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(54) **Micronizing apparatus.**

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FR-A- 2 538 718
US-A- 1 772 150
US-A- 3 065 919
US-A- 3 995 784

(73) Proprietor: **TPT TECHNOLOGIES S.r.l.**
Via Serbelloni 1
I-20122 Milan(IT)

(72) Inventor: **Manolo, Umberto**
Via Martinengo Cesaresco, 78
I-25100 Brescia(IT)

(74) Representative: **Porsia, Dino, Dr. et al**
c/o Succ. Ing. Fischetti & Weber Via Caffaro 3/2
I-16124 Genova (IT)

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Description

The invention relates to a micronizing apparatus for processing organic and inorganic products.

Document US-A-3 065 919 describes an apparatus for micronic grinding, comprising means for feeding the product, together with at least one product-conveying fluid such as ambient air, to a first distributing disk with vertical axis, which by rotating distributes the composite flow on the rough surface of a first ring where a first comminution or grinding of the product takes place, the air-and-product flow being then conveyed to a second distributing disk with vertical axis and of a greater diameter, which is rotated at a higher speed than the first disk, and which accelerates and uniformly distributes the said flow on a second comminution ring of a very hard material and tapered downwardly, whereby some of the product will temporarily stay on the said ring, and will be broken owing to the dynamic impact thereon of the product particles progressively delivered from the said second distributing disk, and reaches a third comminution or grinding stage comprising a disk and a ring which are similar to the second disk and ring, and from which the said flow is finally discharged for further processing.

Documents US-A-1 772 150 and FR-A-2 538 718 disclose grinding apparatuses in which the product is delivered to the center of the respective single grinding disks.

According to the present invention, there is provided a micronizing or grinding apparatus for processing organic and inorganic products, of the type disclosed above with reference to document US-A-3 065 919 which is characterized by the fact that the product is delivered to the centre of the disks (10, 21, 35) and that the product flow leaving the second grinding stage is mixed with a fresh ambient air flow before reaching the third grinding stage.

Further features and advantages of the apparatus are disclosed in the dependent claims.

The apparatus object of the present invention will be now described with reference to the figures of the attached sheet of drawings, in which:

Figure 1 diagrammatically shows the apparatus in a sectional view taken on an ideal vertical plane containing the axis of rotation of the distributing disks;

Figures 2 and 3 show some possible configurations of the channels in the distributing disks, in a sectional view taken on line II-II of figure 1;

Figure 4 shows the chamber from which flows the micronized product, in a sectional view taken on line IV-IV of figure 1.

In figure 1 there appears that the product to be processed is fed from the top of the apparatus into the funnel-shaped chamber 1, through a flow- or flow rate-regulating device, such as for example, a star-shaped rotary valve diagrammatically shown at 2, the whole in such a manner that only a predetermined and adjustable flow of product will flow into the said chamber 1. The chamber 1 is surrounded by a larger chamber 3 which is also fixed to the frame or to the casing 4 of the apparatus, the whole in such a manner that between the chambers 1 and 3 there will be left an interspace 5 which is open to the atmosphere through a duct 6 intercepted by a flow-regulating valve 7 and a filter 8.

The chamber 1 and the interspace 5 co-axially discharge into the well 9 provided in a horizontal circular disk 10 which by suitable means to be disclosed hereinafter, is supported and is rotated at the required speed around its axis, always in one direction. The disk 10 is radially provided with a plurality of equispaced channels 11 of a suitable cross-section, and preferably having the configuration shown in plan view in figure 2, or the configuration of the alternative embodiment according to figure 3, which will be described later on.

The disk 10 consists of two superposed disks which are secured to each other by means of screws, and in one of them, for example in the lower disk, the channels 11 are formed, for example, by milling or by electroerosion, while the function of the other disk is to close the said channels at their top side.

