crushers, when after the preliminary crushing the majority of problematic uncrushed particles have been removed using the separation technique.

[0008] In prior art, the counter blade assembly is generally formed as a uniform unit extending the entire width of the crusher. The mechanics are then at their simplest, but possible disturbances cause hard impacts to the counter blade structure and blade seats of the crusher rotor. Due to the high cutting rates of the secondary crusher, it has been impossible to feed impurities, such as material containing iron, into this type of crusher.

[0009] The opening for rejected material between the guide and counter blade structure is preferably located between the highest point of the crusher rotor surface and the horizontal plane formed by the crusher rotor axle, and the fixed guide on the side of the path of the accepted material is connected to a set of screens arranged below the crusher rotor and surrounding it at an axial distance of the size of the crusher blade structure. It is then possible to remove the problem particle at an as high location as possible, which leaves as much space as possible in elevation for its further processing, while it is not necessary to reduce the screen surface area. The purpose of the set of screens is to ensure the correct piece size.

[0010] For reasons of expediency, the fixed guide is a member that extends in the axial direction of the rotor and narrows in a wedge-like manner toward the counter blade structure, and the part of the counter blade structure cooperating with it is formed of a wedge-like exten-

sion of the body of the counter blade structure formed on the reverse side of the counter blade structure. In a normal crushing situation, these direct the crushed material to the set of screens, but in a fault situation, the wedge-like extension of the counter blade structure body is arranged to turn in the manner of a pendulum together with the portion of the counter blade structure at that location and to open a path for the rejected material to the discharge chute essentially in the direction of the tangent of the rotor surface.

[0011] The set of screens preferably comprises two body portions, the division surface between which runs below the crusher rotor in its axial direction, and replaceable screen plates set on top of them. The body portions with their screen plates can then preferably also be pulled on rails to the side of the crusher. In addition, they are also arranged to be separately and independently adjustable in the vertical-horizontal direction.

[0012] In a prior-art set of screens, the body is typically a one-piece structure with fixed screen plates, and this entity is mounted as a completely fixed structure to the crusher. Drawbacks of this type of solution include difficulty of replacement, difficulty or lack of adjustment, and sensitivity to damage caused by impurities.

[0013] Another known way is to provide the set of screens with hinges. This enables easy maintenance, but also requires space below the machine. In addition, the screen set is adjusted one entire screen block at a time. The clearance between the crusher rotor and set of screens cannot then be made as desired if the set of screens has a faulty radius, caused by accuracy of manufacture, in comparison with the radius of the surface formed by the blade tips of the crusher rotor.

[0014] In the set of screens of the invention it is possible to use screen plates bent to 60° to 90°, and their adjustment close to a rotor, typically at a distance of 0.5 to 3 mm from the rotor, is easier done than the adjustment of a screen plate bent to 150° to 180°. With screen plates bent to 75° to 90°, it is possible to compensate partly for possible manufacturing errors in the bending of the screen plate.

LIST OF FIGURES

[0015] The invention will now be described in greater detail by means of a preferred embodiment and with reference to the attached drawings, in which

Figure 1 shows a crusher rotor and its counter blade assembly during joint action in the axial direction of the rotor, and

Figure 2 shows in more detail the set of screens visible below the crusher rotor in Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Figure 1 shows a crusher rotor arrangement that comprises a crusher rotor 1 that crushes material and a counter blade assembly 2 arranged in cooperation therewith. The crusher rotor 1 has a crusher blade structure 3 fastened to its circumference and extending in its lateral direction. The counter blade assembly 2 in turn has the actual counter blade structure 4 that crushes and cuts material together with the crusher blade structure 2 of the crusher rotor 1, and a spring structure 7, 9 of the counter blade structure 4.

[0017] The spring structure is made up of a bearing system between the body 5 of the counter blade structure 4 and a swing axle 7 in the direction of an axle 6 of the crusher rotor 1, and of spring means 9 arranged between the body 8 of the counter blade assembly 2 and the body 5 of the counter blade structure 4.

