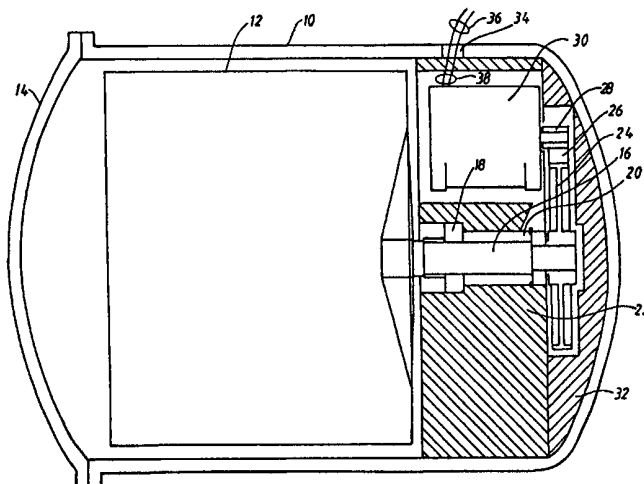




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁷ : D06F 43/02, 37/30</p>	<p>A1</p>	<p>(11) International Publication Number: WO 00/63483 (43) International Publication Date: 26 October 2000 (26.10.00)</p>
<p>(21) International Application Number: PCT/SE00/00767 (22) International Filing Date: 20 April 2000 (20.04.00) (30) Priority Data: 9901403-7 20 April 1999 (20.04.99) SE (71) Applicant (for all designated States except US): AKTIEBOLAGET ELECTROLUX [SE/SE]; S-105 45 Stockholm (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): UHLIN, Göran [SE/SE]; Möllaregatan 5, S-340 14 Lagan (SE). (74) Agent: SVAHN, Göran; AB Electrolux, Group Intellectual Property, S-105 45 Stockholm (SE).</p>	<p>(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).</p> <p>Published With international search report. In English translation (filed in Swedish).</p>	

(54) Title: APPARATUS FOR CLEANING TEXTILES WITH A DENSIFIED LIQUID TREATMENT GAS



(57) Abstract

An apparatus for cleaning of textile objects by a densified liquid state treatment gas, such as liquified carbon dioxide, comprises a treatment chamber (10) in which a high pressure prevails during the treatment process in order for the treatment gas to remain in liquid phase at essentially ambient temperature. The treatment chamber (10), at one side gable thereof, is closable by means of a door (14) and encloses a rotatably mounted wash drum (12) supporting the textile objects to be cleaned. The wash drum (12) is rotated by a driving device comprising an electric motor (30) and possibly a transmission (24, 26, 28) and disposed in the treatment chamber (10). In order to facilitate repair and maintenance of the driving device, the shaft support of the drum, and the like, the treatment chamber (10) comprises a sledge device (40) which supports the rotatable wash drum (12) with shaft support and driving device and which can be moved between a first position in the treatment chamber and a second position outside the same.

FOR THE PURPOSES OF INFORMATION ONLY

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

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

APPARATUS FOR CLEANING TEXTILES WITH A DENSIFIED LIQUID

TREATMENT GAS

The present invention relates to an apparatus for cleaning of textile objects by a densified liquid state treatment gas, such as liquid carbon dioxide, in a treatment chamber in which a high pressure prevails during the treatment process in order
5 for the treatment gas to remain in liquid phase at essentially ambient temperature, said treatment chamber, at one side gable thereof, being closable by means of a door and encloses a rotatably mounted wash drum supporting the textile objects to be cleaned, said wash drum being rotated by a driving device
10 comprising an electric motor and possibly a transmission.

In an apparatus of the kind referred to, regularly, the choice has been made to place the driving device outside of the treatment chamber. There are a number of reasons for this and a first one is the high pressure prevailing in the treatment
15 chamber during operation of the machine. Another reason is the treatment agent itself which in case of placing of the driving device in the treatment chamber can penetrate into the motor and the transmission affecting vital parts therein. One possible effect is electric short-circuit in the motor winding
20 caused by the decomposition of the insulating varnish of the winding due to the contact with the treatment agent. Moreover, it is to be feared that the bearings of the motor may corrode and, as a result of the pressure cycling appearing during operation of the machine, the bearing grease can ferment to
25 disappear from the bearings. As the treatment agent, liquid carbon dioxide or the like, is aggressive against certain kinds of rubber and plastics it is to be feared that the transmission, usually comprising a V-belt or a cogged belt made from rubber or plastics, can decompose and be destroyed.