Around the disk 10 and at the proper distance therefrom, a ring 12 is co-axially provided, with its generatrix being vertical and with its inner surface 112 being suitably roughened, for example, by knurling, by electroerosion, or by any other suitable tecnique. The ring 12 is made of any suitable wear-resistant material, for example, of steel or cast iron.

The ring 12 has its upper edge closed by the casing 4 of the apparatus, and has its lower edge connected to a funnel-shaped chamber 13.

The distributing disk 10 can be rotatably supported as shown in figure 1 by the vertical shaft of a bevel gear pair 14, with the box 15 containing same being supported by equispaced spokes 16 secured to chamber 13. The horizontal shaft of gears 14 is connected to a shaft 17 which is tightly passed through the sidewall of chamber 13, and which is to be connected to a geared motor 18 fixed to the portion 104 of the casing of the apparatus.

It is understood that differently from what has been described and shown, the disk 10 may be rotatably supported by the chamber 13 or by the casing 4, and that the driving of said disk may be effected with means located in the upper chamber 19, to avoid the presence in chamber 13 of the spokes 16 and the shaft 17 which inevitably cause

a loss of head in the flow flowing through the apparatus.

The funnel-shaped chamber 13 discharges into the central well 20 provided in the distributing disk 21, which is similar to the previously considered disk 10, but that it has a greater diameter. Shown at 11′ are the channels provided in disk 21, which are similar to the channels 11 shown in figures 2 or 3, but which differ from the former since they are longer, and their depth slightly decreases from the interior toward the exterior of said disk 21.

The disk 21 is keyed onto the upper end of a vertical shaft 22 which is rotatably supported by an intermediate support provided with bearings 23, and which in turn is fastened to a base frame 24. The lower end of shaft 22 is connected through the transmission drive 25 to a motor 26 mounted onto the base frame 24 and with adjustable speed. The direction of rotation of disk 21 preferably is concordant with that of the upper disk 10, this in order to avoid any loss of head in the flow flowing through the micronizer.

The distributing disk 21 is co-axially surrounded by a ring 27 made of a very hard material, such as steel suitably hardened at least at its inner surface 127, which is characterized by having a generatrix that is partly vertical and that at its lower end terminates in a curve oriented toward the centre of said ring, and having an angular amplitude between 15° and 90°. The ducts 11′ in disk 21 discharge at any suitable intermediate point of the generatrix of surface 127.

The lower end of ring 27 is connected to a funnel-shaped chamber 28 surrounded by a chamber 29 forming a hollow space 30 which is open to the atmosphere through a duct 31 intercepted by a control valve 32 and a filter 33.

The chamber 28 and the hollow space 30 discharge co-axially into the central well 34 in a distributing disk 35 keyed onto the driving shaft 22, which is similar to, and has the same diameter as the disk 21, but which differs therefrom owing to its downwardly diverging truncated-cone configuration, and due to the fact that its channels 11″, which therefore are longer than the channels 11′, have a height dimension gradually decreasing from the interior toward the outer part of the disk 35 more markedly than it occurs for channels 11′.

The disk 35 is surrounded by a ring 36 just like the upper ring 27, which at its top side is closed by means of the connection 204 with the chamber 29, and at its bottom side is connected to a chamber 37 fastened onto the base frame 24, and which is in form of the volute of a centrifugal fan, as shown in figure 4 of the drawings.

The tangential duct 137 of said chamber 37 is connected to one or to a plurality of cyclones (not shown) for separating the product from air, which in turn are connected to the suction of a fan or a lower (not shown) having suitable characteristics. The suction obtained in the bottom chamber 37 is such that from the outside a proper air stream is drawn through the circuit 5-6-7-8, so that the product gradually introduced into the chamber 1 by the means 2 will get into the well 9 in disk 10 and will be admixed with the said air stream flowing through the channels 11, and thanks to the rotation of said disk 10 the flow of air and product will be uniformly distributed on the inner surface of the rough ring 12, where a first comminution of the product is achieved. The disk 10 is rotated at a relatively moderate speed which in any case is much lower than that of the underlying disks 21 and 35 (see hereinafter).

