

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 484 894 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
02.10.1996 Bulletin 1996/40

(51) Int. Cl.⁶: **A47L 9/18**

(21) Application number: **91118890.2**

(22) Date of filing: **05.11.1991**

(54) **Separator for solid and liquid particles from an air current**

Separator für flüssige und feste Partikel in einer Luftströmung

Séparateur de particules solides et liquides à partir d'un courant gazeux

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

(30) Priority: **05.11.1990 YU 2084/90**

(43) Date of publication of application:
13.05.1992 Bulletin 1992/20

(73) Proprietor: **ING. BIRO ESTABLISHMENT**
FL-9494 Schaan (LI)

(72) Inventor: **Broznic, Darko**
YU-51000 Rijeka (YU)

(74) Representative: **Büchel, Kurt F., Dr.**
Patentbüro Büchel & Partner AG
Letzanaweg 25-27
9495 Triesen (LI)

(56) References cited:

WO-A-91/15146	AT-B- 348 472
FR-A- 670 220	FR-A- 2 159 439
FR-A- 2 417 287	GB-A- 490 746
NL-C- 32 508	

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 0 484 894 B1

Description

The invention relates to the technical field of vacuum cleaners and more particularly to separators according to the introductory part of claim 1. Such a vacuum cleaner is shown in FR-A-670220.

During the suction of dusty air currents in conventional vacuum cleaners, and because tiny particles of dust are accumulated at the top of the paper or textile filter sack, the suction strength is reduced as it depends (directly proportional) on the amount of dirt already clogged to the filter sack. Vacuum cleaners adapted for the suction of liquids require special provisions depending on whether solid particles (dust) and/or liquids (water) is/are to be sucked. Furthermore, with conventional vacuum cleaners, the suction of hot and incandescent particles (e.g. ash, welding cinder, close-burning coal etc.) is not possible.

The first of these problems can partially be solved by increasing the filtering surface, but even in such a case, the suction power and efficiency are reduced. The other two problems, however, cannot be avoided if filtering is used.

The above mentioned vacuum cleaner disclosed in FR-A-670 220 as well as the vacuum cleaner disclosed in NL-C-32508 and a similar separator disclosed in FR-A-2159439 show properties to avoid some of the above mentioned problems since they provide a liquid medium and guide the air current through said medium.

The object of the invention therefore is to provide a separator for a vacuum cleaner which avoids the above mentioned disadvantages.

The aim of the invention is achieved by the measures proposed in the characterising part of claim 1. The inventive separator is positioned vertically to the surface of the medium. Further embodiments and improvements of the invention are described in the subclaims.

The instant hydroactive separator of solid particles and liquids forms a diffuser at the ending of the suction tube, installed in the vacuum cleaner's container. All parts of the construction are solidly connected to each other. The use of a flexible suction tube, eventually made of ribbed rubber (bellows) and/or the use of floats enabling the raise or fall of the separator - depending on the water level - is preferred.

The invention will be described in more detail in relation to the enclosed figures.

Fig.1 presents a partial section of the separator;

Fig.2 presents a partial section of the separator when not in operation;

Fig.3 presents a partial section of the separator in operation;

Fig.4 presents a cross section along the line IV.-IV. of Fig.2.

Reference numerals of the drawings refer to:

CARRIER REINFORCEMENT	1
LINKS	2
DIFFUSOR	3
PROTECTIVE Skirt (cylinder)	4
PROTECTIVE COVER	5
FLOATS	6
WATER	7
RECESSIONS	8
AIR CURRENT	9
HOUSING	10
SUCTION TUBE	11
VACUUM MOTOR	12
EXHAUST	13
FLEXIBLE SUCTION TUBE	14

Description of the single parts of the separator:

CARRIER REINFORCEMENT 1 - its function (purpose) is to reinforce the construction and to build a cylindrical diffuser.

LINKS 2 - present the hard connection between the protective cylinder 4 and the other parts of the separator. There are two links, but, alternatively, may be more. They may have a fan blade shape in order to force the air current 9 into a cyclone like rotation.

DIFFUSOR 3 - forms the ending of the flexible suction tube 14.

