Local and international patent name search report
Patent attorney: Paulo Lopes (Patent Attorney / IP specialist representing MyPatent)
Reference: MC00034 [PREPARED FOR JASON DALE]

Citing the name of Douglas Forbes as the inventor, the applicant or the assignee

As requested, a South African name search and an international on-line name search was conducted to locate any patents or patent applications citing the name of Douglas Forbes as the inventor or the applicant (patentee).

From the South African Name Search (see section "**Douglas Forbes (LNS)**") you will note that the only South African patent granted to Douglas Forbes is South African patent no. **99/6722** entitled "**Apparatus and Method for Granulating a Material**". A status report (see section "**STATUS REPORT (ZA 99.6722)")** in respect of this patent has been provided for your reference, from which you will note the following:

1. that the patent lapsed due to non-payment of renewal fees on 26 October 2006; and
2. that a number of changes in ownership were effected against this patent during its term (see "Remarks" in the status report).

Another interesting fact that I would like to point out is that provisional patent application no. **98/9718**, which was originally filed on 26 October 1998 and from which South African patent no. **99/6722** and international patent application no**. WO 00/24518** claimed priority, was during its term post-dated by two days to 28 October 1998 so as to allow the filing of the international patent application within the allowable 12 month period. Please note however, that due to the patent having lapsed, this point is mute.

From the International On-Line Name Search (see "**Douglas Forbes (IONS)**") you will note that national phase patent applications, extending from international patent application **WO 00/24518**, were filed into Australia, Taiwan and Uruguay. From my searches, it seems that the Australian patent application lapsed before ever becoming granted in Australia. It was necessary to engage foreign agents in each of these countries respectively in order to be sure of the statuses of the patent applications. Accordingly, please refer to section "**Statuses of international patent applications**".

P.T.O

Douglas Forbes (LNS)

South African Name Search
Date of Search: 26 February 2009
Applicant Searched: Douglas Forbes
Inventor Searched: Douglas Forbes
Assignee Searched: Douglas Forbes

Period Searched: 1 January 1989 to 26 January 2009

We conducted a name search through the South African Patent Office records to locate any South African patents or patent applications filed in the above listed names and within the abovementioned period.

During the course of our search, the following South African patents and patent applications were located.

Patent Applications

Official No	Title	Remarks and Status
93/00875	Anti Highjack-Anti Theft Device	Provisional application which lapsed on 9 February 1994
98/09718	Apparatus and Method for Granulating a Material	Provisional application which was extended into South African complete patent application no. 99/6722 and international patent application no. WO 00/24518
2000/03258	Particle Liberator Apparatus	Provisional application which lapsed on 29 June 2001

Patents

Official No	Title	Status
99/06722	Apparatus and Method for Granulating a Material	Lapsed on 26 October 2006 due to non-payment of renewal fees

DISCLAIMER

The results of the search depend on the accuracy of the South African Patent Office records and the information provided to us. Our search was designed to locate any South African patents or pending applications filed in any of the above listed names in the indicated period. It should be noted that recently filed applications may not be reflected in the official records for several months after filing.

STATUS REPORT

Date: 28 February 2009

Number: ZA 99/6722

Applicant: Douglas FORBES

Title: Apparatus and Method for Granulating a Material

Inventor: Douglas FORBES

Priority Claim:

Priority Country:	Priority Number:	Priority Date:
1. ZA	1. 98/9718	1. 28 October 1998

Complete Specification Filed: 16 October 1999

Complete Specification Accepted: 3 January 2001

Advertisement of Acceptance: 30 May 2001

Grant Date: 30 May 2001

Status: Lapsed on 26 October 2006

Last Renewal Paid: 26 October 2005

Assigned to: Safari Trust on 7 February 2003

Licensees: -

Address for Service: Galgut & Galgut

Remarks:

1. Applicant substituted from Douglas Forbes to Vortaire Ltd on 23 February 2000;
2. Another applicant substitution from Vortaire Ltd back to Douglas Forbes on 7 April 2000;
3. Yet another applicant substitution from Douglas Forbes to Hertzmomsioux Trust on 13 July 2000;
4. Above applicant substitution was cancelled on 3 April 2001, with ownership of the patent reverting back to Douglas Forbes;
5. Assignment from Douglas Forbes to Safari Trust on 21 May 2002;
6. Above assignment was cancelled on 18 July 2002, with ownership of the patent reverting back to Douglas Forbes; and
7. Assignment from Douglas Forbes to Safari Trust on 7 February 2003.

Douglas Forbes (IONS)

International On-line Name Search

Date of Search:	28 February 2009
Applicant Searched:	Douglas Forbes
Inventor Searched:	Douglas Forbes
Databases Searched:	Australian Patent Office; Canadian Patent Office; Esp@cenet; United States Patent and Trademark Office; and WIPO

We conducted an international name index search through the above databases, which revealed the following patents or patent applications, which may be of interest:

Official No	Title
AU 2000,015,267	Apparatus and Method for Granulating a Material
TW 445,175	Apparatus for Granulating a Material
UY 25773	Apparatus and Method for Granulating a Material
WO 00/24518	Apparatus and Method for Granulating a Material

DISCLAIMER

The results of the search depend on the accuracy of the databases used and the information provided to us. Our search was designed to locate any patents or pending applications in the indicated names and in the indicated field of technology. It should be noted that recently filed applications may not be reflected in official records for several months after filing.

P.T.O

Statuses of international patent applications

As instructed, I have now obtained the statuses of the foreign patents located by our searches from my foreign agents. I report as follows:

1. Australian Patent Application No 1526700

   This application was never examined nor granted in Australia.

2. Uruguayan Patent Application No 25773

   This application has not yet been granted in Uruguay. According to the records, no request for examination has yet been filed. The period in which to request examination in Uruguay is still open. However, based on the statuses of the corresponding patents and patent applications in the other countries, I believe that examination has not yet been requested because the application has been abandoned by the applicant.

3. Taiwanese Patent No 455175

   This patent was granted on 11 July 2007. However, due to non-payment of the required certificate fee and the annuity fee, this patent lapsed.

As such, it seems that Douglas Forbes currently holds no granted and enforceable patent rights in any of the abovementioned countries.

P.T.O

Further notes and observations

1. Requirements for an invention to be patentable in South Africa

For an invention to be patentable in South Africa, that invention must be:

- new;
- inventive; and
- capable of being applied to trade, industry or agriculture.

The requirement that the invention be capable of being applied to trade, industry or agriculture is self explanatory and accordingly, no further explanation is required. Inventiveness is a subjective test based on the opinion of an expert in the relevant field of technology. If the expert is of the opinion that the invention is obvious, the invention will not be patentable based on a lack of inventiveness.

I must point out however, that to date, only about 4 patents in South Africa have ever been revoked on the ground of a lack of inventiveness. For this reason, where an invention is novel (i.e. where the invention is new) but inventiveness is questionable, a applicant is better advised to file a patent application and face possible revocation proceedings, rather than not filing a patent application at all.

As such, it is obvious that the most important requirement for obtaining a patent is the novelty. An invention is considered to be new if it has never been disclosed to the public, in anyway, anywhere in the world – in other words, absolute novelty.

The only way of evaluating the novelty of an invention is to conduct searches to examine existing products (prior art), that are detrimental to the novelty of the invention. Having said this, and due to the sheer number of inventions developed globally on a daily basis, no search can ever be 100% conclusive.

2. South African Patenting Process

The patenting process in South Africa **should** generally comprise of three steps:

- conducting a novelty search;
- filing a provisional patent application and thereafter;
- filing a complete patent application, claiming as a priority date the date on which the provisional application was first filed.

However, there is no legal requirement in South Africa that a search be conducted at all. The onus is on the applicant to conduct searches of their own. In fact, the South African Patent Office is considered to be a non-examining patent office meaning that not even the South African Patent Office themselves conduct any searches or examination relating to the subject matter of

a patent application. **For this reason, it is estimated that a huge number of patent applications, having been filed and even granted at the South African Patent Office, are invalid**.

A provisional patent application sets down a date (the priority date) on which the novelty of a subsequently filed complete patent application is determined. A provisional patent application never grants into an enforceable patent itself. It simply maintains a applicant's rights to extend the provisional patent application into a South African complete patent application or an international patent application, within 12 months from the date of filing the provisional patent application. If a complete patent application or an international patent application is not filed within 12 months from the priority date, the provisional patent application will lapse and will be of no force or effect.

The importance of the priority date is significant for another reason. The validity of a complete patent application, claiming priority from a provisional patent application, will be adjudicated on prior art existing before the priority date (i.e. the date on which the provisional patent application was filed) and not on prior art existing before the filing date of the complete patent application, which may be up to 12 months later (sometimes even 15 months later).

Although a complete patent application may be filed in the first instance, i.e. without having first filed a provisional patent application, it is not advisable to do so. The effect of a complete patent application, once granted, is to provide a applicant with a 20 year monopoly in South Africa during which, he may prevent others from making, using, exercising, disposing of or importing the protected invention.

I point out that a complete patent granted to a applicant in South Africa in no way guarantees that the applicant is an expert in that field or even that the patent is valid. In fact, parties that may be interested in purchasing a South African patent from a applicant will only do so after conducting due diligences of their own, or after receiving the examination reports of corresponding patent applications in foreign examining countries.

As an alternative to filing a South African complete patent application subsequent to the filing of a provisional patent application, an applicant may file an international (PCT) patent application.

Patent rights are territorial in nature, meaning that a patent must be obtained in each and every country in which protection is required – there is no such thing as a world wide patent. Before acceding to the Patent Cooperation Treaty (PCT), it was necessary for a applicant to, within 12 months of filing a provisional patent application, file complete patent applications in South African as well as in every other foreign country in which the applicant required protection. In today's terms, this would mean that the applicant would have to raise, within 12 months, about R25000 to R35000 per country to file a foreign patent application.

One of the many advantages of the PCT system is that the applicant can now file a single international patent application within the 12 month period, for about R15000 to R20000, and delay the cost of filing individual patent applications in each of the foreign countries by a further at least 18 months, providing the applicant with more time to raise the required capital to file each of the patent applications. It is for this reason that it is possible for a South African patent

application to enter into South African, via an international patent application, up to 34 months from the date of filing the provisional patent application.

P.T.O

Knowledge of the patenting system and applicable time lines is essential to understanding the results of searches conducted to locate relevant South African patents or patent application.

3. South African Patenting Searching

There are a number of different searches that may be conducted to locate relevant South African patents or patent application, namely:

- Name searches - which are searches conducted through the official records of the South African Patent Office to locate all South African patents or patent applications citing a particular person as the applicant (patent applicant or owner), the inventor or the patent assignee (a new owner to which the patent may be transferred to during its life time).

- Equivalent searches – which are searches conducted through the official records of the South African Patent Office to locate any South African patents or patent applications corresponding to a known foreign patent or patent application.

- Subject matter searches - which are searches conducted through the relevant manual abstract records at the South African patent office to locate all patents relating to a particular subject matter.

Assuming that the necessary information is available, a name search is the easiest and therefore cheapest way to determine if a certain person holds any patents or patent applications in their name.

P.T.O

4. Penalties for false representations

Section 85 of the Patents Act provides the following:

(1) Any person who—

(a) falsely represents that any article is a patented article; or

(b) represents that any article is the subject of a patent application, knowing that no such application has been made or that an application made in respect thereof has been refused or withdrawn or has lapsed,

shall be guilty of an offence and on conviction liable to a fine not exceeding R1 000 or to imprisonment for a period not exceeding 12 months or to both such fine and such imprisonment.

(2) If any person disposes of any article on which is stamped, engraved or impressed or to which is otherwise applied the word "patent", "patented" or any other word expressing or implying that the article is patented, or to which any marking is applied in any manner expressing or implying that the article is patented, he shall be deemed for the purposes of this section to represent that the article is a patented article.

(3) The provisions of subsection (2) shall not apply to a person who disposes of articles in good faith in the ordinary course of trade provided, when called upon to do so, he discloses the identity of the person from whom he acquired the article in question.

(4) Any person who is of the opinion that he is prejudiced by a representation referred to in subsection (1) (a) or (b), may apply to the commissioner for an interdict against the continuation of that representation.

5. Conclusions

- Anybody can obtain a patent for anything at the South African Patent Office due to the fact that it is a non-examining patent office. This is a key difference to foreign patent offices who employ full time examiners to examine the subject matter of all patent applications filed and, only if the examiner is satisfied that the invention fulfils the patent requirements, will a patent on that invention be granted;

- According to the results of the search, Douglas Forbes holds no patent rights in his personal name; both in South Africa and abroad

- Even if Douglas Forbes held a granted patent in South Africa, that in itself would not guarantee that the invention works or is valid, due to the non-examining status of the South African Patent Office; and

- Due to the non-examining status of the South African Patent Office, the South African patenting system is open to abuse by mistaken inventors who file patent applications believing them to be patentable when they are in fact not, or by fraudulent inventors who file patent applications while knowing full well that their inventions are not patentable.