30 In order to avoid the problems indicated the driving motor and the transmission can be placed outside of the treatment chamber but the solutions for transmitting rotational movement from the driving motor to the drum, situated in the treatment chamber, will be expensive. If a certain leakage is accepted

a relatively complex sealing box can be used for a rotational shaft attached to the treatment drum, and in this way said rotational shaft can extend through a wall of the treatment chamber to be connected to the driving motor on the outside.

5 Another solution, described in the patent publication US-A-5,267,455, involves the use of a magnetic coupling constituting a very expensive alternative.

Another solution to the problem of securing a good contact between the textiles and the treatment agent in the wash drum is disclosed in the patent publication US-A-5,651,276. According to this solution, instead of using a rotatable drum, a plurality of arrays of nozzles have been provided through which jets of treatment liquid are emitted. The intention is that these jets shall bring about the stirring of the laundry in the wash drum. The obvious drawback of this arrangement is that the jets of treatment agent give an uneven cleaning result as compared to the case in which a wash drum is rotated in a treatment drum partly filled with a treatment agent.

10
15

A further solution to the problem discussed is disclosed in the patent publication US-A-5,669,251. According to this solution the rotatable drum in the treatment chamber has been retained and in addition a plurality of rows of nozzles have been provided which emit jets of a treatment agent. These jets are used a.o. for rotating the wash drum. One drawback associated with this arrangement is that the jets of treatment liquid gives an uneven cleaning result. Another drawback is that by means of the jets only, it can be difficult to achieve a reliable rotation of the wash drum and, accordingly, an adequate stirring of the laundry.

20
25

Accordingly, it is an object of the invention to remedy the drawbacks associated with the use of jets of a treatment liquid for the cleaning of the laundry and for stirring of the same and/or rotation of the wash drum. Another object of the invention is to eliminate the need for couplings between the wash drum in the treatment chamber and a driving device situated outside of the treatment chamber. A further object of

30
35

the invention is to facilitate service on a driving device provided for the rotation of the drum.

The objects indicated are achieved in an apparatus which, in accordance with the invention, have been given the characteristic features indicated in the appendant claims.

A closer study of the conditions for placing the driving device, and the possible transmission, inside of the treatment chamber has shown that such placing is actually possible if certain measures are taken. It has been noticed that electric short-circuits can only take place via impurities in CO₂-liquid. A first measure is therefore to see to it that the liquid level in the treatment chamber does not exceed half of the drum height and to place the driving motor as high as possible in the treatment chamber. Both as liquid and as gas carbon dioxide is a good insulator, however, by this placing, where the motor will get into contact with gaseous carbon dioxide only and to a minor extent will be exposed to splashes of liquid carbon dioxide, the risk is highly reduced that impurities in the CO₂-liquid accompany the liquid splashes to penetrate into the motor. In order to further reduce the risk of electric short-circuit due to CO₂-liquid attacking the protective varnish of the motor winding the latter is chosen with a quality not influenced by the liquid.

The feared risk of bearing corrosion has been found groundless because water and moisture are bound to the CO₂-liquid. Likewise, feared fermentation effects in the bearing grease have not come up. However, due to the pressure cycling it is important that the bearings be kept ventilated. This is achieved by means of bearings of the type RS provided with sheet metal sleeves having the effect of shielding but still ventilating the ball races.

As to the transmission, i.e. usually a V-belt or a cogged belt, such belt is usually chosen to be made from a material not penetrated and broken down by the carbon dioxide. One such material is PPSE, a TEFLON™ type material. In a practical embodiment a belt has been chosen made from polychloroprene

marketed under the name "Poly-V-profile" by the German company OPTIBELT.