[0018] The counter blade structure 4 and its body 5 are divided in the axial direction of the crusher rotor 1 into several portions that have each their own spring means 9. The number of portions these components should preferably be divided into depends on the width of the crusher rotor 1. This art is previously known and, thus, need not be described in more detail herein.

[0019] According to the invention, between the crusher rotor 1 and counter blade assembly 2, on the reverse side of the counter blade structure 4 in the rotation direction of the rotor 1, a fixed guide 10 is also mounted in cooperation with the counter blade structure 4 to divide the space between the counter blade assembly 2 and crusher rotor 1 into separate routes for the accepted and rejected material.

[0020] In this example structure, the fixed guide 10 is a member that extends in the axial direction of the crusher rotor 1 and narrows in a wedge-like manner toward the counter blade structure 4 and may at its simplest be formed of bent plate material that is fastened to the side walls of the body of the crusher. Correspondingly, the part of the counter blade structure 4 cooperating with the fixed guide 10 is formed of a wedge-like extension 11 of the body 5 of the counter blade structure 4 formed on the reverse side of the counter blade structure 4 and, when the counter blade structure 4 yields against the spring means 9, the extension is arranged to turn in the manner of a pendulum around the swing axle 7 together with the portion of the counter blade structure 4 at that location and to open an opening or route 12 for rejected material. The opening 12 between the guide 10 and said extension 11 for rejected material is appropriately located between the highest point of the crusher rotor 1 surface and the horizontal plane A formed by the rotor 1 axle 6.

[0021] In connection with the movement of the material being processed, the crusher has for the material being processed a feed hopper 13 above the crusher rotor 1, for the rejected material a discharge chute 14 behind the opening 12, and for the accepted material a discharge hopper 15 below the crusher rotor 1. Below the discharge hopper 15, there is a conveyor 16 for transporting the accepted material to the following processing station.

[0022] The spring means 9 described above are typically hydraulic cylinders and the start of their yield is con-

trolled by their hydraulic counter-pressure and their return to the crushing position is controlled by control automatics. In addition to the hydraulic cylinders 9 acting as spring means, it is sensible to arrange hydraulic or mechanical overload protectors, in which case the mechanical overload protectors could be break pins, for instance.

[0023] The counter blade structure 4 is most preferably formed of individual blade bits or elements that are arranged using bolt fastening to the body 5 of the counter blade structure 4. For detecting the position of the counter blade structure, there may be electric sensors whose signals are used in controlling the crusher rotor 1. In addition, the distance of the blades or blade elements of the counter blade structure 4 can be adjusted by screws relative to the surface of the crusher rotor 1.

[0024] The fixed guide 10 on the side of the path of the accepted material is connected to a set of screens 17 arranged below the crusher rotor 1 and surrounding it at an axial distance of the size of the crusher blade structure 3.

[0025] In this example embodiment, the screen set 17 comprises two body portions 17a, 17b that have the same width as the crusher and whose division surface 18 runs directly below the crusher rotor 1 in its axial direction. On top of these body portions 17a, 17b, replaceable screen plates 19a, 19b made of bent and perforated plate-like and wear-resistant material, generally of wear-resistant steel.

[0026] The body portions 17a, 17b are located on rails 20 along which the right body portion 17a can be pulled to the right, all the way to the side of the crusher. The left body portion 17b is correspondingly pulled to the left. When the body portions 17a, 17b are pulled to the sides, the screen plate 19a, 19b may be cleaned or replaced. At the division surface 18, the screen plates 19a, 19b have sealing steel elements that do not allow material to pass through the seams of the screen plates 19a, 19b. Each body portion 17a, 17b can be separately adjusted vertically preferably at four points, and a horizontal adjustment has also been arranged independent of the vertical adjustment.