DOCUMENTATION ON LAPSED PATENT CAN BE FOUND BELOW

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification [7] : **B02C 19/18**	**A1**	**(11) International Publication Number:**	**WO 00/24518**
		(43) International Publication Date:	4 May 2000 (04.05.00)

(21) International Application Number: PCT/ZA99/00112

(22) International Filing Date: 28 October 1999 (28.10.99)

(30) Priority Data:
98/9718 28 October 1998 (28.10.98) ZA

(71)(72) Applicant and Inventor: FORBES, Douglas [ZA/ZA]; P.O. Box 26319, Hout Bay, 7872 Cape Town (ZA).

(74) Agents: MORRISON, Ian et al.; Ian Morrison Forster & Company, FMI House, Gleneagles Park, Flanders Drive, Kwa Zulu Natal, P.O. Box 2004, 4300 Mount Edgecombe (ZA).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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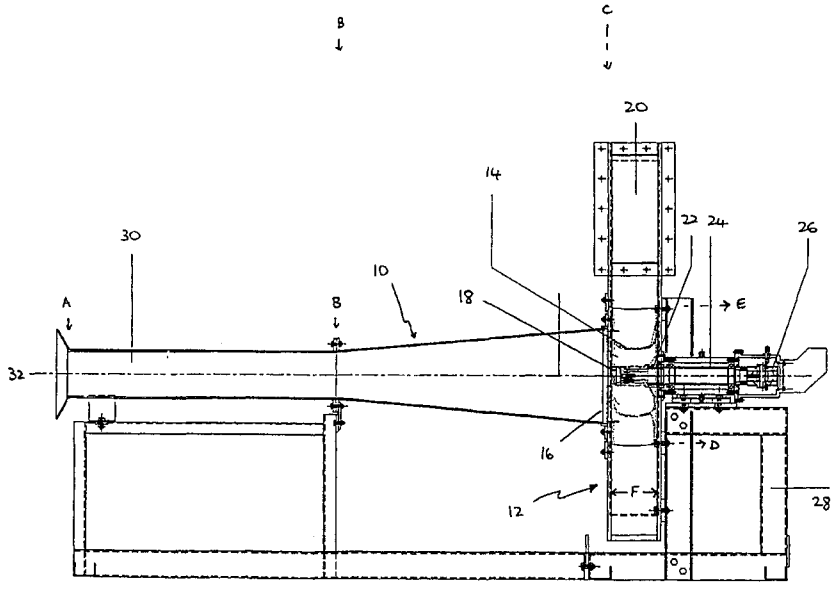
(54) Title: APPARATUS AND METHOD FOR GRANULATING A MATERIAL



(57) Abstract

An apparatus for processing material comprises a cyclone chamber, an impeller suction fan for creating a cyclone within the chamber, feed means for introducing material into the chamber batchwise and means for collecting the processed material, the impeller and/or the inlet to the chamber being adapted to reduce the temperature of water in the chamber to a temperature approaching absolute zero, under which conditions of temperature and vacuum the material to be processed is subjected to forces which result in the disassociation of bonding within the material, the chamber being further adapted to contain any explosions or implosions which may occur and to ensure any recombination of hydrogen and oxygen to form water before the outlet.

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Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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APPARATUS AND METHOD FOR GRANULATING A MATERIAL

TECHNICAL FIELD OF THE INVENTION

This invention relates to an apparatus and method for granulating a material and in particular for the atomic conversion of naturally occurring materials into naturally occurring elements as found in the periodic table.

BACKGROUND OF THE INVENTION

In a wide variety of processes, it is necessary to reduce material to a particle size in the range 20 to 70 microns.

The degree to which this can be achieved by mechanical methods is limited and the process is slow and results in machinery requiring high levels of maintenance which is costly. Accordingly there has been some development of apparatus in which no grinding of the material by the apparatus itself takes place. Instead the material is degraded by collision and self-abrasion between individual particles or aggregates of material within a vortex formed in a cyclonic air stream.

U S Patent 5 402 947 describes an apparatus in which a high pressure air stream is used to create a vortex in a cyclone chamber. The vortex entraps the material, holding it in a cyclonic suspension in which it is subjected to violent turbulence causing it to break up by collision and self-abrasion.

U S Patent 3 147 911 recognizes that the pressure of the air stream within the chamber must be sub-atmospheric and accordingly employs a suction fan or blanket to draw air through the chamber. This method necessitates that the air stream and entrained particulate material must pass through the fan subjecting it to the severe wear and tear. Accordingly this method could only be used for softer materials to a limited extent and was completely unsuitable for processing stone, coal or cement for example.

A further patent PCT/GB 98/00422 describes an apparatus for creating a cyclone in a stream of air passing through a conduit which is circular in cross-section. In this form, the applicants claim that centripetal forces created by the motion of the air stream pull any particulate material entrained in the air stream away from the walls of the conduit and towards its central region. If a wide range of sonic frequencies are created within the conduit, a pattern of powerful vortices are created in the air stream. Energies are released by conversion of the potential energy to kinetic energy due to the stresses created within the cyclone which causes a minute explosion. The vortices of the cyclone take the form of implosions which are capable of breaking the material up further into smaller particles.

It is also claimed by the applicants of PCT /GB 98/00422 that the vortices created in the cyclonic air stream carry further harmonic frequencies generated by the specially designed apparatus, this sets up a pulse from the standing wave configuration within the system, and this causes pockets of air within the standing wave to achieve a velocity beyond the sonic range. This can be tuned for a particular type of material which enhances the ability of the vortices created to break up very hard and soft material such as stone and to dry materials.

This phenomenon is claimed to be achieved by apparatus for processing a material, according to a first aspect of the present invention comprising a cyclone chamber; an impeller suction fan for creating a cyclonic air stream within the cyclone chamber, the fan having an inlet and an outlet for passage of the air stream therethrough; and a feed assembly for feeding material into the path of the cyclonic air stream for processing the material in the cyclone chamber, wherein the cyclonic air stream includes non-conflicting effects of vacuum forming centripetal vortices, parts of which travel at supersonic speeds; series of harmonics and subsequent sub harmonics inherent in the apparatus and induced; supersonic resonance; standing wave; thermal shock; pressure changes, cavitation, the stresses of which in combination convert the potential energy of material conveyed by the cyclonic air stream to kinetic energy. In effect then this apparatus uses harmonics, tuning the frequencies generated by the vortices (or by external input) to coincide with the frequencies of the bonds in the material, thereby causing the material to implode.

This process has been found to have a number of difficulties, the main one being that the explosion which results in the cyclone chamber does not degrade all the material into the required size and as a result, undegraded material exits the chamber and hits the impeller. The force with which this occurs results in even the fan constructed of the materials known to man lasting no more than a few hours.

In the present invention, a similar but modified apparatus is used to create certain conditions in a cyclone chamber.

In this apparatus of the invention, the degradation of the material is more controlled and complete reducing drastically the damage to the impeller and increasing the efficiency of the apparatus relative to prior art methods.

It is an object of the invention to provide an apparatus for processing materials for use in mining and mineral processing, management of waste material, industrial applications and agricultural applications.

At this the applicants are aware of the advantages of the apparatus in the mining industry for separation and drying. Naturally occurring ores of up to 70 mm in diameter may be reduced to powder form. The actual particle size of the feed will depend on the moisture content and density of the material as these factors govern the through-put of the apparatus.

The use of the apparatus in this sector has important consequences for the environment as it separates naturally occurring bonded materials into the individual elements reducing or eliminating the need for the use of toxic chemicals, for example cyanide in extraction of gold.

In coal mining, the apparatus may be used to increase the B.T.U. of coal as the conversion process in the apparatus dramatically reduced the moisture content thereof (typically to less than 0.2%).

In the waste material management sector the apparatus finds a use in the recycling of pre-treated waste products, including sewerage and industrial sludges by means of its drying effect. Furthermore the extremes of heat and temperature changes within the apparatus eliminate pathogens.

The use of the apparatus in the recycling of glass results in the formation of a glass powder which is easily remelted for re-use.

The industrial sector may make use of the drying properties of the apparatus for the recycling of pulp for paper manufacture. Additionally coal may be powdered to reconstitution as briquettes for furnaces, barbecues and the like.

Known agricultural applications include the production of natural organic fertilizers for example by processing a combination of dung and straw. A further application is the reduction of bagasse to powdered form which can be reconstituted into fuel.

DISCLOSURE OF THE INVENTION

According to the invention, an apparatus for processing material comprises a cyclone chamber, an impeller suction fan for creating a cyclone within the chamber, feed means for introducing material into the chamber batchwise and means for collecting the processed material, the impeller and/or the inlet to the chamber being adapted to reduce the temperature of water in the chamber to a temperature approaching absolute zero, under which conditions of temperature and vacuum the material to be processed is subjected to forces which result in the disassociation of bonding within the material, the chamber being further adapted to contain any explosions or implosions which may occur and to ensure any recombination of hydrogen and oxygen to form water before the outlet.

In the preferred form of the invention, the cyclone chamber comprises a frusto-conical section, the wide end of the frusto-conical section opening into an impeller section comprising an impeller rotatable within a casing including a spiral volute or removable liner ; the centre of the spiral coinciding with the axis of rotation of the impeller and the longitudinal axis of the cyclone chamber. An inlet section may be provided

attached to the narrow end of the cyclone chamber. The spiral volute leads to an outlet. The inlet may include a conical flare at an angle of 60° to the longitudinal axis of the chamber.

Also in the preferred form of the invention the dimensions of the impellers determine the dimensions of the apparatus and the following dimensions are directly proportional to the length of the impeller: the length of the inlet section, the length of the frusto-conical section, the width of the impeller section in which the impeller rotates and the diameter of the impeller.

Furthermore the cross-sectional area of the inlet is directly proportional to the cross-sectional area of the inlet to the impeller section. In the preferred form the cross-sectional area of the cyclone chamber is 24,090% of the cross-sectional area of the outlet. The cross-sectional area of the outlet is also proportional to impeller size and is preferably 38,227% of the impeller circumferential area.

Also in the preferred form, the cross-sectional area of the inlet is 44,444% of the circumferential area of the impeller.

The apparatus may be built in a variety of different sizes, provided the relative dimensions of the various components specified remain in this proportionality. This will ensure that the processed material passes through the impeller blades and out of the outlet with minimum contact on any surface.

In the preferred form of the invention, the clearance between the outer edge of the impeller blades and the inside lining of the impeller casing is 3 mm to 3,5 mm.

Furthermore, the point of minimum clearance between the impeller and the volute (lining of the outlet) is 3,175 mm ($^1/_8$ inch) and 1 degree to the right of the vertical plane which passes through the centre of rotation of the impeller (as viewed from the inlet side). The angle of the outlet is 30 degrees and to the left of centre axis of the impeller casing (as viewed from the inlet side).

In one form of the invention in which the impeller diameter is 609,6 mm (24 inches), the impeller width is 195 mm and the internal width of the impeller casing is 201 mm. These dimensions result in the inlet section having a length of 1219,2 mm and an internal diameter of 203,2 mm. The length of the cyclone chamber including the inlet section is 2457,4 mm. The length of the frusto-conical section is 1238,2 mm.

In the preferred form of the invention, the means for collecting the processed material includes a deflector element and an exhaust for discharging the processed material into a hopper or a cyclone air separator or the like equipment.

Also in the preferred form of the invention, the deflector is adapted to create a second cyclone (Vortex) within the chamber, this cyclone being within the first to fan out the processed material between the blades of the impeller, with minimum contact with the blades.

Since the deflector is attached to the impeller shaft, it rotates at the same speed as the impeller. The effect of this rotation is to create a second cyclone or vortex oppositely disposed within the vortex created by the impeller. Thus the eyes of the vortices lie along the same axis which axis coincides with the axes of rotation of the impeller and deflector.

In the preferred form of the invention, the deflector element is attachable to the hub of the impeller and includes a circular base member mounted on shaft element, the shaft element being externally screw threaded for engaging a complimentally threaded central bore in the impeller shaft.

In one form, the deflector element comprises a diametrical ridge formation which includes a first high arcuate section near one side, a low arcuate middle section, and a second high arcuate section near the other side which is lower than the first high section. The ridge may further include an aperture extending through the first high section at an angle of 45° to the longitudinal axis of the ridge.

In the preferred form of the invention, the feed means is a batch feed means and the feed rate is determined according to the composition of the product, and any other pertinent parameters.

The impeller may have three, six or nine equispaced vanes which fit into corresponding axially aligned slots in the hub. The impeller may be driven by either a dynamometer (high speed asynchronous motor) or a hydraulic motor, but conceivably a high speed rotary engine with a high speed gearbox configuration, directly or indirectly coupled, may be used.