PROTECTIVE CYLINDER 4 - a part of construction which has on its upper part a sectional conical surface, that directs the air current 9 to the protective cover 5.

PROTECTIVE COVER 5 - prevents spraying of water onto the vacuum motor 12 inlet. Further sheet guides between said protective cover 5 and said vacuum motor 12 could be provided.

The cylindrical surface between the upper border of the protective cylinder 4 and the protective cover 5 is smaller than the cylindrical surface between the lower border of the protective cover brink and the surface of the liquid 7. Such a relation is necessary because of the decrease of the air current speed and enables separation of remaining water droplets from the air current (in consequence of gravity). On the borders of the protective cover 5, floats 6 are attached.

FLOATS 6 - enable the separator to maintain a constant position in relation to the water surface. The water level, when the vacuum cleaner is off, has to cover the links 2. There are three or more, preferably four floats displaced all around.

WATER 7 - for the functioning of the construction, unavoidably, the water is necessary. In the separator, the water presents the medium by means of which the solid particles, liquids and other materials can be separated from the air current 9.

If the water level can be held constant, the parts 1 to 5 may be held rigidly with respect to the housing 10.

Fig.3 presents a partial section of the separator and the function of the device when the vacuum cleaner is

on. When the vacuum cleaner is turned on, and in consequence of the outside atmosphere effect in the suction tube 14, i.e. in the diffuser 3, the water level is lowered. The air current 9, when issuing from the diffuser 3, forms a recession 8 on the water surface, directing the surface water layers to the protective cylinder 4 and further onto the protective cover 5.

Particles of dust with bigger mass, because of the centrifugal force, unable to be directed to the protective cylinder 4 and to the protective cover 5, rush into the water and sink down or are dispersed in the water. Particles of dust with small mass, to which centrifugal forces have no significant effect, are directed via the air current to the protective cover 5 and are trapped in sprayed water when coming in contact with it.

The conical part of the protective cylinder 4 enables extra whirling circulation where the rest of the light particles is trapped in water and thereby moved out of the air current.

In consequence of the big surface, to which the air current mixed with water droplets comes across, the speed is gently reduced, and because of the gravity effects, the water droplets are separated from the air current 9 and then fall back onto the water surface. In such a way, a purified air current, from which dust and liquids are separated, comes out from the vacuum cleaner's exhaust 13.

The whole construction is reciprocally steadily connected and presents the solid constructive entirety. In the production of the instant separator, known technological processes for the manufacture of conventional vacuum cleaners may be used. Instead of a vacuum motor 12, any other vacuum producing means may be provided.

For the production of the instant separator, known plastic material may be used, but industrial workmanship and technological processes will determine its definite form.

Instead of water, other liquids could be used, e.g. disinfectant liquids like alcohol, or the like for avoiding a bacteriological pollution. Furthermore, the liquid could be exchanged permanently via tubes (not shown).

Claims

1. Separator for solid and liquid particles from an air current (9), applicable especially to vacuum cleaners, with a liquid separator/filter medium (7) whereby - in filtering/separating condition - the air current (9) is sucked through or along said liquid medium (7) in order to bring the solid particles into contact with the liquid and to remove them from the air current, the separator comprising
 - a suction tube (11,14) having an outlet through which - in filtering/separating condition - the air current is guided to the medium,
 - characterized in that** the suction tube (14) is flexible to allow vertical movements of its outlet which is in the form of a diffuser (3) **and that** the dif-

fuser (3) is connected via links (2) with a protective skirt (4), which diffuser (3) and protective skirt (4) are with floats (6) to allow floating of the diffuser (3) and the protective skirt (4) on said liquid medium - under filtering/separating condition.