The air and product flow issuing from the first comminution stage is conveyed from the chamber 13 into the well 20 in disk 21 which, as already disclosed, is rotated at a relatively high speed, while its channels 11′ are longer than the channels 11. Thanks also to the gradual narrowing of the cross-section area of channels 11′ , the flow of air and product is accelerated while it is flowing through the said channels, and as it flows out it violently hits against some of the product temporaneously staying on the inner surface 127 of ring 27, thanks to the downwardly flaring shape of said surface. As a result of the dynamic impact occurring between the product particles on the surface of ring 27, a further and important comminution of said product is achieved on said ring.

The air and product flow issuing from the second comminution stage is conveyed from the chamber 28 into the well 34 in disk 35 together with the pressure air flow flowing into the said well from the circuit 30-31-32-33. This fresh flow of air and product, thus reinforced as to its speed and flow rate, flows through the channels 11″ in disk 35 which further accelerate the said flow, thanks to the fact that they are longer than the channels 11′ and to the more sensible gradual narrowing of their cross-section area. Thanks also to the high speed of rotation of the distributing disk 35, on the inner surface 136 of ring 36 a further and appreciable comminution of the product is achieved through the dynamic impact between the product particles, similarly to what occurs on the inner surface of ring 27.

In figures 2 and 3 it appears that in correspondence of their intermediate portion, the channels in the distributing disks have a portion 111 which is greater in cross-section, and which permits the forming of turbulences apt to guarantee an efficient mixing of differently fine particles of the product, with a consequent homogenization during the final processing of the product. In the modified embodiment according to figure 3, the sum of the cross-

section areas of the terminal branches 211,211′ of channels 11,11′,11″ is equal to, or is smaller than the cross-section area of said intermediate portion 111.

The air and product flow issuing from the third comminution stage flows into the chamber 37 and flows out through the duct 137, and gets to the decantation cyclone or cyclones, where the product is separated from air and is collected into silos or into bags, while air continues to flow toward the suction machine.

It is apparent that by adjusting the suction of air from the outside by means of the valves 7 and 32, and that by changing the speed of rotation of the driving units 18,26 and of the feeding device 2, it is possible to modify the final properties of the processed product.

Since the air flowing through the micronizer and conveying the product is sucked from the outside, and is not compressed air, the said air is at ambient temperature and does not modify the properties of the product to be processed. Cooling circuits may be associated, if required, to the rings 12,27 and 36 for cooling the said rings.

From experiments made by the applicant, it was possible to obtain very satisfactory results when processing even very abrasive products, such as clinker, by adopting the following parameters. The particles of the product fed to the apparatus had a diameter not greater than 5 mm. The diameter of the distributing disks 21 and 35 may vary between 600 and 800 mm. The height of the apparatus between the opening for feeding the product and the chamber 37 may vary between 700 and 900 mm. The outside diameter of the casing of the apparatus may vary between 800 and 1000 mm. The distance between the periphery of the distributing disks 10,21,35 and the relative impact rings 12,27,36 may vary between 4 and 15 mm. The speed of rotation of shaft 22 may be in the order of 3000 rmp. The rate of the air flow through the apparatus can be in the order of 60 cubic meters/hour.

It is however understood that these parameters may widely vary as a function of the properties of the product to be treated.

In order to limit any loss of head in the apparatus, it is provided for the ends of channels 11,11′,11″ which open into the central well in the respective distributing disk, to be suitably flared and correctly oriented as a function of the direction of rotation of the distributing disks, as shown, for example, at 311 in figures 2 and 3. Still for this purpose, the shaft 22 may be eliminated. In fact, the disks 21 and 35 may be rotatably supported by the overlying chambers 13 and 29 and may be driven by means located at a higher level, similarly to what has been disclosed in connection with the disk 10. The rotation of the distributing disks may be otherwise obtained by reaction, by suitably orienting the channels 11,11′,11″ in the direction of the impact rings 12,27 and 36.