The impeller vanes are preferably inclined at an angle of 7.2° from the vertical. Furthermore the vanes are generally concave with the concavity orientated to face the direction of rotation of the impeller. The vanes preferably comprise COR. TEN A steel, a type of spring steel.

In the preferred form the vanes comprise an arcuate spine section of a large radius with a pair of identical side sections of smaller radius.

In one form each vane further includes on the inlet side thereof a flat wing element extending from the side section at an angle of 20° from a tangent on the longitudinal axis of the spine section. The wing preferably tapers toward the slot in the hub of the impeller. Likewise the side section oppositely disposed to the wing also tapers towards the slot in the hub. The wing preferably extends forwardly from the hub at an angle to the axis of rotation of the impeller. In one form the angle is 45°.

A short slot may be provided in the vane separating the wing from the front portion of the side section. The width of the slot is preferably in the range of 0,5 to 4 percent of the length of the vane. The slot may taper towards the base thereof.

The wing preferably extends through the inlet of the impeller section into the cyclone chamber by a distance equal to $^{1}/_{24}$th of the diameter of the impeller. In one form of the invention, the inlet of the impeller section of the apparatus is formed by an annular ring attached to the side sections of the impeller from a point just beyond the slot

separating the wing and side sections, the ring including a flange around the internal circumference of the ring.

A rear annular ring may be affixed to the rear edges of the vanes and the ring may further include a stabiliser or shroud for the impeller comprising a frusto-conical frame, the narrow end of which is attached to the hub of the impeller and the wide end of which engages the near annular ring. The angle of the shroud may be set between 12,5 and 13,5 degrees from the vertical.

The hub of the impeller preferably includes a central bore and is provided with a hydraulic release torque taper lock bush for receiving and being secured to the impeller shaft. The shaft may be supported by a bearing housing mounted on the rear of the impeller casing.

The speed of rotation of the impeller is directly proportional to the size of the impeller. A 24 inch impeller must be rotated at between 3600 and 5400 rpm to create the required vortex. The size of the impeller is selected according to the material to be processed (related to the moisture content of the material).

The first step in the process is calibration of the apparatus. Calibration is carried out according to the type of product and feed rate. This involves determining the water content of the feed which in turn permits the maximum volume permissible with each impeller size. The impeller may be 3, 6, 12, 18, 24, 30 or 36 inches.

The impeller suction fan is activated and begins to draw air through an inlet into the cyclone chamber and out of an outlet or exhaust. The impeller and chamber are designed in order that rotation thereof causes the formation of a vortex within the cyclone chamber. The impeller is design to create a vortex capable of lowering the temperature of the water in the charge to a temperature approaching absolute zero. It is believed that this will result in a sudden and explosive release of energy followed by an instantaneous rise in temperature. The temperature in the eye of the vortex quickly returns to near absolute zero at which point the process repeats itself. As a result, the apparatus produces a pulsating rhythm.

The fragmented material is drawn through the eye of the vortex and is removed by the fan. The eye is located at a predetermined distance from the impeller within the cyclone chamber, the distance being calculated according to the diameter of the impeller and the shape of the cone. The impeller hub includes a deflector element in the form of a diametrical ridge which is designed to create an inner vortex ensuring that the material will pass the impeller vanes with minimum contact. This is similar to a bullet fired from a gun at a revolving aeroplane propeller without the bullet touching the moving propeller. This is achieved by synchronising the pulsed movement of the fragmented material with the rotation of the impeller. The impeller is further designed to create a "braking" effect on the velocity of the suspended material. As the material moves into the impeller, the back pressure created by the volute creates a turbulent effect within the ducting, thus allowing the material to continue being suspended under pressure and then being exhausted through the volute with minimum abrasion.

In this operation, the temperature in the eye of the vortex is critical. Also important is the water content of the feed material as this determines the amount of hydrogen. Saturation of the cyclone chamber because of excessive moisture in the feed material results in a reduction of efficiency in processing the material within the cyclone chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments of the invention will be described with reference to the accompanying drawings, in which:

Figure 1 is a side view of the apparatus according to the invention;

Figure 2 is a sectional side view of the inlet and cyclone chamber;

Figure 2a is a sectional side view of the inlet and cyclone chamber showing the vortex action;

Figure 3 is a front view of the impeller section casing with the cyclone chamber removed;

Figure 4 is a cross-section through the casing of Figure 1;

Figure 5 is a longitudinal section through the spiral volute or removable liner;

Figure 6 is a front view of the impeller;

Figure 7 is a side view of the impeller;

Figure 8 is an isometric view of the impeller;

Figure 9 is an isometric view of the impeller with the front annular ring removed;

Figure 10 is a plan view of a vane of the impeller;

Figure 11 A and B are sectional views through a vane of the impeller;

Figure 12 is an isometric view of a vane;

Figure 13 is a front view of the impeller hub with the vanes removed;

Figure 14 is a bottom view of the impeller;

Figure 15 is a top view of the impeller;

Figure 16 is a side view of the deflector;

Figure 17 is a sectional view through the deflector ridge;

Figure 18 is an isometric view of the deflector;

Figure 19 is a reverse isometric view of the deflector.

DESCRIPTION OF MODES OF THE INVENTION

In Figure 1 the general layout of the apparatus is shown to comprise a cyclone chamber 10 which opens into an impeller section 12 in which an impeller 14 rotates and in so doing creates a vortex within the cyclone chamber.

Material to be granularised is fed into the cyclone chamber batchwise and is caught up in the vortex V1 created by the impeller. The vortex is of such a nature that a vacuum is created and the temperature of water in the cyclone chamber is reduced to near absolute zero at which point an explosion occurs fragmenting the feed material.

The fragmented material moves towards the inlet 16 of the impeller section but is deflected between the vanes of the impeller by a second vortex V2 created by a deflector 18 attached to the hub 22 of the impeller. The vortices created are illustrated generally in Figure 2a.

The fragmented material is blown out of the spiral casing of the impeller section at exit 20.

The impeller is mounted on shaft 24 which is rotated by a high speed asynchronous motor (dynamometer) 26. The apparatus is mounted on support frame 28.

The longitudinal axes of the inlet 30, cyclone chamber and vortices coincide with the longitudinal axis 32 of the impeller shaft and the centre of the spiral of the spiral casing.

In Figure 2, the cyclone chamber comprises a cylindrical inlet section comprising a flared inlet piece 40 and a cylindrical conduit 42. The conduit is bolted to a frusto-conical chamber 44 the wide end of which opens into the impeller section. The angle of the flared inlet is typically 60 degrees.

The impeller section is shown in figures 3,4 and 5 to comprise a spiral volute or removable liner 46 in which the impeller rotates at right angles to the longitudinal axis of the cyclone chamber. The spiral volute is clamped into the impeller casing 46a. The central point 48 of the spiral lies along the same axis as the longitudinal axis of the cyclone chamber, as well as that of the impeller shaft (see figures 6 through 9). The inner surfaces of the cyclone chamber and impeller casing are lined with abrasion resistant plates (not shown).

The impeller section has an exit 50.

The void 46b between the impeller casing and the spiral volute 46 may be filled with a high density silicone vulcanised rubber compound. This is a safety feature designed to prevent the impeller from destroying the apparatus in the event of the impeller shaft shearing. This filling has the added advantage in that it stiffens the casing by adhering to it. It also reduces vibration. A release agent is applied to the external surface of the spiral volute and the front of the casing to prevent the filler adhering to these surfaces.

The minimum clearance between the edges of the impeller vanes and the inner lining of the casing is 3,175 mm. Furthermore the point of minimum clearance between the impeller and the volute (lining of the outlet section) 52, is at an angle of 1 degree to the

right of the vertical plane which passes through the centre of rotation of the impeller as viewed from the inlet side and is also 3,175 mm. This is illustrated in Figure 5.

The dimensions of the impeller, the impeller casing and the cyclone chamber are proportional and although different sizes of the apparatus may be built for different applications, the following dimensions must remain in proportion for the apparatus to operate with minimum damage due to abrasion and other mechanical damage: (see figures 1 and 2)

- The length of the inlet section A to B
- The length of the frusto-conical section (cyclone chamber) B to C
- The diameter of the impeller D to E (see also figure 6)
- The width of the impeller section F

The minimum clearance between the edges of the vanes and the inner lining of the impeller section and the minimum clearance between the impeller and the volute at an angle of 1 degree to the right of the vertical plane which passes through the centre of rotation of the impeller as viewed from the inlet side, must always remain at 3,175 mm.

Turning now to Figures 6 to 15, the impeller and vane construction is described. The impeller (in the embodiment shown) comprises six equi-spaced vanes 60 attached to a central hub 62.

The vanes fit into six axially arranged slots in the hub (Figure 13).

The vanes are generally concave with the concavity orientated to face the direction of rotation of the impeller, and are inclined at an angle of 7.2 degrees from the vertical (see Figure 6, G). The vanes comprise an arcuate spine section 64 of a large radius R200 (Figure 11) with a pair of identical curved side sections 66 of smaller radius R38. On the inlet side of the vanes, nearer to the hub, there is provided a flat wing element 68 extending from the side section 66 at an angle of 20 degrees to a tangent on the longitudinal axis of the spine 64 of the vane. The wing and the opposite side element taper towards the hub at an angle to the axis of rotation of the impeller. In the form shown, this angle is 45 degrees.

The wing 68 is separated from the curved edge 66 of the end portion of the vane by a short, tapered slot 70. The width of the slot is typically 0.5 to 4 % of the length of the vane. The wing of each vane extends through the inlet of the impeller section by a distance equal to $^{1}/_{24}$ th of the diameter of the impeller. Welds 67 and 69 are shown in Figure 11B.

The inlet of the impeller section is formed by an annular ring 72 attached to the side sections 66 of the vanes just beyond the slot 70. The ring includes a flange 74 along the inner circumference thereof.

A second ring 76 is affixed to the rear of the vanes and this ring includes a frusto-conical stabiliser or shroud 78 which engages the hub 62 at its narrow end and the rear wall of the impeller casing at its wide end. This acts to stabilise the impeller. The angle of the shroud is set between 12,5 and 13,5 degrees from the vertical.

The hub of the impeller includes a deflector element 80 (Figures 16, 17, 18 and 19). The deflector serves to create a second vortex in front of the impeller to deflect the granulated material away from the hub of the impeller and allow it to pass between the vanes with the minimum of contact. The deflector comprises a circular base member 82 mounted on a shaft 84 which is screw threaded to engage a central bore in the impeller shaft. The circular base includes a diametrical ridge 86 having a high raised section 88 and a low raised section 90 separated by a trough. The raised section 88 has an aperture 92 extending therethrough at an angle of 45 degrees.

CLAIMS:

1. An apparatus for processing material characterised in that it comprises a cyclone chamber, an impeller suction fan for creating a cyclone within the chamber, feed means for introducing material into the chamber batchwise and means for collecting the processed material, the impeller and/or the inlet to the chamber being adapted to reduce the temperature of water in the chamber to a temperature approaching absolute zero, under which conditions of temperature and vacuum the material to be processed is subjected to forces which result in the disassociation of bonding within the material, the chamber being further adapted to contain any explosions or implosions which may occur and to ensure any recombination of hydrogen and oxygen to form water before the outlet.

2. An apparatus according to claim 1 characterised in that the cyclone chamber comprises a frusto-conical section, the wide end of the frusto-conical section opening into an impeller section comprising an impeller rotatable within a casing including a spiral volute or removable liner ; the centre of the spiral coinciding with the axis of rotation of the impeller and the longitudinal axis of the cyclone chamber.

3. An apparatus according to claim 1 or claim 2 characterised in that an inlet section is provided for attachment to the narrow end of the cyclone chamber.

4. An apparatus according to claim 3 in which the inlet includes a conical flare at an angle of 60 degrees to the longitudinal axis of the chamber.

5. An apparatus according to claim 2 characterised in that the dimensions of the apparatus are directly proportional to the dimensions of the impeller, the following dimensions being directly proportional the length of the impeller: the length of the inlet

section, the length of the frusto-conical section, the width of the impeller section in which the impeller rotates and the diameter of the impeller.

6. An apparatus according to claim 2 characterised in that the cross-sectional area of the inlet is directly proportional to the cross-sectional area of the inlet to the impeller section.

7. An apparatus according to claim 6 characterised in that the cross-sectional area of the cyclone chamber is 24,090% of the cross-sectional area of the outlet.

8. An apparatus according to any of the above claims characterised in that the cross-sectional area of the outlet is proportional to the impeller size and is 38,227% of the circumferential area of the impeller.

9. An apparatus according to any of the above claims characterised in that the cross-sectional area of the inlet is 44,444% of the circumferential area of the impeller.

10. An apparatus according to claim 2 characterised in that the clearance between the outer edge of the impeller blades and the inside lining of the impeller casing is 3 mm to 3,5 mm.