2. Separator according to claim 1, characterised in that it further comprises a protective cover (5) above said skirt (4), said cover (5) being connected to said outlet, said skirt (4) and said diffuser (3) being at least partly immersable into said liquid medium (7).
3. Separator according to claim 1 or 2, wherein the protective skirt (4) has a conical upper part for guiding the air current (9) towards the protective cover (5).
4. Separator according to any one of claims 2 to 3, characterised in that the solidly linked parts constituted by the diffuser (3), the skirt (4) and the cover (5) provide means to decrease the air current speed, whereby the skirt (4) and the protective cover (5) are disc shaped and cylindrical respectively.
5. Separator according to claim 4, characterised in that the covered area of medium (7) between the outlet of the suction tube (14) and the skirt (4) is smaller than the covered area of the medium (7) between the skirt (4) and the protective cover (5) floating on the medium (7).
6. Separator according to claim 4, characterized in that the cylindrical surface between the upper border of the protective skirt (4) and the protective cover (5) is smaller than the cylindrical surface between the lower border of the protective cover (5) and the surface of the medium (7), **or that the** cylindrical surface of the protective skirt (4) immersed into the liquid medium (7) is bigger than the cylindrical surface of the skirt (4) remaining above the liquid medium (7).
7. Separator according to any preceding claim, wherein the floats (6) bear the weight of the outlet and all parts are connected to it and adapted to allow the links (2) to come into contact with the surface of the medium (7), whenever the separator is in the state of inactivity.
8. Separator according to any one of the preceding claims, wherein the medium is or contains a disinfectant.
9. Separator according to any one of the preceding claims, wherein the links (2) have a fan blade shape in order to rotate the air current (9) in a cyclone like manner.

10. Separator according to any one of the preceding claims, wherein the part of the suction tube (14) being flexible is like a bellow.

Patentansprüche

1. Separator für feste und flüssige Partikel aus einem Luftstrom (9), der insbesondere für Staubsauger anwendbar ist, mit einem flüssigen Abscheide- bzw. Filtermedium (7), durch welches der Luftstrom (9) - im Abscheide- bzw. Filtrierzustand - hindurch- oder entlang des flüssigen Mediums (7) gesaugt wird, um die festen Partikel mit der Flüssigkeit in Kontakt zu bringen und sie aus dem Luftstrom zu entfernen, wobei der Separator
 ein Saugrohr (11, 14) mit einem Auslaß aufweist, durch den der Luftstrom (9) - im Abscheide- bzw. Filtrierzustand - zum Medium geführt wird,
dadurch gekennzeichnet, daß das Saugrohr (14) zum Erlauben von vertikalen Bewegungen seines in Form eines Diffusors (3) ausgebildeten Auslasses biegsam ist, und daß der Diffusor (3) über Verbindungen (2) mit einer Schutzeinfassung (4) verbunden ist, wobei der Diffusor (3) und die Schutzeinfassung (4) zum Erlauben des Schwimmens des Diffusors (3) und der Schutzeinfassung (4) auf dem flüssigen Medium - im Abscheide- bzw. Filtrierzustand - mit Schwimmern (6) verbunden sind.
2. Separator nach Anspruch 1, dadurch gekennzeichnet, daß er ferner oberhalb der Schutzeinfassung (4) eine Schutzabdeckung (5) aufweist, welche Abdeckung (5) mit dem Auslaß verbunden ist, wobei die Schutzeinfassung (4) und der Diffusor (3) mindestens zum Teil in das flüssige Medium (7) eintauchbar sind.
3. Separator nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Schutzeinfassung (4) zum Leiten des Luftstromes (9) gegen die Schutzabdeckung (5) einen konischen oberen Teil aufweist.
4. Separator nach einem der Ansprüche 2 bis 3, dadurch gekennzeichnet, daß die aus dem Diffusor (3), der Einfassung (4) und der Abdeckung (5) bestehenden, fest miteinander verbundenen Teile eine Anordnung zum Verringern der Geschwindigkeit des Luftstromes aufweisen, wobei die Einfassung (4) und die Schutzabdeckung (5) jeweils scheibenförmig bzw. zylindrisch sind.
5. Separator nach Anspruch 4, dadurch gekennzeichnet, daß der abgedeckte Flächenbereich des Mediums (7) zwischen dem Auslaß des Saugrohres (14) und der Einfassung (4) kleiner ist als der abgedeckte Flächenbereich des Mediums (7) zwischen der auf dem Medium (7) schwimmenden Einfassung (4) und der Schutzabdeckung (5).