[0027] In the crusher of the invention, the material to be crushed is fed through the feed hopper 13 on top of the crusher rotor 1 and from the crusher rotor 1 it moves between the counter blade structure 4 of the crusher blade structure 3. The crushed material is then directed to the set of screens 17 and through it to the conveyor 16. Material that is too coarse is returned from the set of screens 17 with the crusher blade structure 3 back to the crushing process. When a hard particle within the material to be crushed hits a portion of the counter blade structure 4, the cylinder 9 yields and a chute-like opening 12 is opened between the fixed guide 10 and the extension of the body 5 of the counter blade structure 4, and through it, the hard particle is led to the discharge chute 14. Other portions of the counter blade structure 4 remain in the crushing position and, after the hard particle has been discharged, the yielded portion returns back to the crushing position pushed by the hydraulic cylinder 9.

[0028] The above description of the invention is only intended to illustrate the basic idea of the invention. However, a person skilled in the art is able to implement the details of the invention in many different ways within the scope of the attached claims.

Claims

1. A crusher rotor arrangement that comprises a crusher rotor (1) that crushes material and a counter blade assembly (2) arranged in cooperation therewith, whereby the crusher rotor comprises a crusher blade structure (3) fastened to its circumference and extending in its axial direction, and the counter blade assembly (2) comprises the actual counter blade structure (4) that crushes and cuts material together with the crusher blade structure (3) of the crusher rotor, and a spring structure (7, 9) of the counter blade structure, the counter blade structure (4) and its body (5) being divided in the axial direction of the crusher rotor into several portions each with their own spring means, whereby between the crusher rotor (1) and counter blade assembly (2), on the reverse side of the counter blade structure (4) in the rotation direction of the crusher rotor, a fixed guide (10) is mounted in cooperation with the counter blade structure to divide the space between the counter blade assembly and crusher rotor into separate routes for the accepted and rejected material, **characterised in that** the opening (12) for rejected material between the fixed guide (10) and counter blade structure (4) is located between the highest point of the crusher rotor (1) surface and the horizontal plane (A) formed by the crusher rotor axle (6), and the fixed guide (10) on the side of the path of the accepted material is connected to a set of screens (17) arranged below the crusher rotor (1) and surrounding it at an axial distance of the size of the crusher blade structure.

2. A crusher rotor arrangement as claimed in claim 1, **characterised in that** the fixed guide (10) is a member that extends in the axial direction of the crusher rotor (1) and narrows in a wedge-like manner toward the counter blade structure (4).

3. A crusher rotor arrangement as claimed in claim 1 or 2, **characterised in that** the portion of the counter blade structure in cooperation with the fixed guide (10) is formed of a wedge-like extension (11) of the body (5) of the counter blade structure (4) formed on the reverse side of the counter blade structure (4) and, when the counter blade structure (4) yields, the extension is arranged to turn in the manner of a pendulum together with the portion of the counter blade

structure at that location and to open an opening or path (12) for the rejected material.

4. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** the spring means comprise at least one hydraulic cylinder (9).

5. A crusher rotor arrangement as claimed in claim 4, **characterised in that** the start of the yield of the hydraulic cylinder (9) is controlled by its counterpressure.

6. A crusher rotor arrangement as claimed in claim 4 or 5, **characterised in that** the spring means comprise each not only the hydraulic cylinder (9) but also a mechanical overload protector, such as a break pin.

7. A crusher rotor arrangement as claimed in claim 4 or 5, **characterised in that** the spring means comprise not only the hydraulic cylinder (9) but also a hydraulic overload protector.

8. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** the counter blade structure (4) is formed of individual blade bits or elements.

9. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that**, for detecting the position of the counter blade structure (4), electric sensors are arranged whose signals are used in controlling the crusher rotor.

10. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** the blades or blade elements of the counter blade structure (4) are arranged using bolt fastening to the body of the counter blade structure.

11. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** the distance of the blades or blade elements of the counter blade structure (4) is adjustable relative to the surface of the crusher rotor.

12. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** the set of screens (17) is made up of two body portions (17a, 17b), the division surface (18) between which runs below the crusher rotor (1) in its axial direction, and of replaceable screen plates (19a, 19b) set on top of them.

13. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** the body portions (17a, 17b) with their screen plates (19a, 19b) are pullable to the side of the crusher.

14. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** at the division surface (18) the screen plates (19a, 19b) have sealing elements.