11. An apparatus according to claim 2 characterised in that the point of minimum clearance between the impeller and the volute (lining of the outlet) is 3,175 mm ($^1/_8$ inch) and 1 degree to the right of the vertical plane which passes through the centre of rotation of the impeller (as viewed from the inlet side).

12. An apparatus according to any of the above claims characterised in that the angle of the outlet is 30 degrees and to the left of centre axis of the impeller casing (as viewed from the inlet side).

13. An apparatus according to claim 5 characterised in that the impeller diameter is 609,6 mm (24 inches), the impeller width is 195 mm and the internal width of the impeller casing is 201 mm, the length of the inlet section is 1219,2 mm, the internal diameter of the inlet section is 203,2 mm, the length of the cyclone chamber including the inlet section is 2457,4 mm and the length of the frusto-conical section is 1238,2 mm.

14. An apparatus according to claim 1 characterised in that the means for collecting the processed material includes a deflector element and an exhaust for discharging the processed material into a hopper or a cyclone air separator or the like equipment.

15. An apparatus according to claim 14 characterised in that the deflector is adapted to create a second cyclone (Vortex) within the chamber, this cyclone being within the first vortex.

16. An apparatus according to claim 15 characterised in that the two vortices are oppositely disposed, with the eyes thereof laying along the same axis, the axis coinciding with the axes of rotation of the impeller and deflector.

17. An apparatus according to claim 14 characterised in that the deflector element is attachable to the hub of the impeller and includes a circular base member mounted on shaft element, the shaft element being externally screw threaded for engaging a complimentally threaded central bore in the impeller shaft.

18. An apparatus according to claim 14 characterised in that the deflector element comprises a diametrical ridge formation which includes a first high arcuate section near one side, a low arcuate middle section, and a second high arcuate section near the other side which is lower than the first high section.

19. An apparatus according to claim 18 characterised in that the ridge includes an aperture extending through the first high section at an angle of 45° to the longitudinal axis of the ridge.

20. An apparatus according to claim 1 characterised in that the feed means is a batch feed means and the feed rate is determined according to the composition of the product.

21. An apparatus according to claim 1 characterised in that the impeller has three, six or nine equispaced vanes which fit into corresponding axially aligned slots in the hub of the impeller.

22. An apparatus according to claim 1 characterised in that the impeller is driven by a dynamometer (high speed asynchronous motor).

23. An apparatus according to claim 1 characterised in that the impeller is driven by a hydraulic motor.

24. An apparatus according to claim 1 characterised in that the impeller is driven by a high speed rotary engine with a high speed gearbox configuration, directly or indirectly coupled.

25. An apparatus according to any of the above claims characterised in that the impeller vanes are inclined at an angle of 7.2° from the vertical.

26. An apparatus according to any of the above claims characterised in that the impeller vanes are generally concave with the concavity orientated to face the direction rotation of the impeller.

27. An apparatus according to any of the above claims characterised in that the impeller vanes comprises COR. TEN A steel.

28. An apparatus according to any of the above claims characterised in that the impeller vanes comprise an arcuate spine section of a large radius with a pair of identical side sections of the smaller radius.

29. An apparatus according to claim 28 characterised in that each vane includes on the inlet side thereof a flat wing element extending from the side section at an angle of 20° from a tangent on the longitudinal axis of the spine section.

30. An apparatus according to claim 29 characterised in that the wing tapers toward the slot in the hub of the impeller.

31. An apparatus according to claim 30 characterised in that the side section oppositely disposed to the wing also tapers towards the slot in the hub.

32. An apparatus according to claim 31 characterised in that the wing extends forwardly from the hub at an angle to the axis of rotation of the impeller.

33. An apparatus according to claim 32 characterised in that the angle is 45 degrees.

34. An apparatus according to claim 33 characterised in that the vane of the impeller includes a short slot separating the wing from the front portion of the side section.

35. An apparatus according to claim 34 characterised in that the width of the slot is in the range of 0,5 to 4 percent of the length of the vane.

36. An apparatus according to claim 35 characterised in that the slot tapers towards the base thereof.

37. An apparatus according to claim 29 characterised in that the wing extends through the inlet of the impeller section into the cyclone chamber by a distance equal to $^{1}/_{24}$th of the diameter of the impeller.

38. An apparatus according to claim 2 characterised in that the inlet of the impeller section of the apparatus is formed by an annular ring attached to the side sections of the impeller from a point just beyond the slot separating the wing and side sections, the ring including a flange around the internal circumference of the ring.

39. An apparatus according to any of the above claims characterised in that a rear annular ring is affixed to the rear edges of the vanes and the ring includes a stabiliser or shroud for the impeller comprising a frusto-conical frame, the narrow end of which is attached to the hub of the impeller and the wide end of which engages the near annular ring.

40. An apparatus according to claim 39 characterised in that the angle of the shroud is set between 12,5 and 13,5 degrees from the vertical.

41. An apparatus according to any of the above claims characterised in that the impeller includes a central bore and is provided with a hydraulic release torque taper lock bush for receiving and being secured to the impeller shaft.

42. An apparatus according to claim 41 characterised in that the shaft is supported by a bearing housing mounted on the rear of the impeller casing.

43. An apparatus according to any of the above claims characterised in that the speed of rotation of the impeller is directly proportional to the size of the impeller.

44. An apparatus according to claim 43 characterised in that a 24 inch impeller is rotated at between 3600 and 5400 rpm.

45. An apparatus substantially as described with reference to the accompanying drawings.

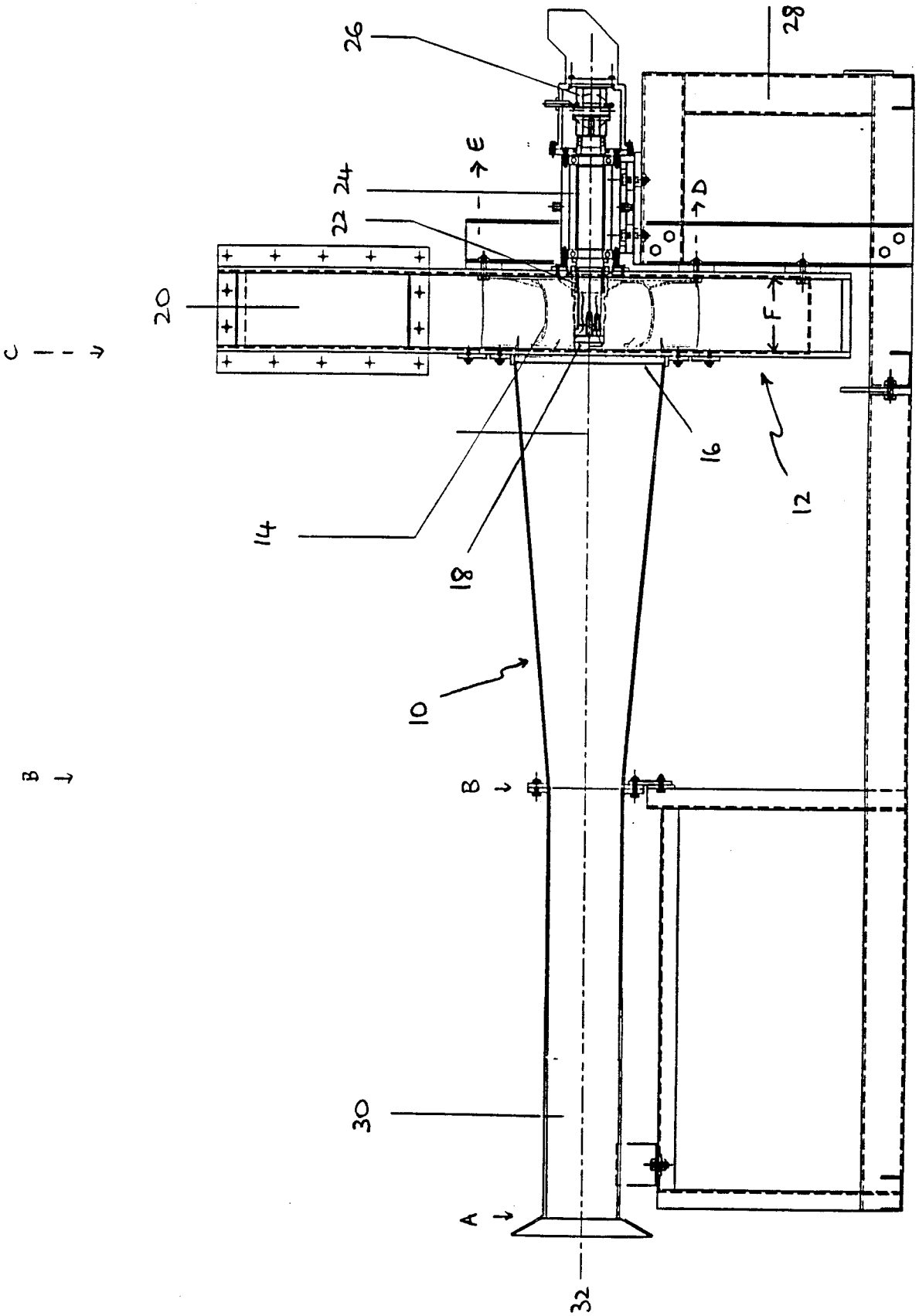


FIGURE 1

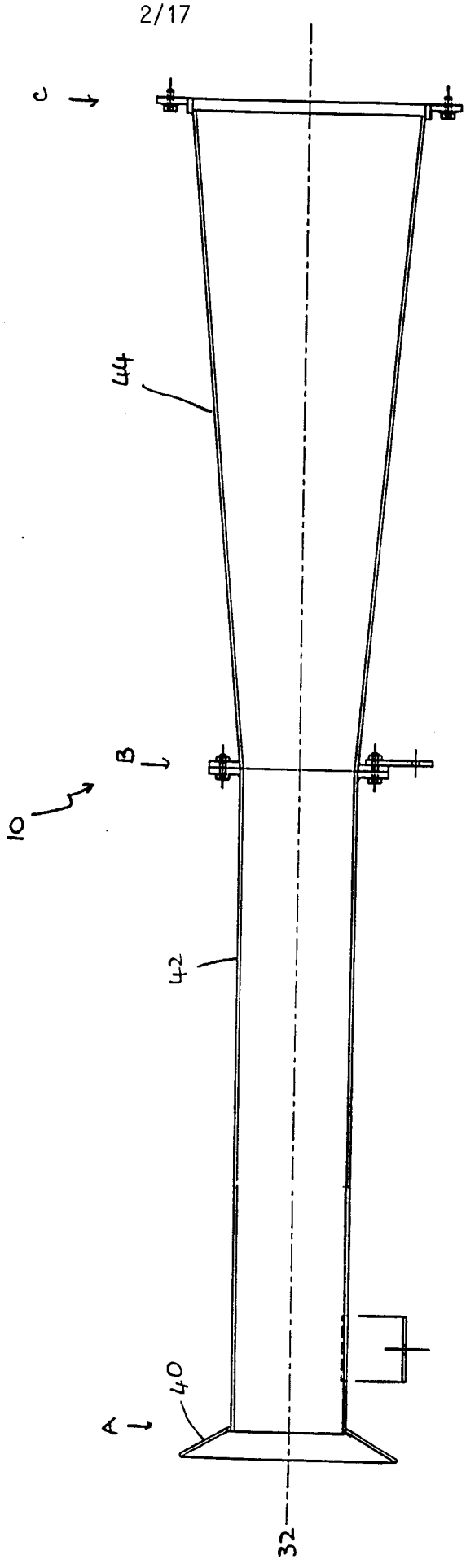


FIGURE 2.