6. Separator nach Anspruch 4, dadurch gekennzeichnet, daß die Zylinderfläche zwischen dem oberen Rand der Schutzeinfassung (4) und der Schutzabdeckung (5) kleiner als die Zylinderfläche zwischen dem unteren Rand der Schutzabdeckung (5) und der Oberfläche des Mediums (7) ist, oder daß die in das flüssige Medium (7) eintauchende Zylinderfläche der Schutzeinfassung (4) größer als diejenige Zylinderfläche der Einfassung (4) ist, welche oberhalb des flüssigen Mediums (7) verbleibt.
7. Separator nach einem der vorhergehenden Ansprüche, bei dem die Schwimmer (6) das Gewicht des Auslasses tragen und alle Teile mit ihm verbunden und so ausgebildet sind, daß sie es den Verbindungen (2) gestatten, mit der Oberfläche des Mediums (7) immer dann in Kontakt zu kommen, wenn sich der Separator im Ruhezustand befindet.
8. Separator nach einem der vorhergehenden Ansprüche, bei dem das Medium ein Desinfektionsmittel ist oder ein solches enthält.
9. Separator nach einem der vorhergehenden Ansprüche, bei dem die Verbindungen (2) zum zyklonartigen Drehen des Luftstromes (9) eine propellerblattförmige Gestalt haben.
10. Separator nach einem der vorhergehenden Ansprüche, bei dem der biegsame Teil des Saugrohres (14) balgartig ausgebildet ist.

Revendications

1. Séparateur, pour des particules solides et liquides, travaillant à partir d'un courant d'air (9) applicable spécialement à des épurateurs travaillant sous vide, avec un milieu liquide séparateur/filtrant (7), de manière que - à l'état de filtration/séparation - le courant d'air (9) soit aspiré sur ledit milieu liquide (7), de manière à mettre les particules solides en contact avec le liquide et à les éliminer du courant d'air, le séparateur comprenant :
 un tube d'aspiration (11, 14) ayant une sortie à travers laquelle - à l'état de filtration/séparation - le courant d'air est guidé vers le milieu,
 caractérisé en ce que le tube d'aspiration (14) est flexible afin de permettre des déplacements verticaux de sa sortie, qui se présente sous la forme d'un diffuseur (3), et en ce que le diffuseur (3) est relié, via des liaisons (2), à une jupe protectrice (4), le diffuseur (3) et la jupe protectrice (4) étant équipés de flotteurs (6) de manière à permettre la flottaison des diffuseurs (3) et de la jupe protectrice (4) sur ledit milieu liquide - à l'état de filtration/séparation.

2. Séparateur selon la revendication 1, caractérisé en ce qu'il comprend en outre : un couvercle protecteur (5) placé au-dessus de ladite jupe (4), ledit couvercle (5) étant relié à ladite sortie de ladite jupe (4) et ledit diffuseur (3) étant au moins partiellement immersible dans ledit milieu liquide (7). 5

3. Séparateur selon la revendication 1 ou 2, dans lequel la jupe protectrice (4) comporte une partie supérieure conique destinée à guider le courant d'air (9) en direction du couvercle protecteur (5). 10

4. Séparateur selon l'une des revendications 2 à 3, caractérisé en ce que les parties, reliées par la matière, constituées par le diffuseur (3), la jupe (4) et le couvercle (5), constituent des moyens permettant de diminuer la vitesse du courant d'air, de manière que la jupe (4) et le couvercle protecteur (5) prennent respectivement une forme discoïde et cylindrique. 15
20

5. Séparateur selon la revendication 4, caractérisé en ce que l'aire couverte du milieu (7), entre la sortie du tube d'aspiration (14) et la jupe (4), est plus petite que l'aire couverte du milieu (7) se trouvant entre la jupe (4) et le couvercle protecteur (5) flottant sur le milieu (7). 25

6. Séparateur selon la revendication 4, caractérisé en ce que la surface cylindrique se trouvant entre la limite supérieure de la jupe protectrice (4) et le couvercle protecteur (5) est plus petite que la surface cylindrique se trouvant entre la limite inférieure du couvercle protecteur (5) et la surface du milieu (7), ou en ce que la surface cylindrique de la jupe protectrice (4) immergée dans le milieu liquide (7) est plus grande que la surface cylindrique de la jupe (4) restant au dessus du milieu liquide (7). 30
35