Differently from what has been illustrated the distributing disks 27 and 35 may be rotated at a different speed, preferably at a peripheral speed of the lower disk which is higher than that of the upper disk.

It is finally understood that depending on the requirements of the product to be treated, the product-conveying medium may consist of a fluid different from air or combined with air, for example, steam.

The distributing disks 21 and 35 may be of a different diameter and, in this case, the disk 35 may not be conical and may have the configuration of disk 21.

Instead of being carried out in three stages, as disclosed, the processing of the product may be effected in two or in four or more stages.

Claims

1. A micronizing apparatus for processing organic and inorganic products, comprising means (2,7) for feeding the product, together with at least one product-conveying fluid such as ambient air, to a first distributing disk (10) with vertical axis, which by rotating distributes the composite flow on the rough surface of a first ring (12) where a first comminution or grinding of the product takes place, the air-and-product flow being then conveyed to a second distributing disk (21) with vertical axis and of a greater diameter, which is rotated at a higher speed than the first disk, and which accelerates and uniformly distributes the said flow on a second comminution ring (27) of a very hard material and tapered downwardly, whereby some of the product will temporarily stay on the said ring, and will be broken owing to the dynamic impact thereon of the product particles progressively delivered from the said second distributing disk (21), and reaches a third comminution or grinding stage comprising a disk and a ring (35, 36) which are similar to the second disk and ring, and from which the said flow is finally discharged for further processing,
characterized by the fact that inlet means (1,13,28) are provided so that the product is delivered to the centre of the disks (10, 21, 35) and that means (31,32,33) are provided so that the product flow leaving the second grinding stage is mixed with a fresh ambient air flow before reaching the third grinding stage.

2. The apparatus according to claim 1, in which the first impact ring (12) is made from cast iron and is internally roughened by knurling, or by electroerosion, or by any other suitable technique.

3. The apparatus according to claim 1, in which the impact rings (27,36) of the second and the third comminution stage are made of steel and have their inner surface, on which the comminution takes place, hardened by means of any suitable treatment.

4. The apparatus according to claim 3, in which the inner surface of the impact rings (27,36) of the second and the third comminution stage has a generatrix partly formed by a straight line and terminating at its lower end in a curve which is oriented towards the centre and has an angular amplitude between 15° and 90°.

5. The apparatus according to claim 1, in which suitable means may be provided for cooling the different impact rings (12,27,36).

6. The apparatus according to claim 1, in which the distributing disks (21,35) of the second and the third comminution stage have substantially the same diameter, so that it is possible to use impact rings (27,36) with like features, the last distributing disk (35) being shaped with a downwardly diverging conical configuration.

7. The apparatus according to claim 1, in which the third disk has a greater diameter than the second disk.

8. The apparatus according to claim 1, in which suitable means may be provided for adjusting the speed of rotation of the distributing disks (10,21,35).

9. The apparatus according to claim 1, characterized by the fact that the distributing disks (10, 21, 35) are provided with radially directed distributing channels (11, 11′, 11″).

10. The apparatus according to claim 9, in which the rotation of the distributing disks (10,21,35) is obtained by means of the reaction of the flow against the respective impact ring, the channels (11,11′,11″) in the distributing disks being accordingly suitably oriented.

11. The apparatus according to claim 9, in which the channels (11,11′,11″) in the distributing disks are characterized by having an intermediate portion (111) which is greater in cross-section.

12. The apparatus according to claim 9, in which the inlet ends (311) of the channels (11,11′,11″) in the distributing disks are suitably flared and oriented.

13. The apparatus according to claim 9, in which the distributing disks consists each of two superposed disks secured to each other by means of screws, so that the channels formed in at least one of the said two disks, for example, by milling, by electroerosion, or by any other suitable technique, will have their surface closed by the other disk.

14. The apparatus according to claim 9, in which the channels (11′,11″) in the second (21) and in the third distributing disk (35) are characterized by having a cross-section area which gradually decreases towards the periphery of the respective disks.