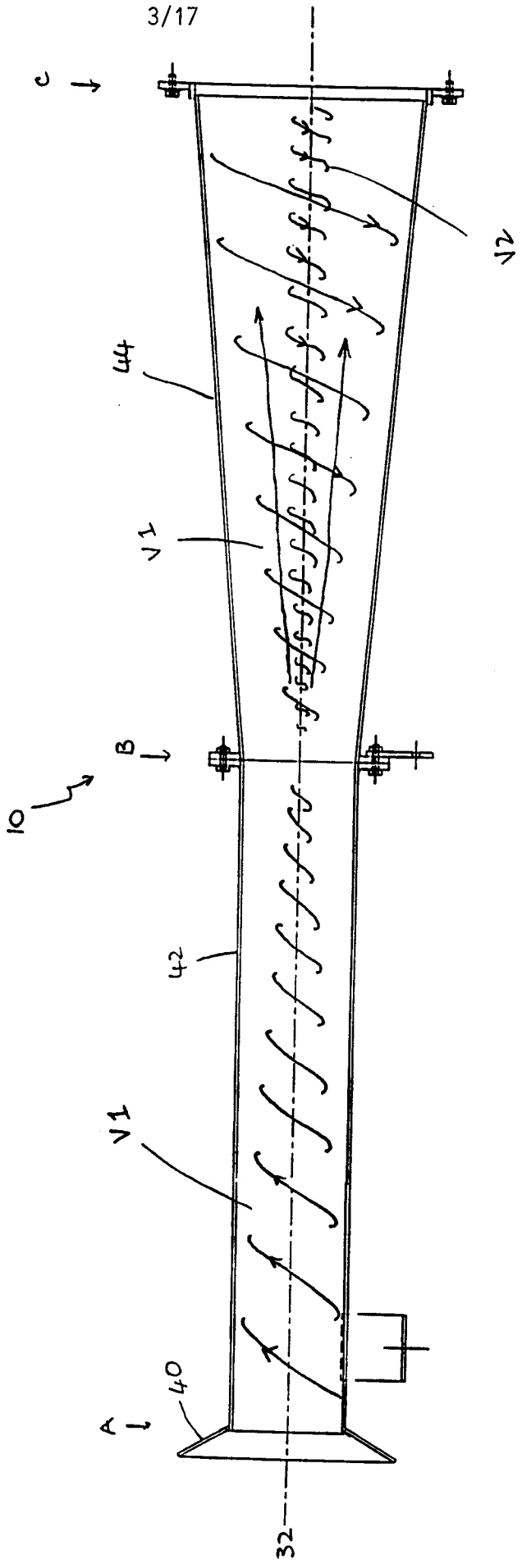
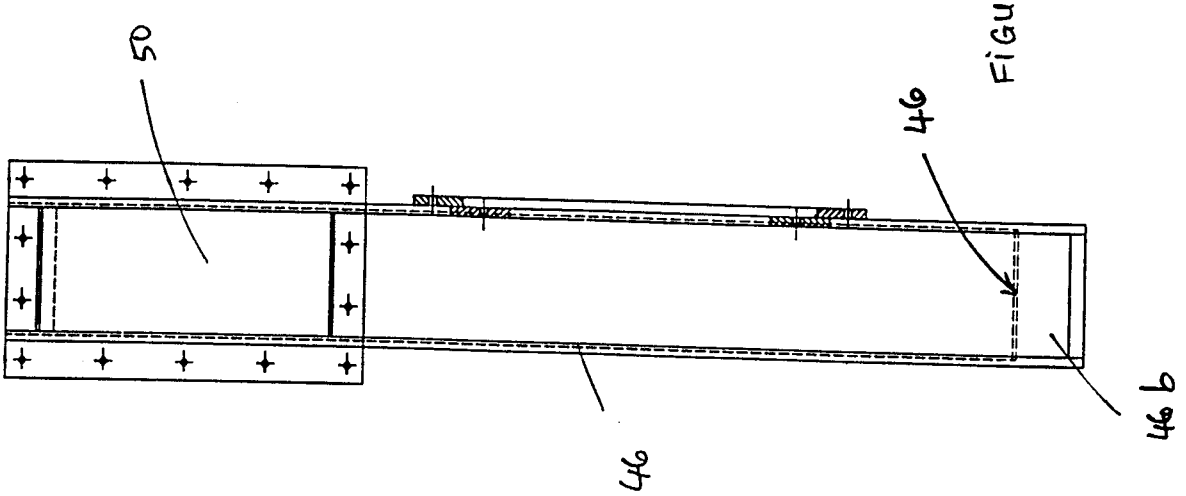


FIGURE 2a.

FIGURE 4.



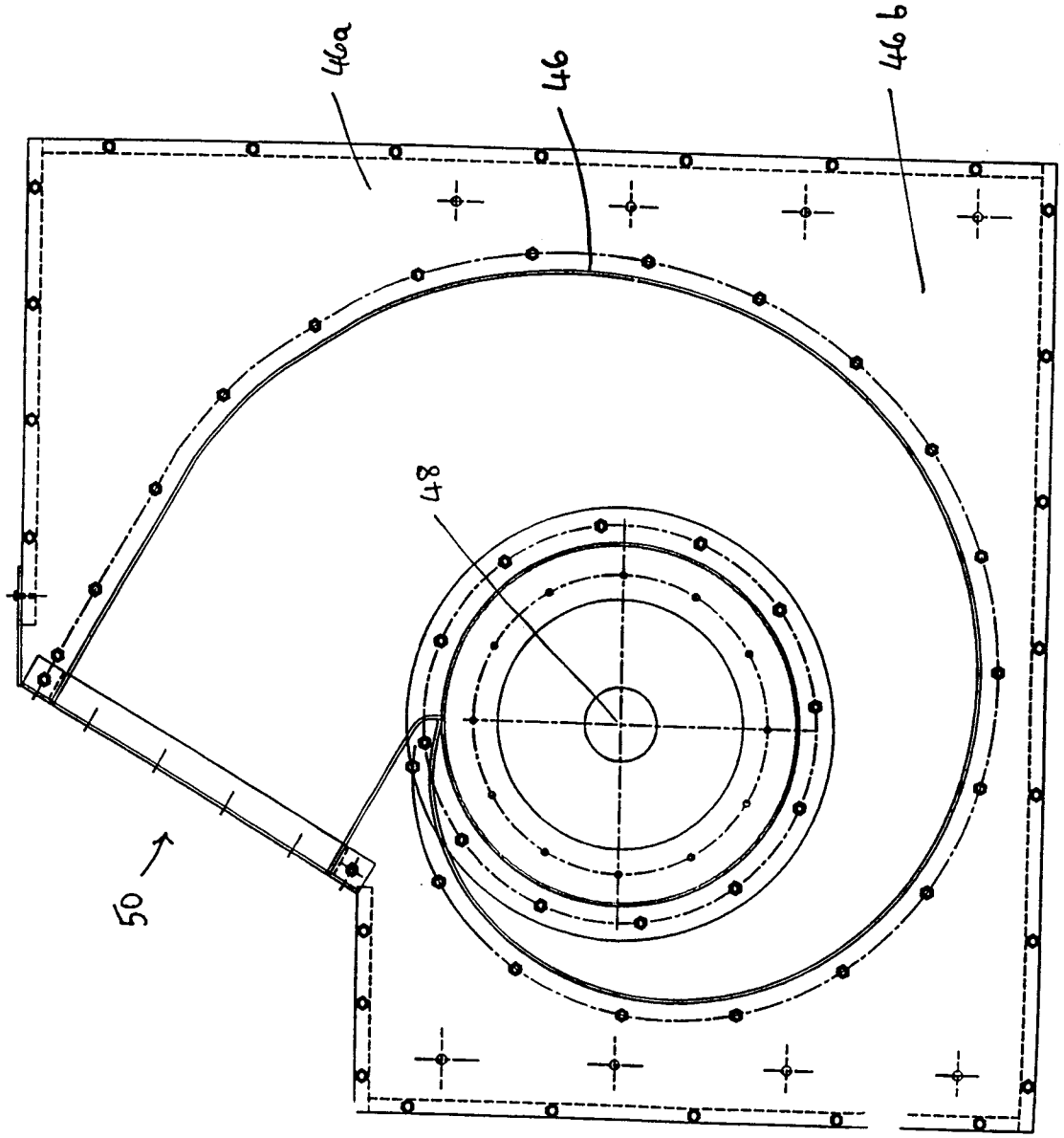


FIGURE 3

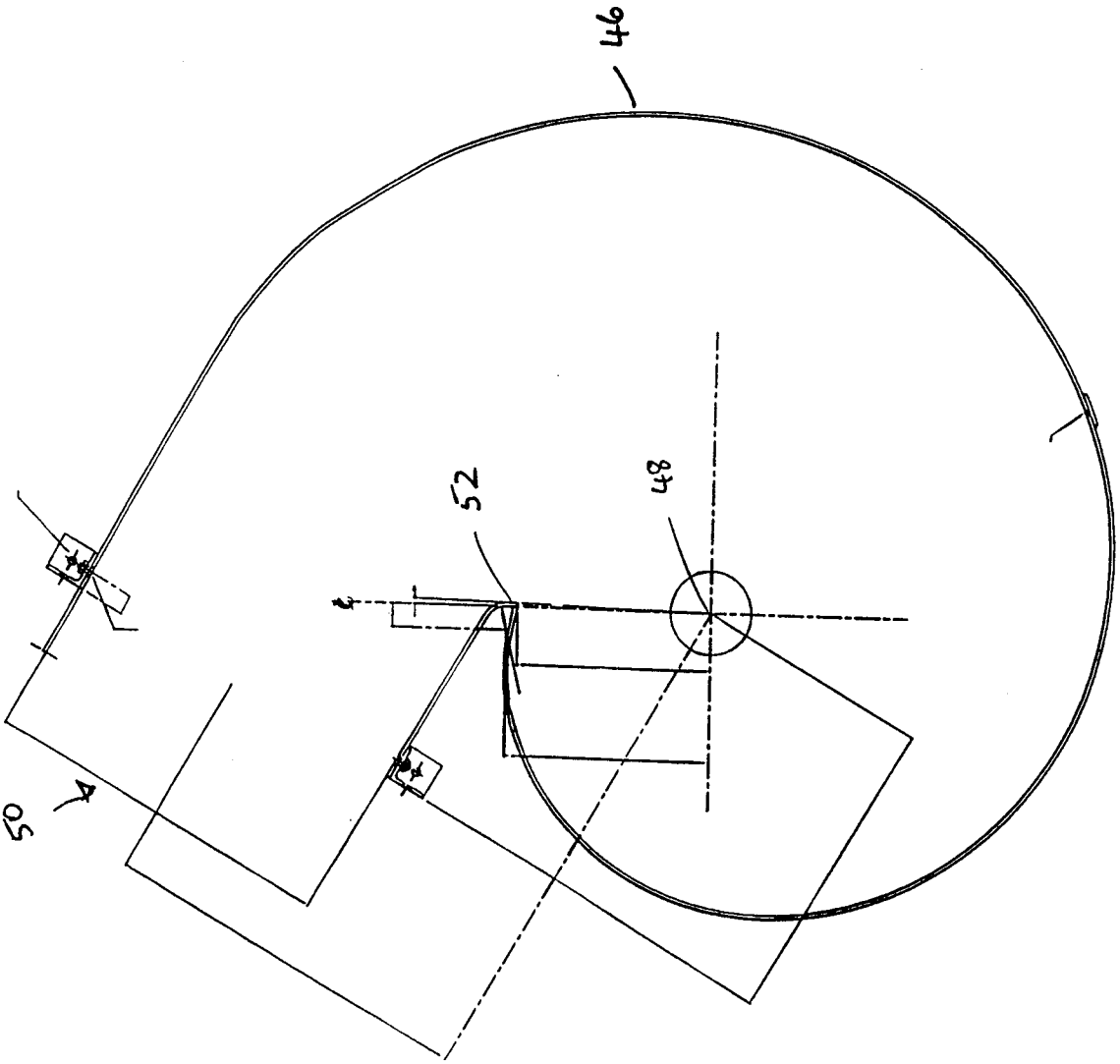


FIGURE 5.

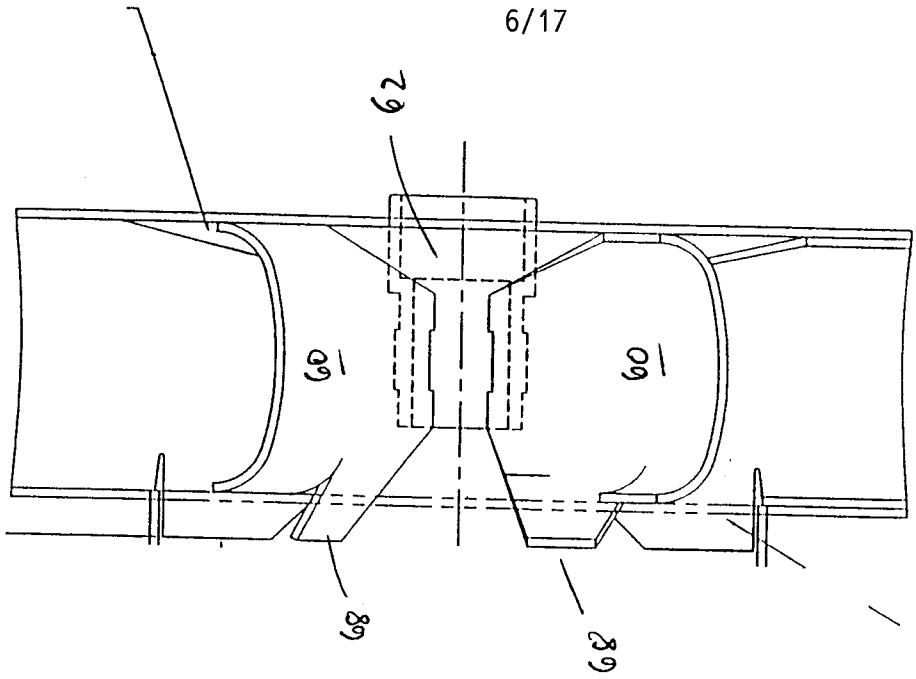


FIGURE 7.