The invention will now be described more in detail in connection with an embodiment and with reference to accompanying drawings, in which:

Fig. 1 schematically shows a longitudinal section along a treatment chamber closable by a door and having a wash drum rotatably provided and driven by a driving device built-in into said treatment chamber; and

Figs. 2 and 3, also schematically, show a sledge which supports the wash drum and the driving device, where Fig. 2 shows a section through the treatment chamber at the side opposite to the door and Fig. 3 is a section along the line III-III in Fig. 2.

The invention relates to an apparatus for cleaning of textile objects by a densified liquid state treatment gas, such as liquified carbon dioxide, in a treatment chamber. The apparatus, hereinafter referred to as a washing machine, in addition to the treatment chamber and the wash drum rotatably disposed therein, comprises a plurality of further components and a control device for the control of the washing machine. A view of the design of such washing machine can be obtained from the patent publication US-A-5,267,455, referred to above. The description given below will be restricted to the treatment chamber and the arrangement therein.

With reference to Fig. 1 a treatment chamber 10 is shown in the form of a drum-shaped outer container in which a wash drum 12 is rotatably disposed. The treatment chamber 10 is designed to resist high pressures and is closable by means of a door 14 together with suitable locking means, not shown. The wash drum 12 is provided with a shaft 16 journaled in bearings 18, 20 provided in a bearing housing 22. A pulley 24 is attached to the free end of the shaft 16 and is intended, via a transmission belt 26, to be connected to a corresponding pulley 28 provided on the shaft of an electric drive motor 30. The drive motor is excentrically disposed with respect to the shaft 16 of

the wash drum at as high level as possible in the treatment chamber 10. In order to prevent the treatment liquid, in the example the liquid carbon dioxide, from filling up spaces where it is of no use, i.e. outside of the space where the wash drum is rotating and the cleaning of the laundry takes place, the spaces not occupied by the shaft support and the driving device for the wash drum are filled with a suitable material, such as a plastics material or aluminium, as schematically indicated by 32 in Fig. 1. The power supply to the electric motor 30 takes place via a pressureproof coupling device 34 to which connects an outer lead 36. A corresponding inner lead 38 connects to the motor 30. Such pressureproof coupling devices are available in the market where a suitable design can be chosen.

During the cleaning process in the washing machine the wash drum 12 is rotated by the drive motor 30 via the transmission belt 24 in the same way as in washing machines intended for water wash. By placing the drive motor 30 excentrical with respect to the drum shaft 16, axially the motor will occupy essentially the same space as the support 18, 20 for the drum shaft 16 resulting in a very compact design of the driving device. By the built-in design of the driving device no drive components will be required which call for space outside of the treatment chamber 10.

Even if components of the driving device can be made very reliable the washing machine should still be designed so as to facilitate service on the driving device and the drum support components. Hence, in accordance with the invention the treatment chamber 10 comprises a sledge device 40 provided to movably support the wash drum with the shaft support and the driving device, the sledge device 40 being adapted to alternatively take a first position in the treatment chamber 10 or a second position outside the same. As shown in Figs. 2 and 3 the sledge device is formed mainly by the bearing housing 22 provided for the bearings 18, 20, said bearing housing (22) having wheels 42 suitably distributed along the inner periphery of the treatment chamber 10. The wheels 42 are rolling on and

steered by longitudinal races 44 fixedly mounted to said inner periphery of the treatment chamber 10. On repair and maintenance of the components of the sledge device 40 said device is manually moved from its position in the treatment chamber to a service position adjacent to the loading opening of the treatment chamber. In case of more extensive service the sledge device 40 and components supported thereon can be transferred to a handling carriage, or the like, by means of which it can be transported to a suitable workshop. Of course, the sledge device can be moved from its normal position in the treatment chamber to the service position by means of motor operated means of a suitable design.

Above, the invention has been described in the form of an embodiment of no-limiting nature. Accordingly, a plurality of modifications can be made within the scope given by the appendant claims. For example, the wheels of the sledge device can be replaced by gliding cushions or the like.