Patentansprüche

1. Feinzerkleinerungsvorrichtung für die Verarbeitung von organischen und anorganischen Stoffen, welche Mittel (2, 7) zur Zuführung des Stoffes zusammen mit wenigstens einem Stofftransportfluid wie beispielsweise Umgebungsluft zu einer ersten Verteilscheibe (10) mit vertikaler Achse beinhaltet, wobei die Verteilscheibe durch Drehung den Gemischstrom auf der rauhen Oberfläche eines ersten Ringes (12), wo eine erste Zerkleinerung oder ein Mahlen des Stoffes stattfindet, verteilt, der Luft- und Stoffstrom danach zu einer zweiten Verteilscheibe (21) mit vertikaler Achse und mit einem größeren Durchmesser, die mit höherer Geschwindigkeit als die erste Scheibe gedreht wird transportiert wird, wobei die zweite Verteilscheibe (21) den besagten Strom beschleunigt und gleichmäßig auf einen zweiten Zerkleinerungsring aus sehr hartem Material und nach unten konisch zulaufend verteilt, wobei etwas von dem Stoff zeitweise auf dem besagten Ring bleiben wird, und darauf infolge des dynamischen Aufpralls der stetig von der besagten zweiten Verteilscheibe (21) gelieferten Stoffpartikel gebrochen wird, und erreicht eine dritte Zerkleinerungs- oder Mahlstufe, die eine Scheibe und einen Ring (35, 36), die gleich der zweiten Scheibe und dem zweiten Ring ist, beinhaltet und von der der besagte Strom zuletzt zu weiterer Verarbeitung abfließt, **dadurch gekennzeichnet,** daß Einlassmittel (1, 13, 28) in der Art und Weise vorgesehen sind, daß der Stoff zum Mittelpunkt der Scheiben

(10, 21, 35) gefördert wird, und daß Mittel (31, 32, 33) in der Weise vorgesehen sind, daß der Stoffstrom, der die zweite Mahlstufe verläßt, mit einem frischen Umgebungsluftstrom gemischt wird, bevor er die dritte Mahlstufe erreicht.

2. Feinzerkleinerungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der erste Aufprallring (12) aus Gußeisen gefertigt und an der Innenseite durch eine Rändelung oder durch Elektroerosion oder durch eine andere geeignete Technik aufgerauht ist.

3. Feinzerkleinerungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Aufprallringe (27, 36) der zweiten und dritten Zerkleinerungsstufe aus Stahl gefertigt sind und an ihrer Innenseite, auf der die Zerkleinerung stattfindet, durch irgendeine geeignete Behandlung gehärtet sind.

4. Feinzerkleinerungsapparat nach Anspruch 3, dadurch gekennzeichnet, daß die innere Oberfläche der Aufprallringe (27, 36) der zweiten und dritten Zerkleinerungsstufe eine Erzeugende hat, die zum Teil aus einer geraden Linie geformt ist und an ihrem unteren Ende in einer Kurve endet, die gegen das Zentrum orientiert ist und die eine Winkelamplitude zwischen 15° und 90° hat.

5. Feinzerkleinerungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß für die Kühlung der verschiedenen Aufprallringe (12, 27, 36) geeignete Mittel vorgesehen sind.

6. Feinzerkleinerungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Verteilscheiben (21, 35) der zweiten und dritten Zerkleinerungsstufe im wesentlichen gleiche Durchmesser haben, so daß es möglich ist, Aufprallringe (27, 36) mit gleichen Merkmalen zu benutzen, wobei die letzte Verteilscheibe (35) mit einer nach unten divergierenden konischen Konfiguration gestaltet ist.

7. Feinzerkleinerungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die dritte Scheibe einen größeren Durchmesser als die zweite Scheibe hat.

8. Feinzerkleinerungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß geeignete Mittel zur Einstellung der Drehgeschwindigkeit der Verteilscheiben (10, 21, 35) vorgesehen sind.

9. Feinzerkleinerungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Verteilscheiben (10, 21, 35) mit radial gerichteten Verteilkanälen (11, 11', 11'') versehen sind.

10. Feinzerkleinerungsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Drehung der Verteilscheiben (10, 21, 35) mittels der Reaktion des Stromes gegen den entsprechenden Aufprallring erzeugt wird, wobei die Kanäle (11, 11', 11'') in den Verteilscheiben entsprechend geeignet angeordnet sind.

11. Feinzerkleinerungsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Kanäle (11, 11', 11'') in den Verteilscheiben ein im Querschnitt größeres Mittelteil (111) besitzen.

12. Feinzerkleinerungsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Einlassenden (311) der Kanäle (11, 11', 11'') in den Verteilscheiben in geeigneter Weise konisch erweitert und ausgerichtet sind.

13. Feinzerkleinerungsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Verteilscheiben jeweils aus zwei aufeinander liegenden Scheiben bestehen, die aneinander durch Schrauben befestigt sind, so daß die in wenigstens einer der besagten zwei Scheiben eingebrachten Kanäle z. B. durch Fräsen, durch Elektroerosion oder durch eine andere geeignete Technik an ihrer Oberseite durch die andere Scheibe geschlossen sind.

14. Feinzerkleinerungsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Kanäle (11, 11', 11'') in der zweiten (21) und in der dritten Verteilscheibe (35) einen Bereich besitzen, in dem der Querschnitt graduell in Richtung auf die Peripherie der entsprechenden Scheiben abnimmt.

Revendications

1. Broyeur fin pour traiter des produits organiques et minéraux comprenant des moyens (2, 7) destinés à alimenter en le produit, en même temps qu'au moins un fluide entraînant le produit, tel que de l'air ambiant, un premier disque (10) répartiteur d'aie vertical qui, en tournant, répartit le courant composite sur la surface rugueuse d'un premier anneau (12) où a lieu une première fragmentation ou un premier broyage du produit, le courant d'air et le produit étant ensuite envoyés à un deuxième disque (21) de répartition d'axe vertical et de plus grand diamètre, qui tourne à une plus grande

vitesse que le premier disque et qui accélère et répartit uniformément ce courant sur un deuxième anneau (27) de fragmentation, en un matériau très dur et s'amincissant vers le bas, une partie du produit restant temporairement sur l'anneau et étant rompue par l'impact dynamique des particules de produit qu'il reçoit et qui sont envoyées progressivement par le deuxième disque (21) de répartition et atteignant un troisième étage de fragmentation ou de broyage comprenant un disque et un anneau (35, 36) qui sont analogues aux deuxièmes disque et anneau, et à partir duquel le courant est déchargé finalement en vue d'être traité ultérieurement,

caractérisé par le fait qu'il est prévu des moyens d'entrée (1, 13, 28) de manière à envoyer le produit au centre des disques (10, 21, 35) et qu'il est prévu des moyens (31, 32, 33), de sorte que le courant de produit quittant le deuxième étage de broyage soit mélangé à un courant d'air ambiant frais, avant d'atteindre le troisième étage de broyage.

2. Broyeur suivant la revendication 1, dans lequel le premier anneau (12) d'impact est en fonte et est rendu rugueux intérieurement par moletage ou par électro-érosion ou par toute autre technique convenable.

3. Broyeur suivant la revendication 1, dans lequel les anneaux (27, 36) d'impact des deuxièmes et troisièmes étages de fragmentation sont en acier et leur face intérieure, sur laquelle a lieu la fragmentation, est durcie au moyen d'un traitement convenable.

4. Broyeur suivant la revendication 3, dans lequel la face intérieure des anneaux (27, 36) d'impact des deuxième et troisième étages de fragmentation ont une génératrice formée en partie d'une ligne droite et se terminant à son extrémité inférieure en une courbe qui est orientée vers le centre et qui a une amplitude angulaire comprise entre 15° et 90°.