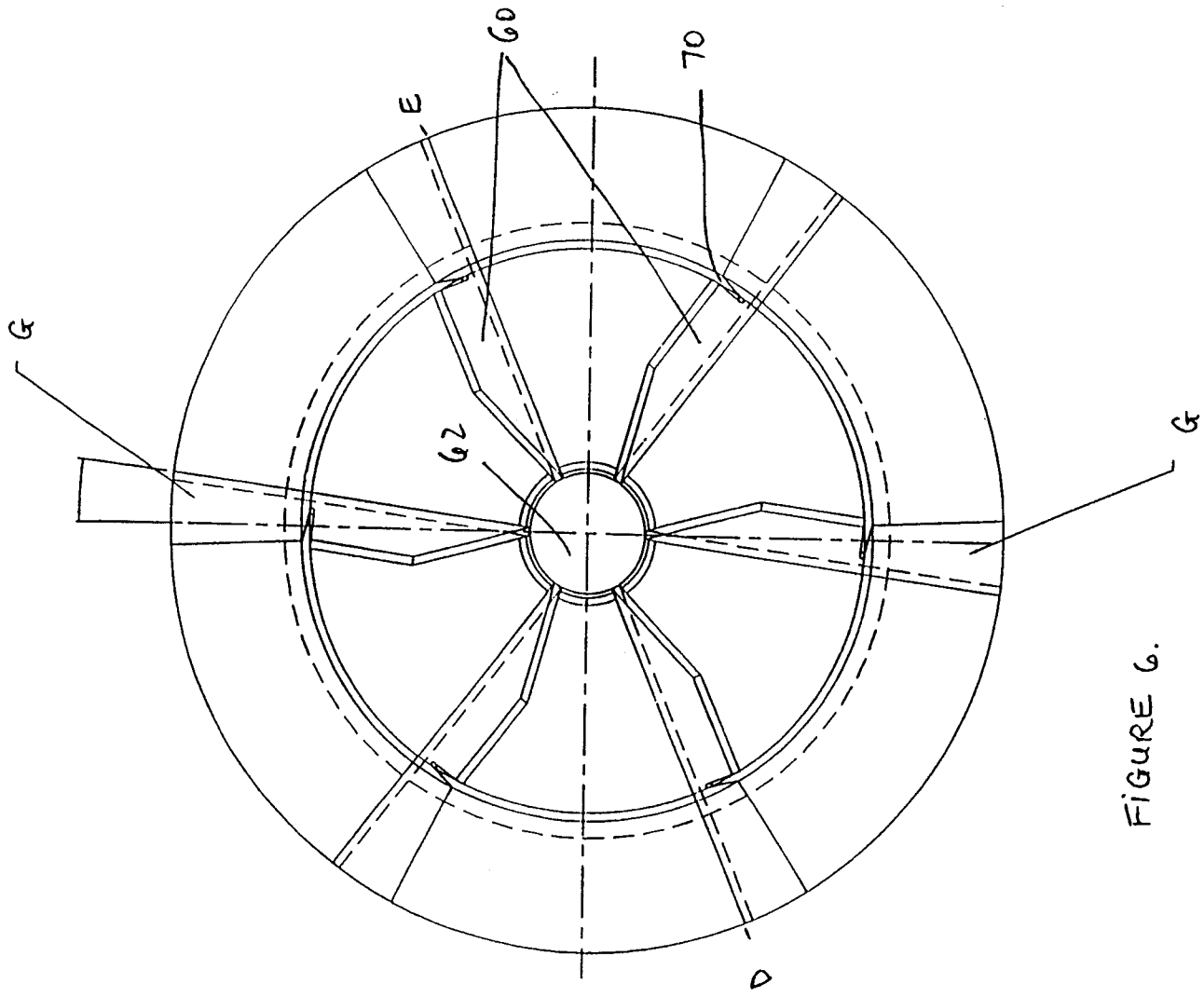


FIGURE 6.

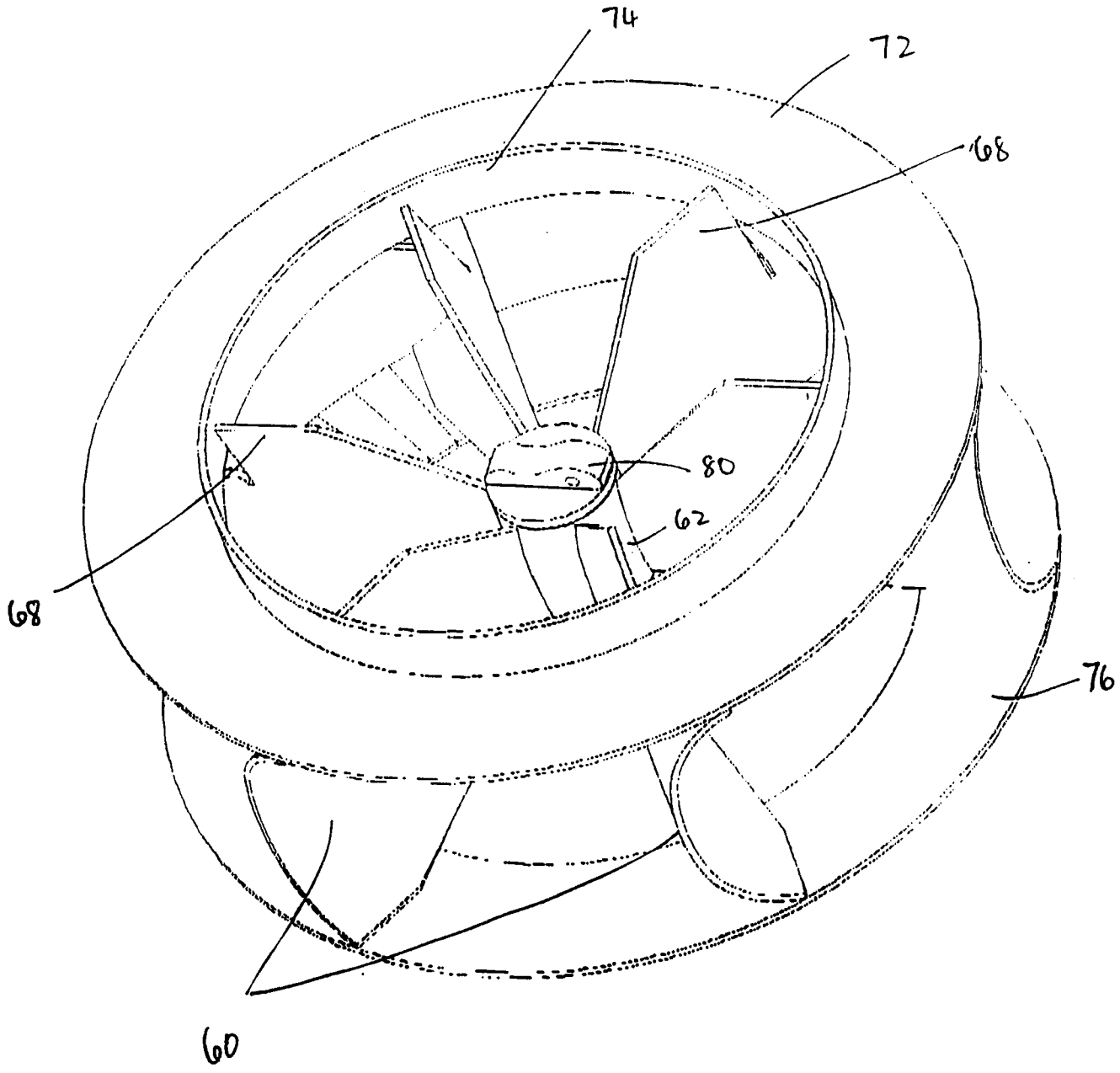


FIGURE 8.

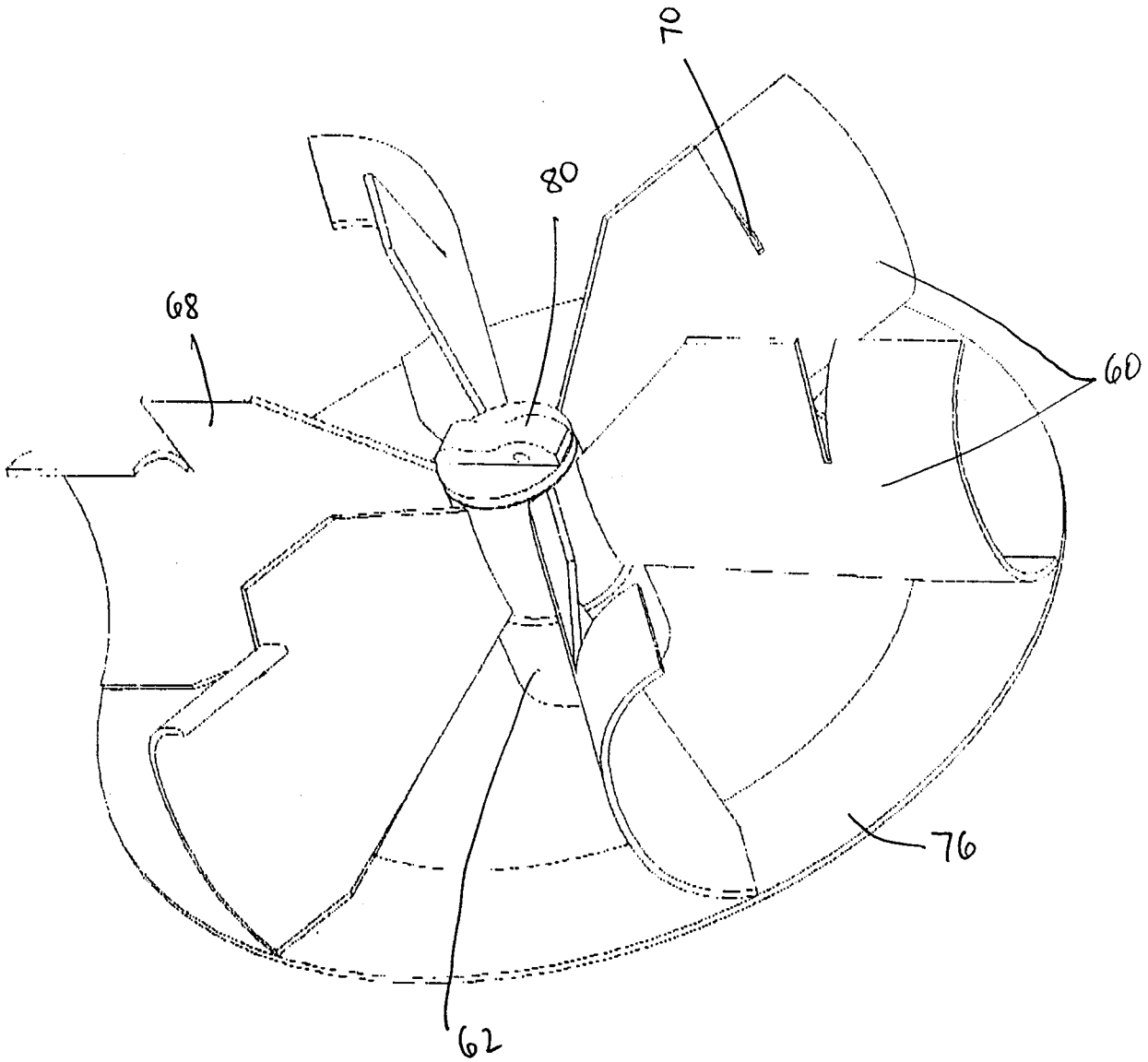


FIGURE 9.