7. Séparateur selon l'une des revendications précédentes, dans lequel les flotteurs (6) portent le poids de la sortie et de toutes les parties lui étant connectées et sont adaptés pour permettre aux liaisons (2) de venir en contact avec la surface du milieu (7) si le séparateur se trouve en état d'inactivité. 40
45

8. Séparateur selon l'une des revendications précédentes, dans lequel le milieu et ou contient un désinfectant. 50

9. Séparateur selon l'une des revendications précédentes, dans lequel les liaisons (2) ont une forme de pale d'ailtage, de manière à faire tourner le courant d'air (9) d'une façon analogue à celle d'un cyclone. 55

10. Séparateur selon l'une des revendications précédentes, dans lequel la partie du tube d'aspiration (14) flexible est analogue à un soufflet.

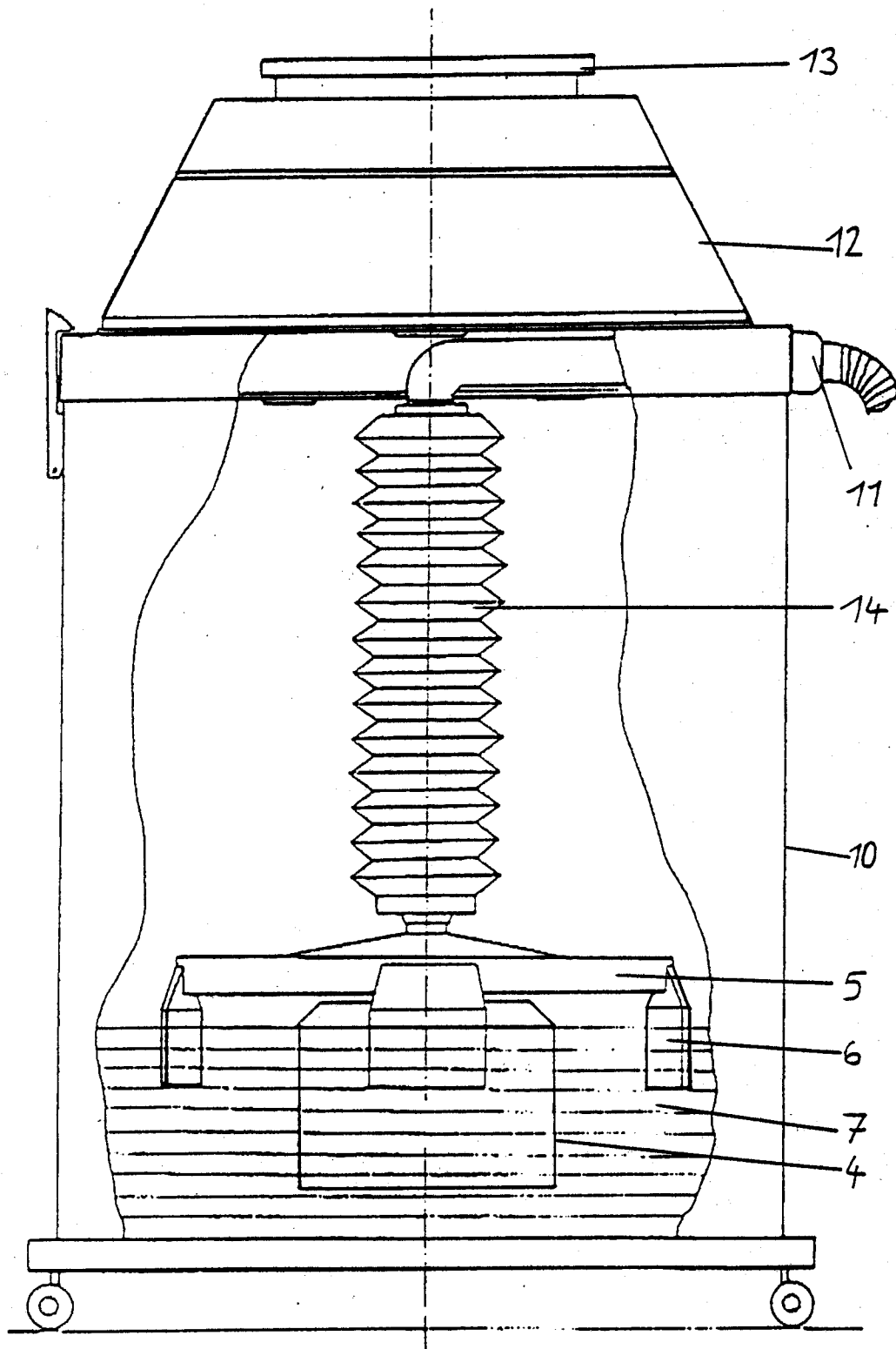
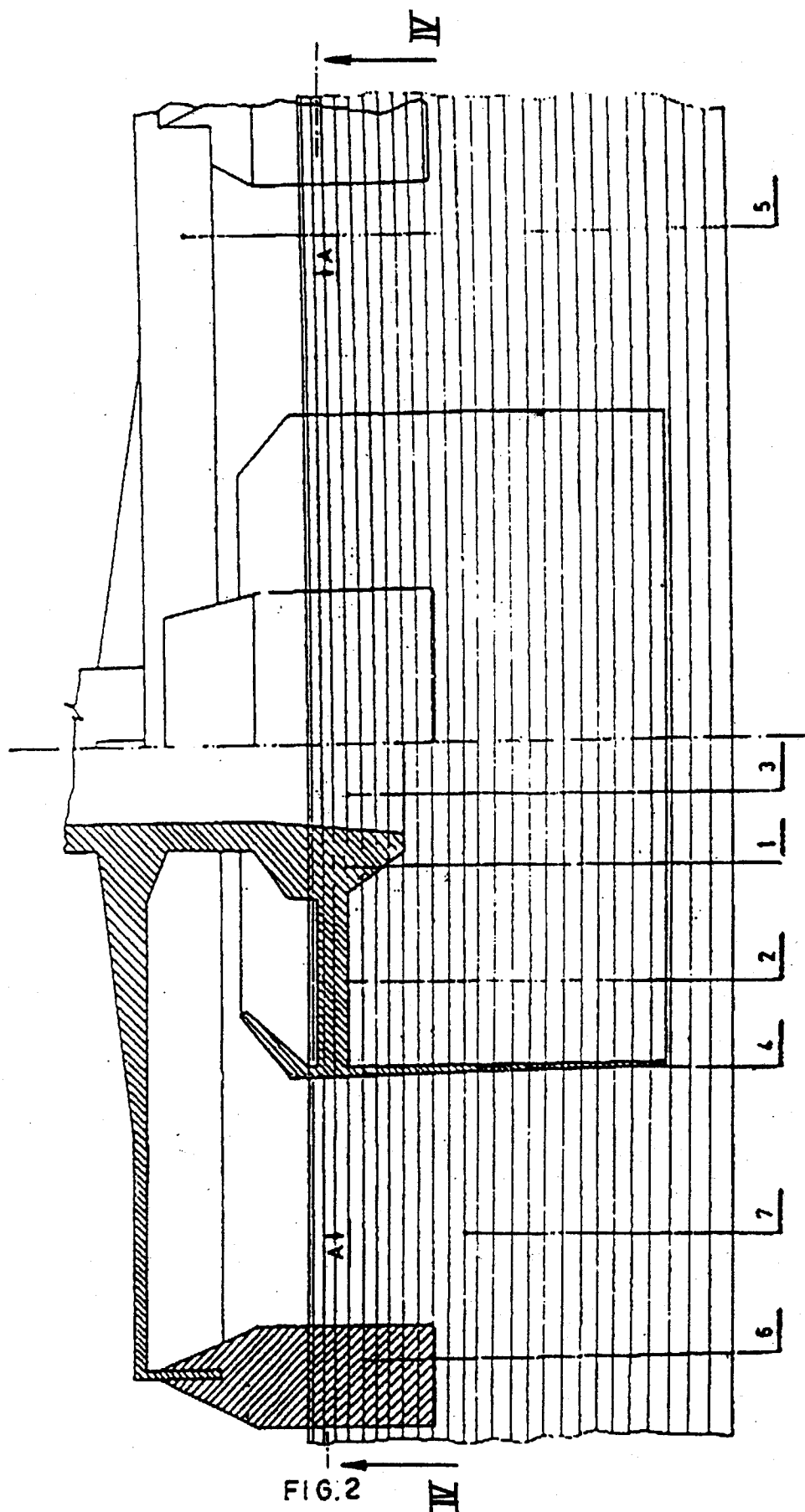