5. Broyeur suivant la revendication 1, dans lequel il est prévu des moyens de refroidissement des divers anneaux (12, 27, 36) d'impact.

6. Broyeur suivant la revendication 1, dans lequel les disques (21, 35) de répartition des deuxième et troisième étages de fragmentation ont sensiblement le même diamètre, de sorte qu'il possible d'utiliser des anneaux (27, 36) d'impact ayant les mêmes caractéristiques, le dernier disque (35) de répartition étant conformé en ayant une configuration conique divergeant vers le bas.

7. Broyeur suivant la revendication 1, dans lequel le troisième disque a un diamètre plus grand que le deuxième disque.

8. Broyeur suivant la revendication 1, dans lequel il est prévu des moyens destinés à régler la vitesse de rotation des disques (10, 21, 35) de répartition.

9. Broyeur suivant la revendication 1, caractérisé par le fait que les disques (10, 21, 35) sont munis de canaux (11, 11',11") de répartition dirigés radialement.

10. Broyeur suivant la revendication 9, dans lequel la rotation des disques (10, 21, 35) de répartition est obtenue au moyen de la réaction du courant sur l'anneau d'impact respectif, les canaux (11, 11' ,11") des disques de répartition étant orientés convenablement de manière correspondante.

11. Broyeur suivant la revendication 9, dans lequel les canaux (11, 11', 11") des disques de répartition sont caractérisés par une partie (111) intermédiaire de plus grande section transversale.

12. Broyeur suivant la revendication 9, dans lequel les extrémités d'entrée (311) des canaux (11, 11', 11") des disques de répartition sont évasées et orientées convenablement.

13. Broyeur suivant la revendication 9, dans lequel les disques de répartition consistent chacun en deux disques superposés fixés l'un à l'autre moyen de vis, de sorte que les canaux formés dans l'un au moins des deux disques, par exemple par fraisage, par électro-érosion ou par toute autre technique convenable, aient leurs surfaces proches de l'autre disque.

14. Broyeur suivant la revendication 9, dans lequel les canaux (11', 11") du deuxième (21) et du troisième disque (35) de répartition sont caractérisés par une section transversale qui diminue peu à peu vers la périphérie des disques respectifs.