C l a i m s

1. Apparatus for cleaning of textile objects by a densified liquid state treatment gas, such as liquified carbon dioxide, in a treatment chamber (10) in which a high pressure prevails during the treatment process in order for the treatment gas to remain in liquid phase at essentially ambient temperature, said treatment chamber (10), at one side gable thereof, being closable by means of a door (14) and encloses a rotatably mounted wash drum (12) supporting the textile objects to be cleaned, said wash drum (12) being rotated by a driving device comprising an electric motor (30) and possibly a transmission (24,26,28), **characterized** in that the driving device (24,26,28,30) is disposed in the treatment chamber (10).
2. Apparatus according to claim 1, **characterized** in that the liquid level in the treatment chamber does not exceed half of the drum height and that the electric motor is disposed excentrically in the treatment chamber in the upper part thereof.
3. Apparatus according to claim 1 or claim 2, **characterized** in that the driving device (24,26,28,30) is disposed at the side gable opposite to the door (14).
4. Apparatus according to any of the preceding claims, **characterized** in that the power supply to the electric motor (30) takes place via electric conductors (36,38) which in an interface formed by the housing of the treatment chamber are interconnected via a pressureproof coupling device (34).
5. Apparatus according to any of the preceding claims, **characterized** in that the wash drum (14) is provided with a shaft (16) extending towards the side gable where the driving device (24,26,28,30) is disposed and at its end being provided with a transmission pulley (24) connected to a corresponding transmission pulley (28) disposed on the driving shaft of the electric motor, said motor (30) being excentrically disposed in the treatment chamber (10) in a space situated between the gable opposite to the door (14) of the wash drum and the

transmission pulley (24) provided on the drum shaft (16).

6. Apparatus according to claim 5, **characterized** in that the two transmission pulleys (24,28) are interconnected by a belt (26).

5 7. Apparatus according to any of the preceding claims, **characterized** in that non-occupied parts of the space enclosing the driving device (24,26,28,30), the bearing means (18,20) for the drum shaft (16), and the like, are filled with a solid material unaffected by the treatment gas , such as a suitable
10 plastics material or aluminium.

8. Apparatus according to any of the preceding claims, **characterized** in that the treatment chamber (10) comprises a sledge device (40) adapted to movably support the wash drum with the shaft support and the driving device, said sledge
15 device (40) being adapted to alternatively take a first position in the treatment chamber (10) or a second position outside the same.

9. Apparatus according to claim 8, **characterized** in that the treatment chamber (10), at its inner periphery, is provided
20 with longitudinal races (44), suitably distributed along said periphery, said sledge device (40) comprising a bearing housing (22) for the support (18,20) of the drum shaft, said bearing housing (22) being provided with wheels (42) intended to roll on the races (44) and to be peripherally steered thereby.