15. A crusher rotor arrangement as claimed in any one of the preceding claims, **characterised in that** the body portions (17a, 17b) are separately and independently adjustable in the vertical-horizontal direction.

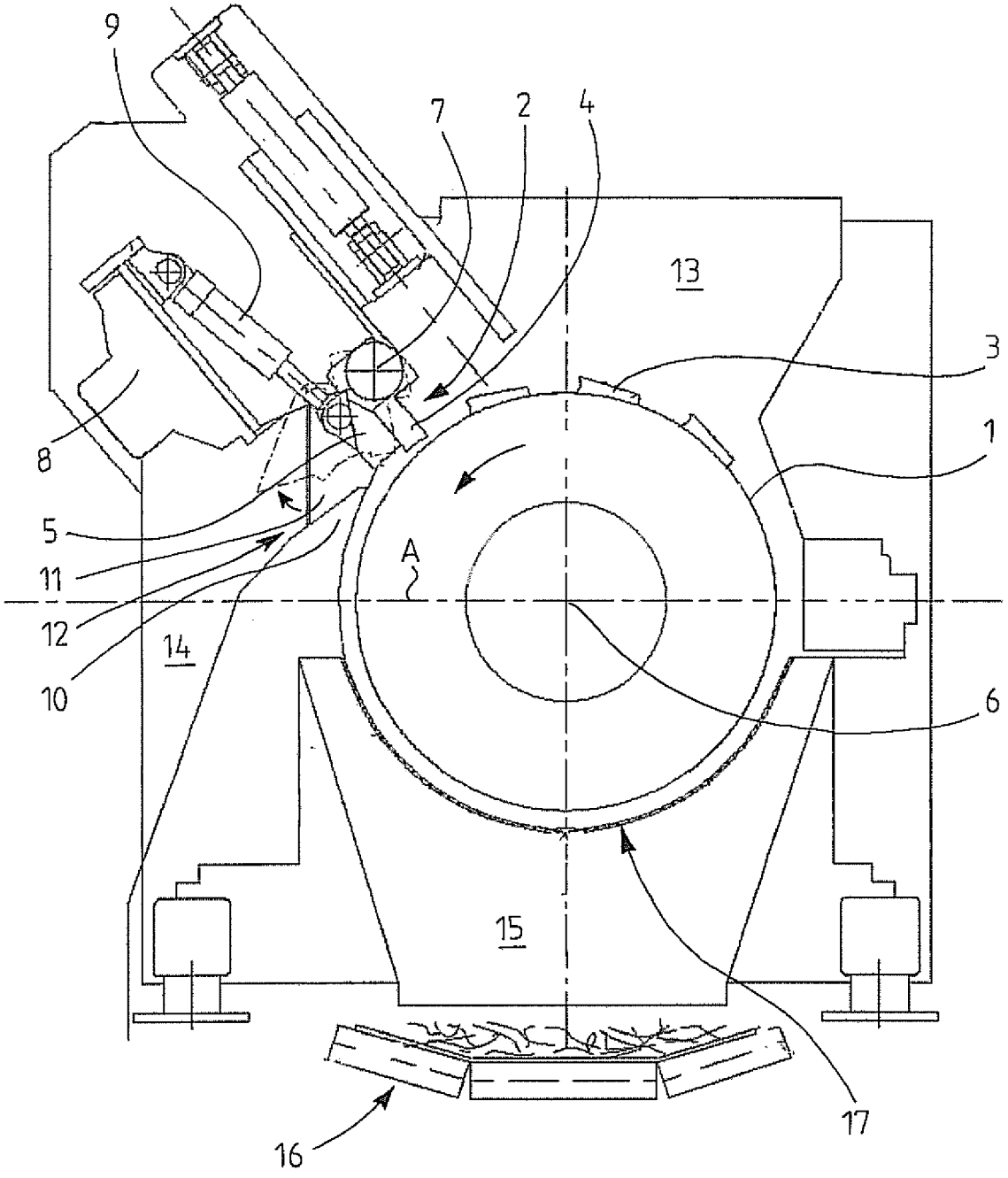

FIG. 1

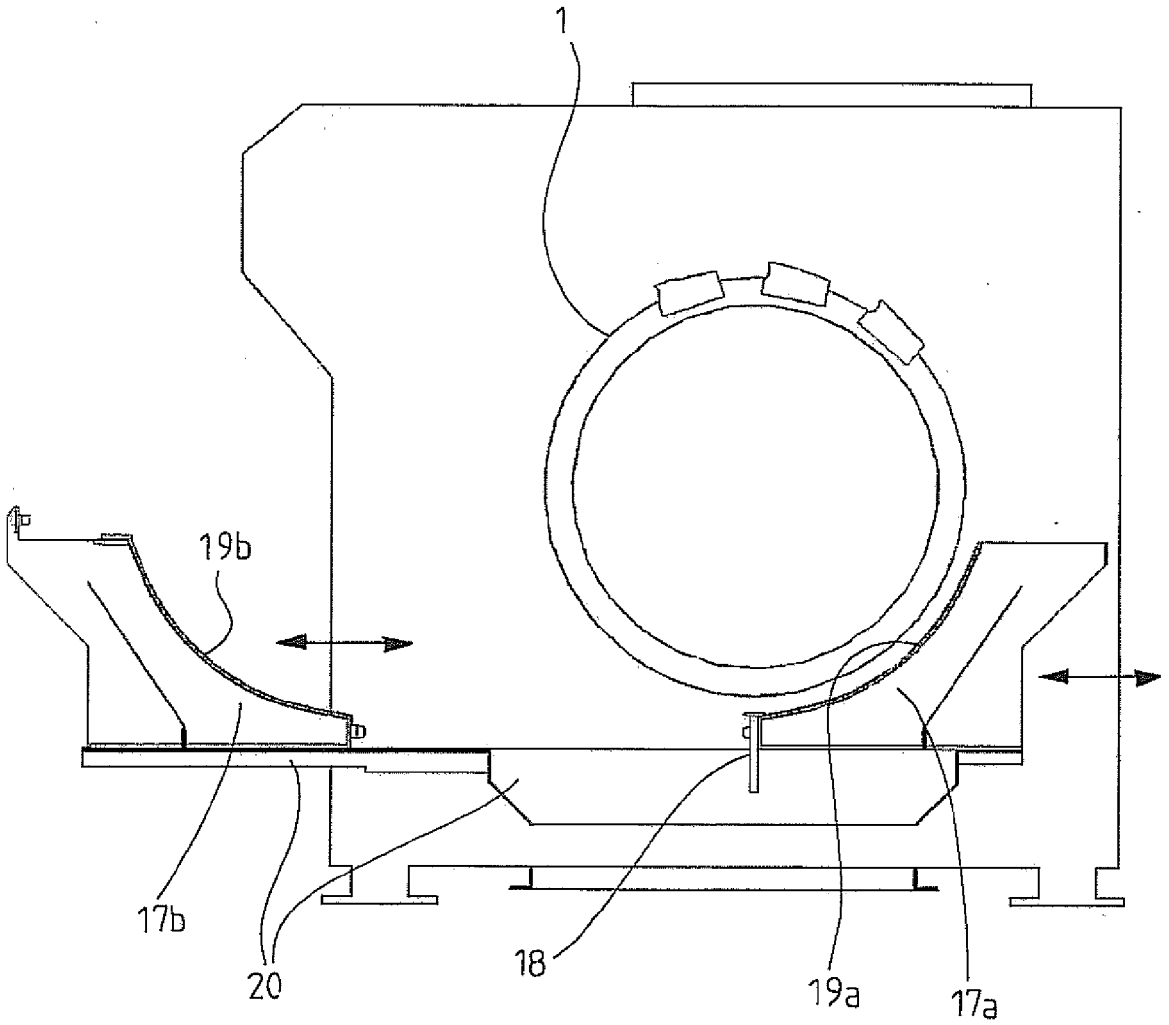

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 4961

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

B02C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 December 2008	Kopacz, Ireneusz

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 16 4961

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12-12-2008

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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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