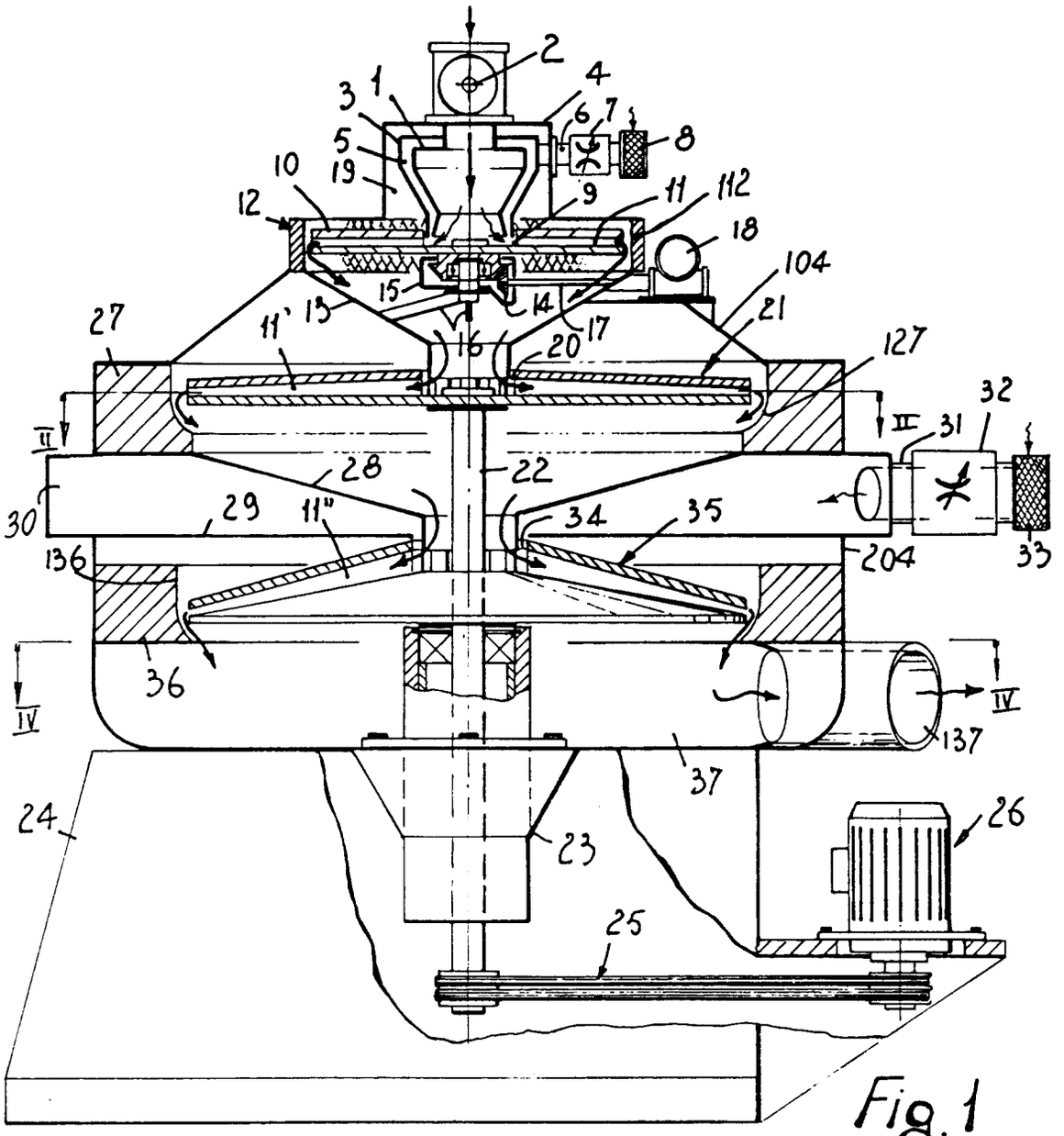

Fig. 1

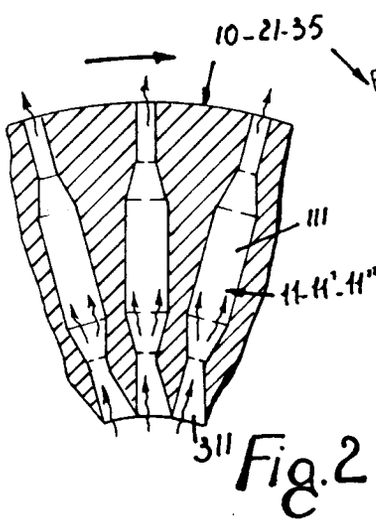

Fig. 2

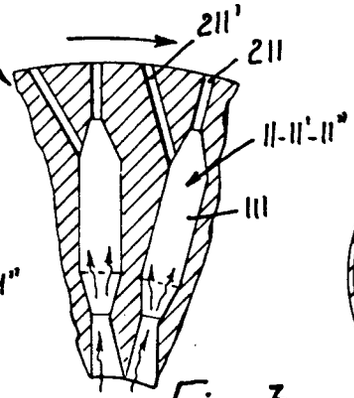

Fig. 3

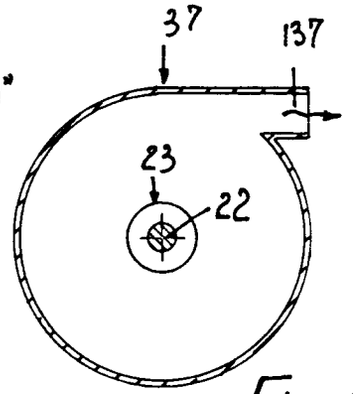

Fig. 4