FIG. 1



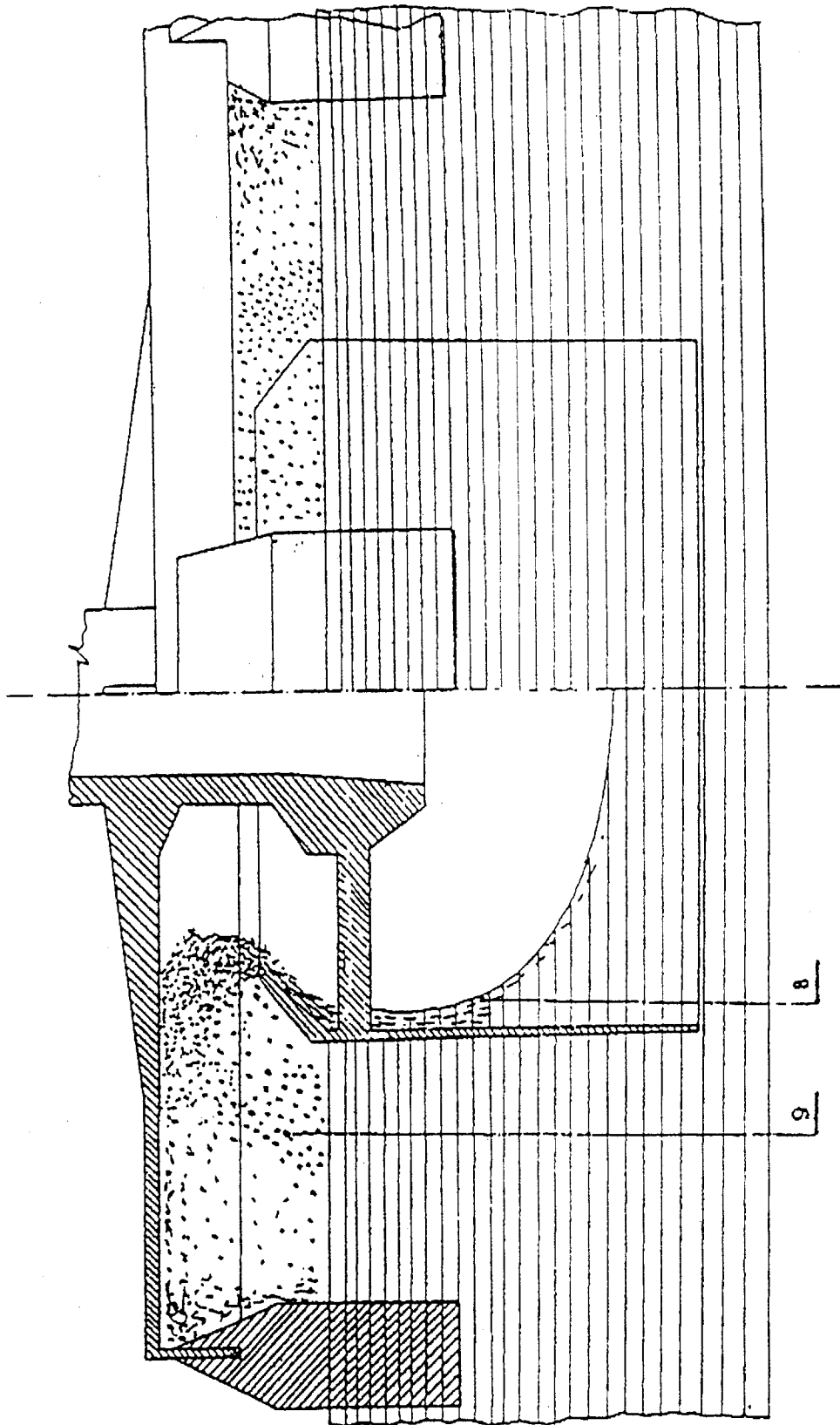