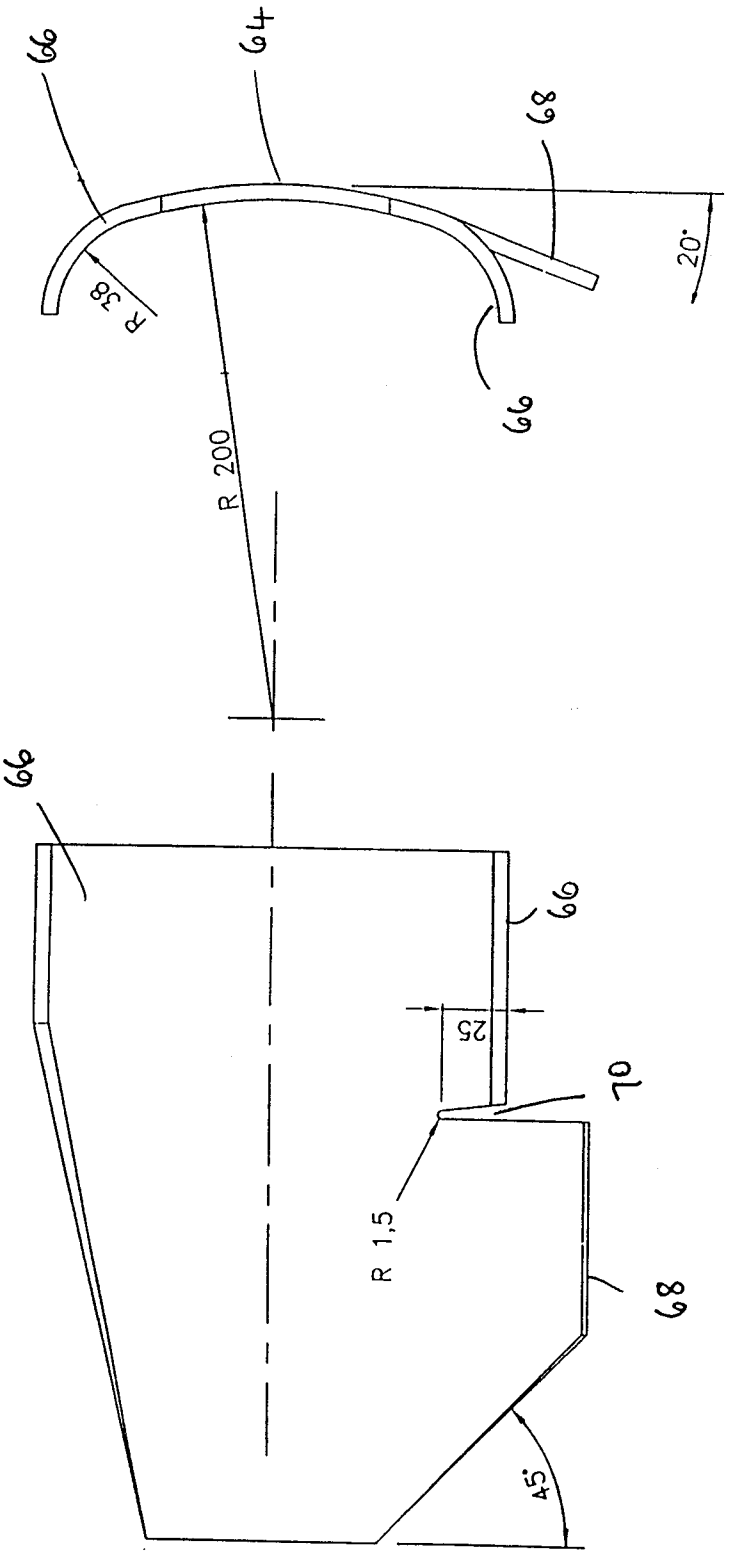


FIGURE 11a

FIGURE 10.

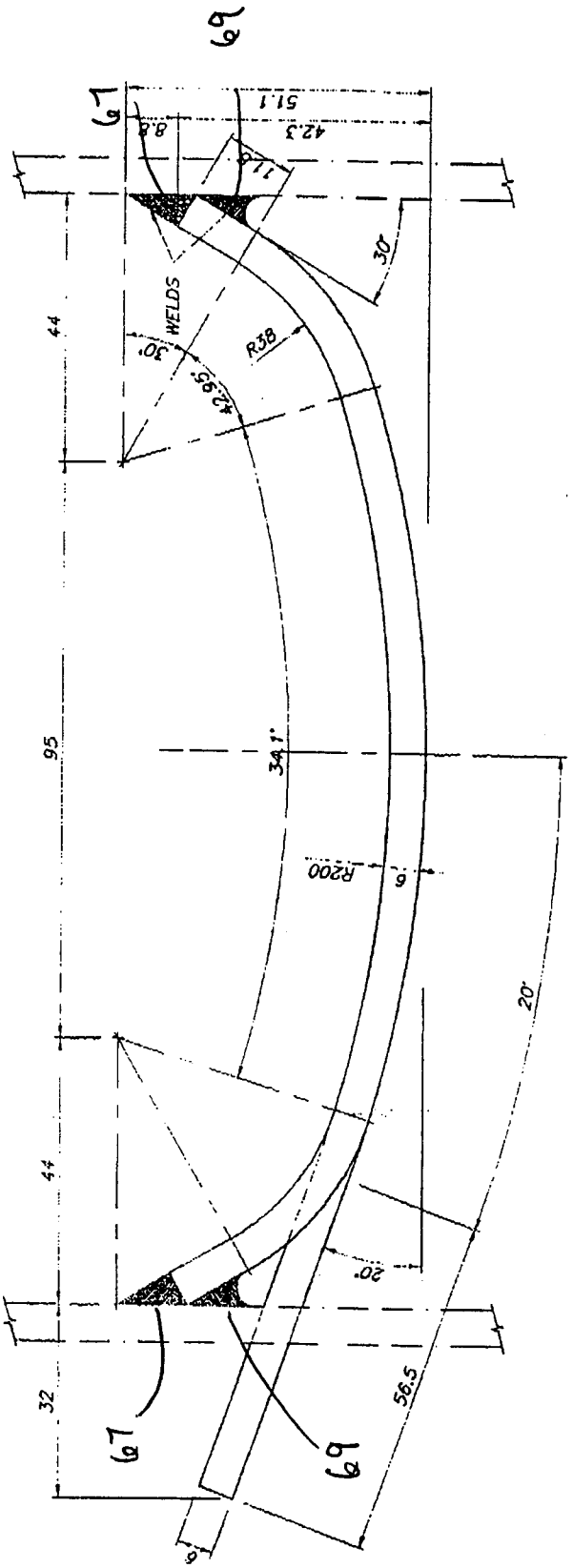

69
67
51.1
42.3
8.8
11.6
30°
WELDS
30°
R38
44
95
34.1°
R200
6
20°
44
32
67
69
56.5
9

FIGURE 11b

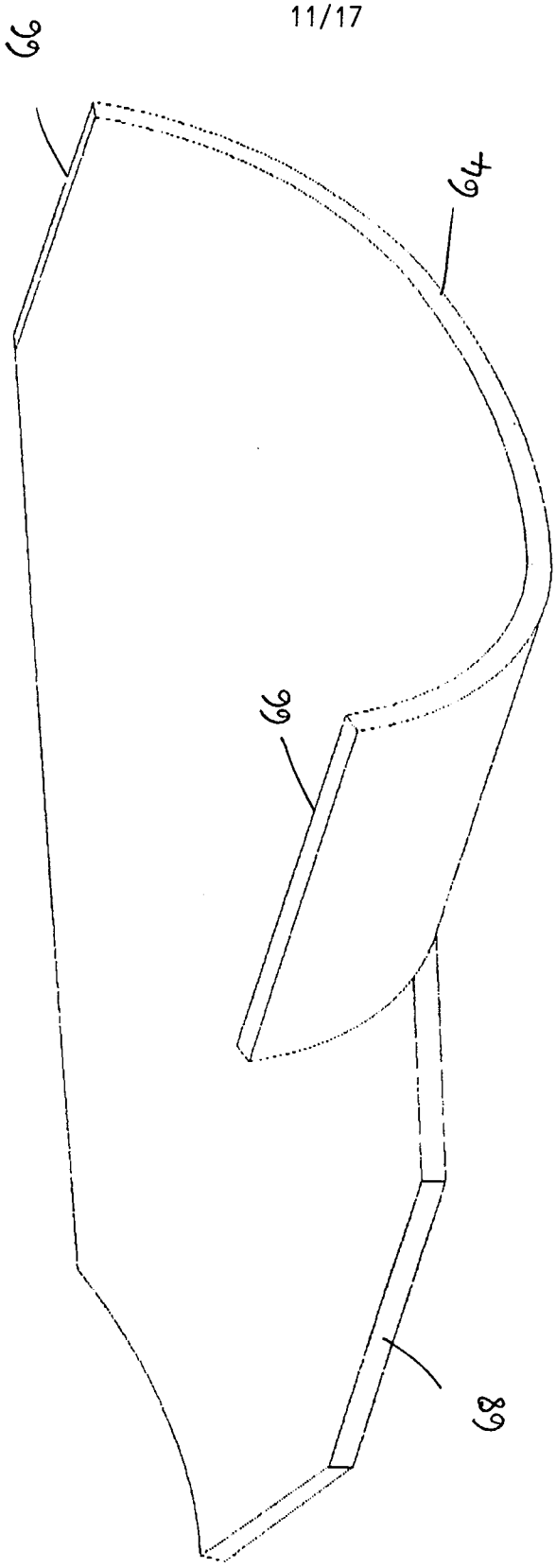


FIGURE 12.

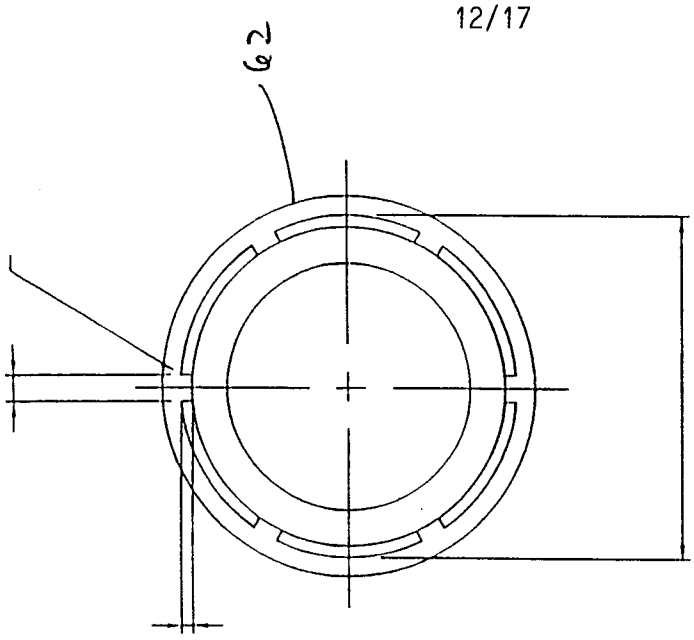


FIGURE 13.

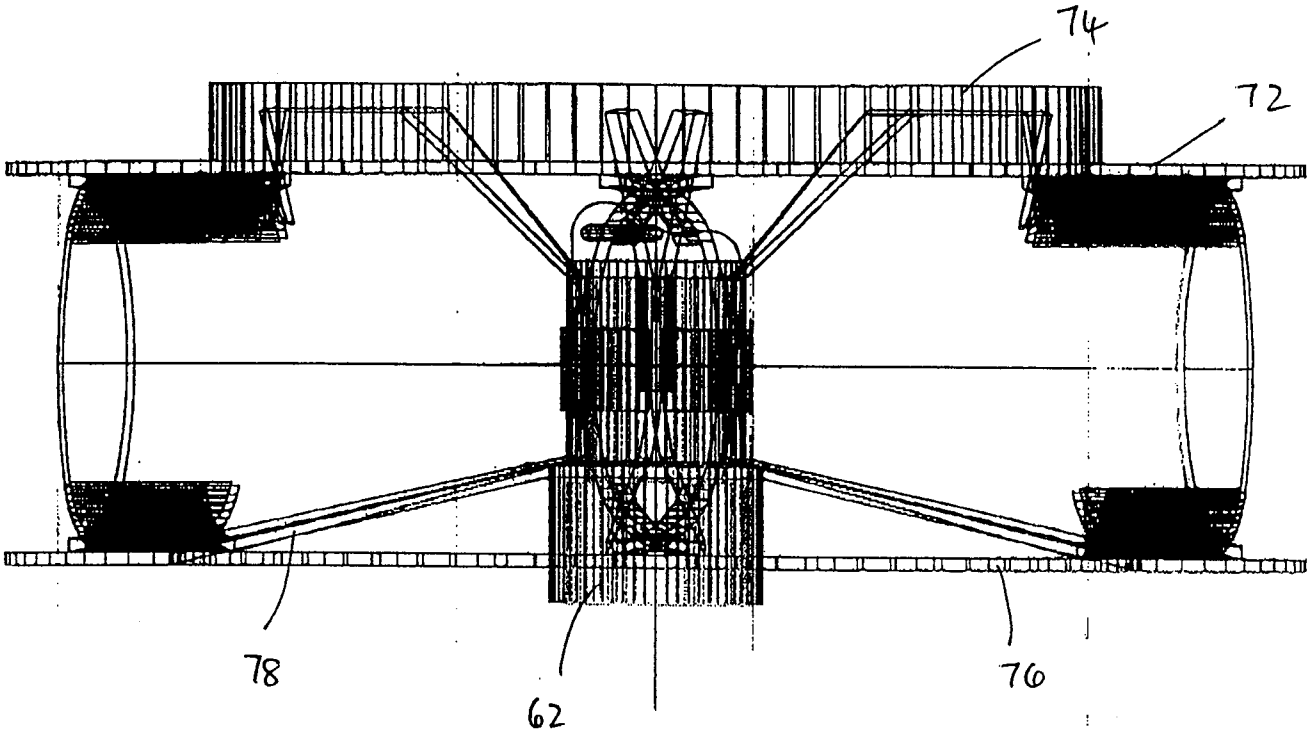


FIGURE 14.