1 / 2

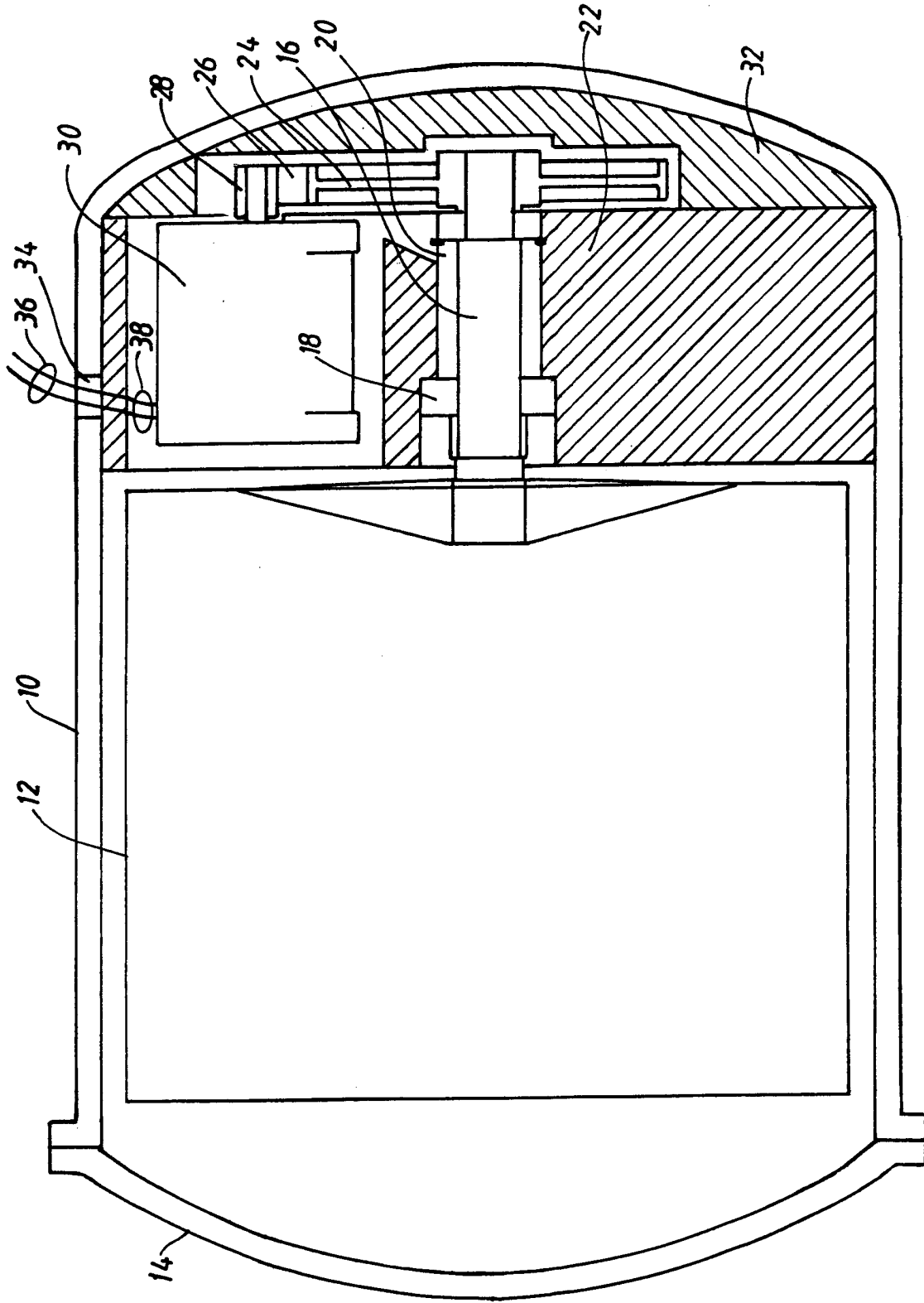


FIG.1

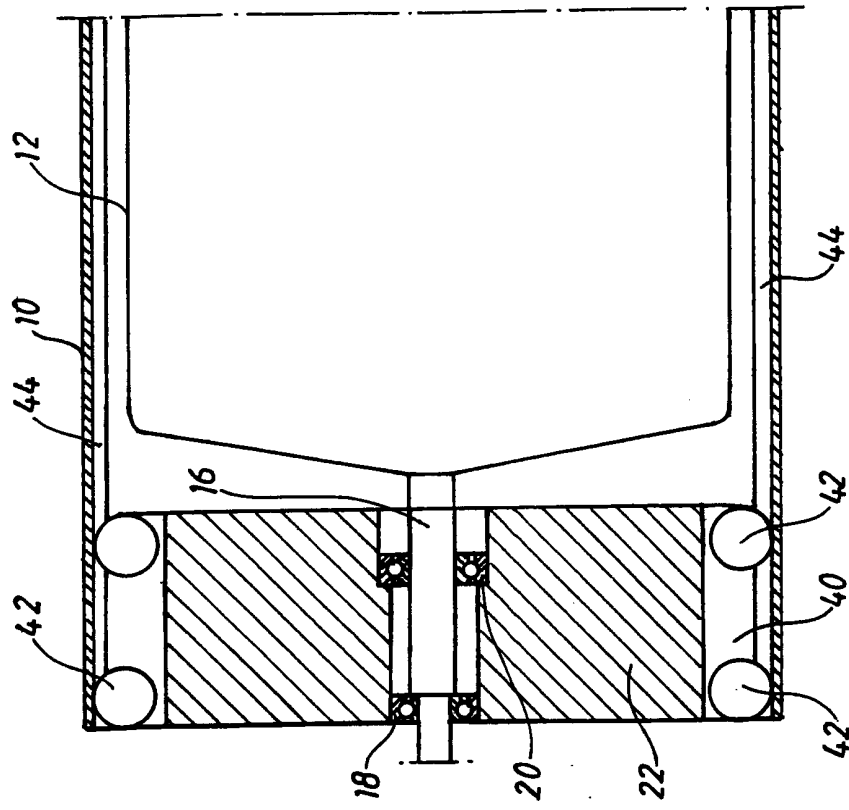


FIG. 3

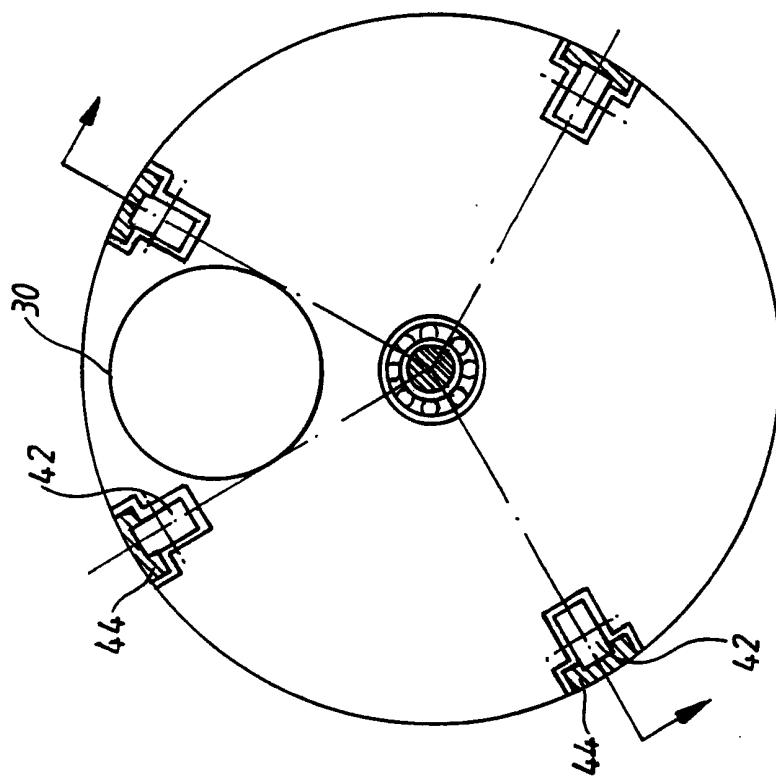


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/00767

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D06F 43/02, D06F 37/30

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)

IPC7: D06F

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

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, 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	GB 1509315 A (BOSCH-SIEMENS HAUSGERATE GMBH), 4 May 1978 (04.05.78), figure 1 --	
A	US 5301379 A (SCHAAL), 12 April 1994 (12.04.94), figure 1 --	
A	US 5267455 A (DEWEES ET AL), 7 December 1993 (07.12.93), figure 2 --	
P,A	WO 9949122 A1 (MICELL TECHNOLOGIES, INC.), 30 Sept 1999 (30.09.99), figure 6, abstract --	

 Further documents are listed in the continuation of Box C. See patent family 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

4 July 2000

Date of mailing of the international search report

06-07-2000

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Anna Ljungdahl / JA A

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/00767

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5651276 A (PURER ET AL), 29 July 1997 (29.07.97) -- -----	

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE 00/00767

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1509315 A	04/05/78	AT 340360 B	12/12/77
		AT 406575 A	15/04/77
		CH 584307 A	31/01/77
		DE 2427839 A	02/01/76
		FR 2273899 A,B	02/01/76
		NL 7506462 A	09/12/75
US 5301379 A	12/04/94	DE 59201588 D	00/00/00
		EP 0527699 A,B	17/02/93
		ES 2071474 T	16/06/95
		US 5357771 A	25/10/94
US 5267455 A	07/12/93	AU 666037 B	25/01/96
		AU 4672593 A	31/01/94
		BR 9306717 A	08/12/98
		CA 2139950 A	20/01/94
		EP 0651831 A	10/05/95
		JP 7508904 T	05/10/95
		US 5412958 A	09/05/95
		WO 9401613 A	20/01/94
		WO 9949122 A1	30/09/99
US 5651276 A	29/07/97	CN 1132284 A	02/10/96
		EP 0711864 A	15/05/96
		JP 2857087 B	10/02/99
		JP 8206393 A	13/08/96
		US 5925192 A	20/07/99