FIG.3

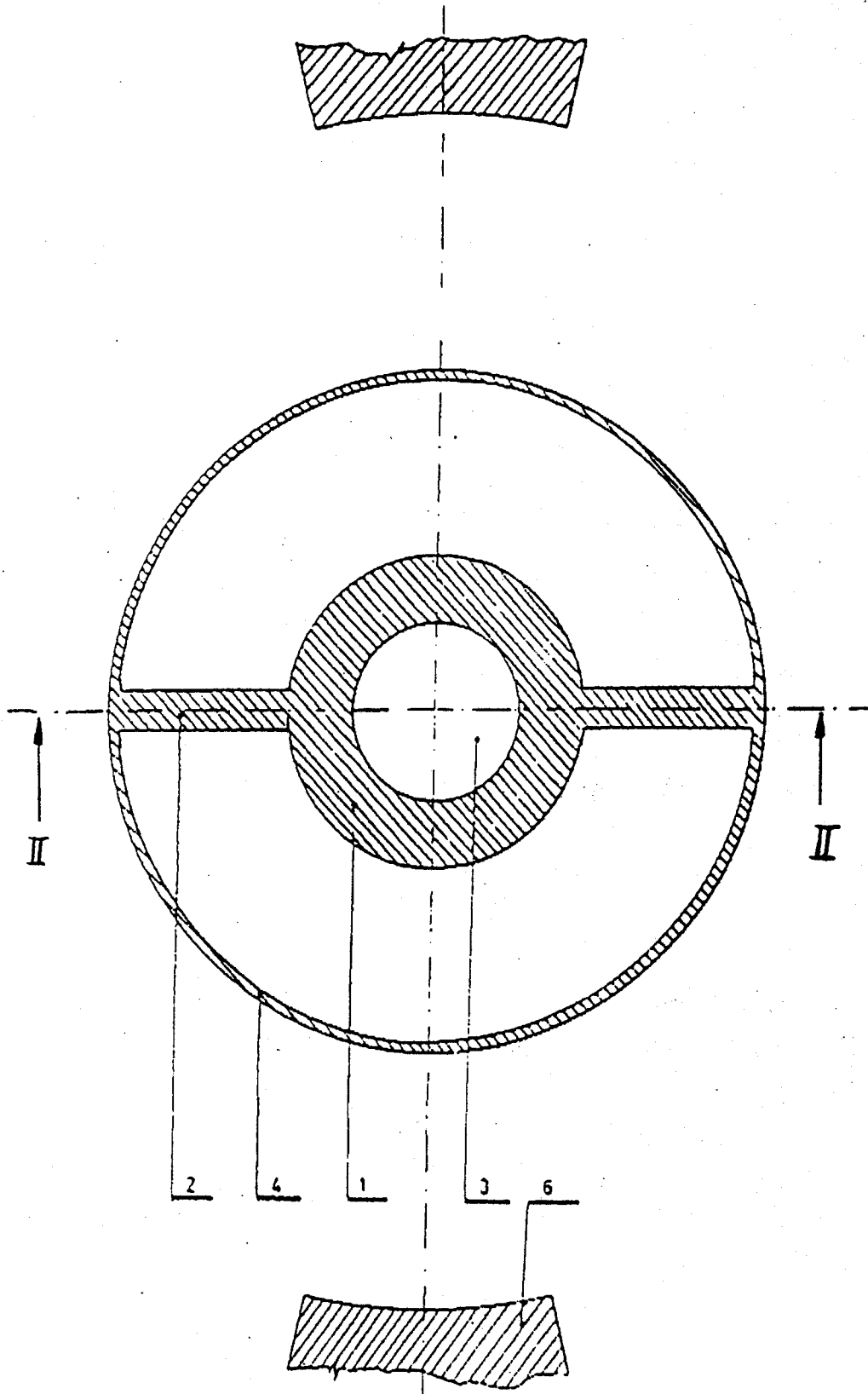


FIG. 4