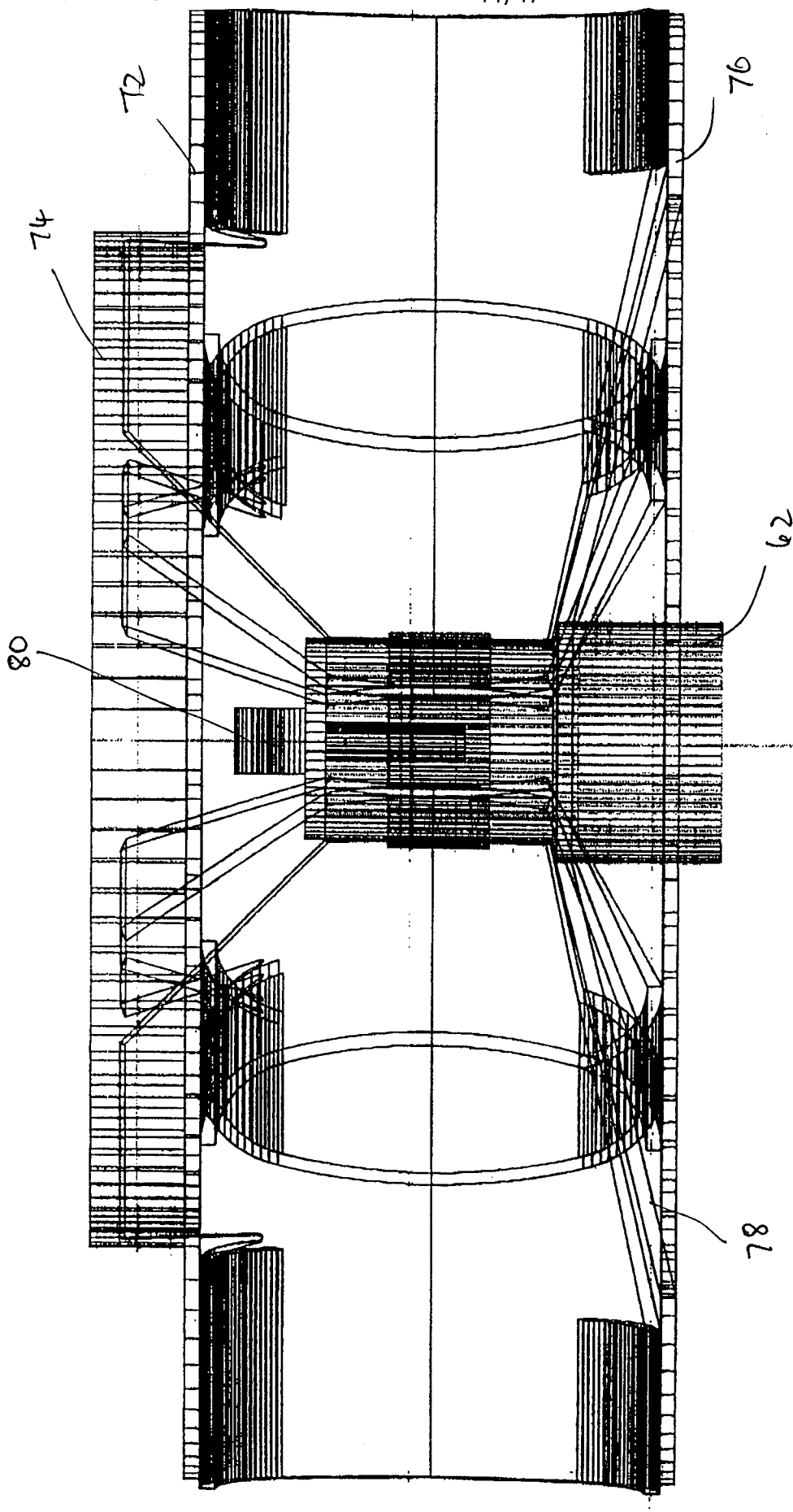


FIGURE 15.

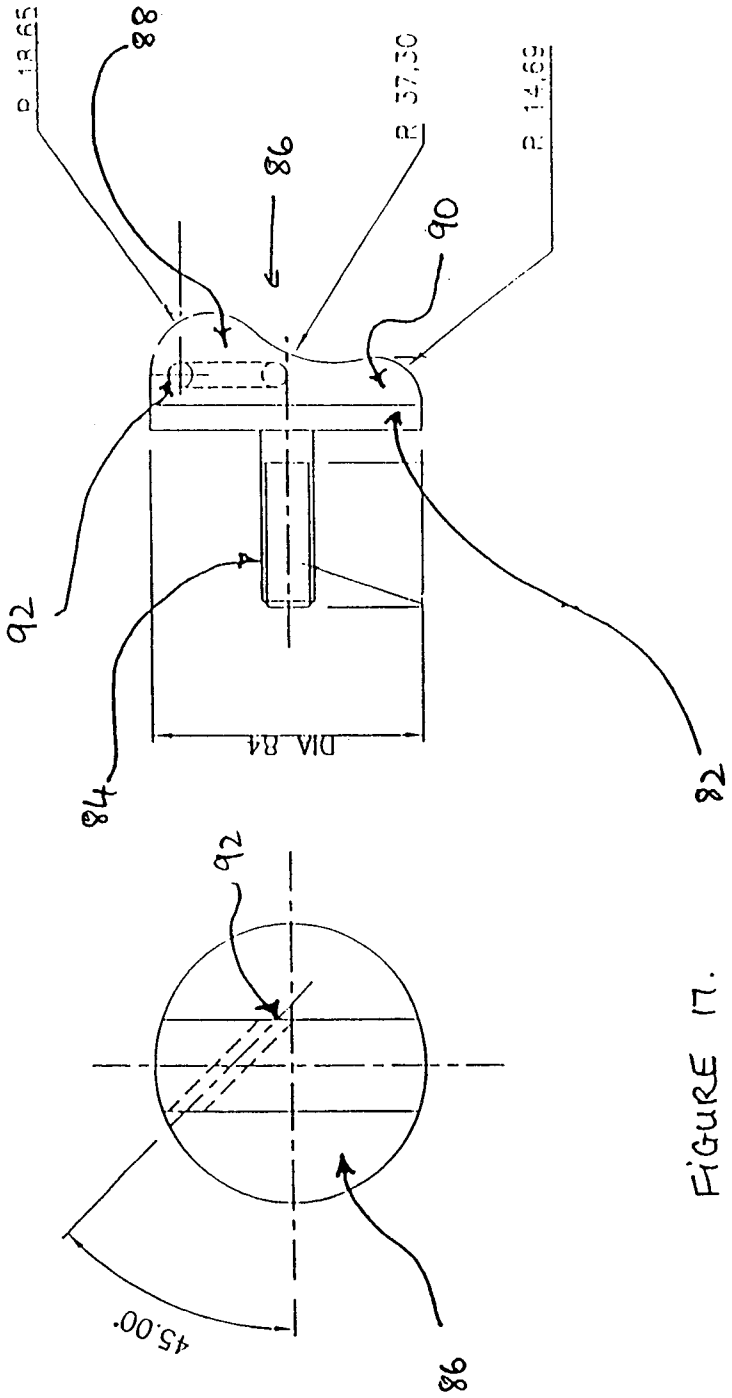


FIGURE 16.

FIGURE 17.

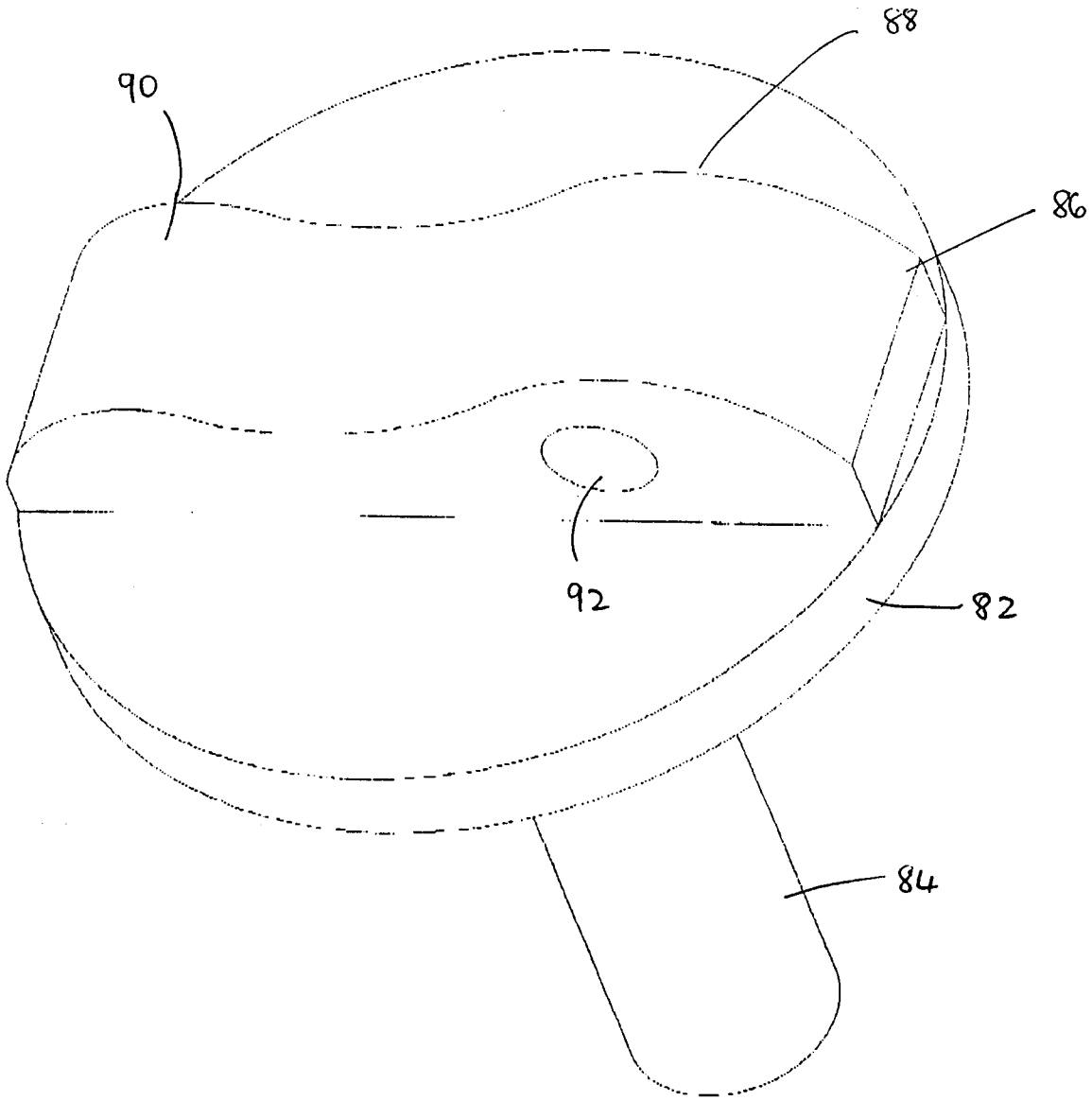


FIGURE 18.

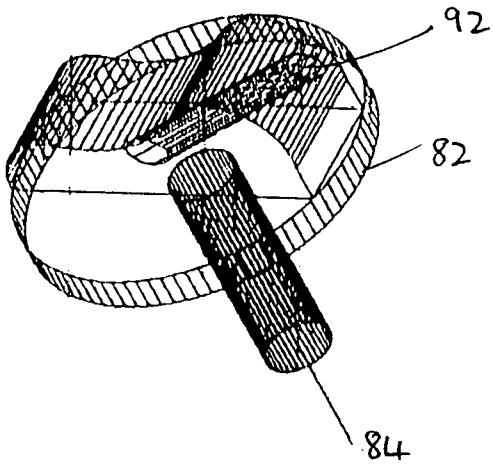


FIGURE 19.

INTERNATIONAL SEARCH REPORT

Interna nl Application No
PCT/ZA 99/00112

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B02C19/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B02C F26B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 35756 A (NEXT CENTURY TECHNOLOGIES LTD ;SEEBACH CHRISTOPHER F N (GB); JARRE) 20 August 1998 (1998-08-20) cited in the application the whole document	1-45
A	US 4 892 261 A (ROLLE THOMAS E ET AL) 9 January 1990 (1990-01-09) column 3, line 14 - line 25 column 5, line 14 - line 26; figures 1-14	1
A	WO 86 04527 A (CP COAL MILLS INC) 14 August 1986 (1986-08-14) abstract; figures 1-5	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Interna al Application No
PCT/ZA 99/00112

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