

Forms 7 and 8

AUSTRALIAPatents Act 1952DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION
APPLICATION FOR A PATENT OR PATENT OF ADDITION

78059/87

Name(s) of
Applicant(s)In support of the application/made by _____
Sunds Defibrator Aktiebolag, S-851 94 Sundsvall, Sweden

Title

for a patent for an invention entitled _____
Apparatus for treatment of fibre suspensionsName(s) and
address(es)
of person(s)
making
declarationI/~~we~~, Leif-Otto Illum
Svenska Cellulosa Aktiebolaget SCA
Kungsgatan 33
S-111 56 Stockholm - Sweden

do solemnly and sincerely declare as follows:-

1. I am/~~we are~~ the applicant(s) for the patent, or
~~any one~~ authorised by the abovementioned applicant
to make this declaration on its behalf.
2. The basic application(s) as defined by Section 141
of the Act was/~~were~~ made in the following country
~~or countries~~ on the following date(s) by the
following applicant(s) namely:-

Country, filing
date and name
of Applicant(s)
for the or
each basic
applicationin Sweden on August 7, 1986
by Sunds Defibrator Aktiebolag, S-851 94 Sundsvall, Sweden
in _____ on _____ 19____
by _____

3. The said basic application(s) was/~~were~~ the first
application(s) made in a Convention country in respect
of the invention the subject of the application.

Name(s) and
address(es)
of the or
each actual
inventor

4. The actual inventor(s) of the said invention is/~~are~~
Rolf Bertil Reinhall
P O Box 7299
BELLEVUE, WA 98007 - USA

See reverse
side of this
form for
guidance in
completing
this part

5. The facts upon which the applicant(s) is/~~are~~ entitled
to make this application are as follows:-

The applicant is the assignee of the actual inventorDECLARED at Stockholm this 9th day of January 1989SUNDS DEFIBRATOR AKTIEBOLAGLeif-Otto Illum
Leif-Otto Illum

(12) PATENT ABRIDGMENT (11) Document No. AU-B-78059/87
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 598582

(54) Title
APPARATUS FOR TREATMENT OF FIBRE SUSPENSIONS

International Patent Classification(s)
(51)⁴ **D21B 001/30 D21D 001/30**

(21) Application No. : **78059/87** (22) Application Date : **20.07.87**

(87) WIPO Number : **WO88/00992**

(30) Priority Data

(31) Number	(32) Date	(33) Country
8603346	07.08.86	SE SWEDEN

(43) Publication Date : **24.02.88**

(44) Publication Date of Accepted Application : **28.06.90**

(71) Applicant(s)
SUNDS DEFIBRATOR AKTIEBOLAG

(72) Inventor(s)
ROLF BERTIL REINHALL

(74) Attorney or Agent
GRIFFITH HACK & CO. MELBOURNE

(56) Prior Art Documents
SE 441758
SE 134912
SE 86309

(57) Claim

1. Apparatus for treating a fibre suspension comprising a housing having an inlet and an outlet, a rotor arranged within said housing, a stator surrounding said rotor within said housing, the inner surface of said stator cooperating with the outer surface of said rotor to define a refining gap therebetween for the treatment of fibre suspension being supplied thereto, a portion of said stator including a plurality of screening apertures therein to permit the outward passage therethrough of at least a portion of the fibre suspension being treated within said refining gap for discharge from said apparatus through said outlet of said housing, said refining gap providing a first treating zone having an inlet and a second treating zone having an outlet arranged along a portion of the length of said rotor, and adjusting means for adjusting the width of the refining gap within the first treating zone independently of the width of the refining gap within the second treating zone.

AU-AI-78059/87

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

598582

 INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)
(51) International Patent Classification⁴ :

D21B 1/30, D21D 1/30

A1

(11) International Publication Number:

WO 88/ 00992

(43) International Publication Date: 11 February 1988 (11.02.88)

(21) International Application Number: PCT/SE87/00341

(22) International Filing Date: 20 July 1987 (20.07.87)

(31) Priority Application Number: 8603346-1

(32) Priority Date: 7 August 1986 (07.08.86)

(33) Priority Country: SE

(71) Applicant (for all designated States except US): SUNDS
DEFIBRATOR AKTIEBOLAG [SE/SE]; S-851 94
Sundsvall (SE).

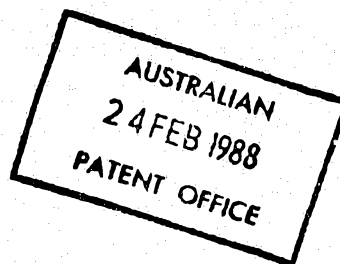
(72) Inventor; and

(75) Inventor/Applicant (for US only) : REINHALL, Rolf,
Bertil [SE/US]; P O Box 7299, Bellevue, WA 98007
(US).(74) Agent: ILLUM, Leif-Otto; Svenska Cellulosa Aktiebo-
laget SCA, Kungsgatan 33, S-111 56 Stockholm (SE).(81) Designated States: AT (European patent), AU, DE (Eu-
ropean patent), FI, FR (European patent), GB (Euro-
pean patent), JP, NO, SE (European patent), US.

Published

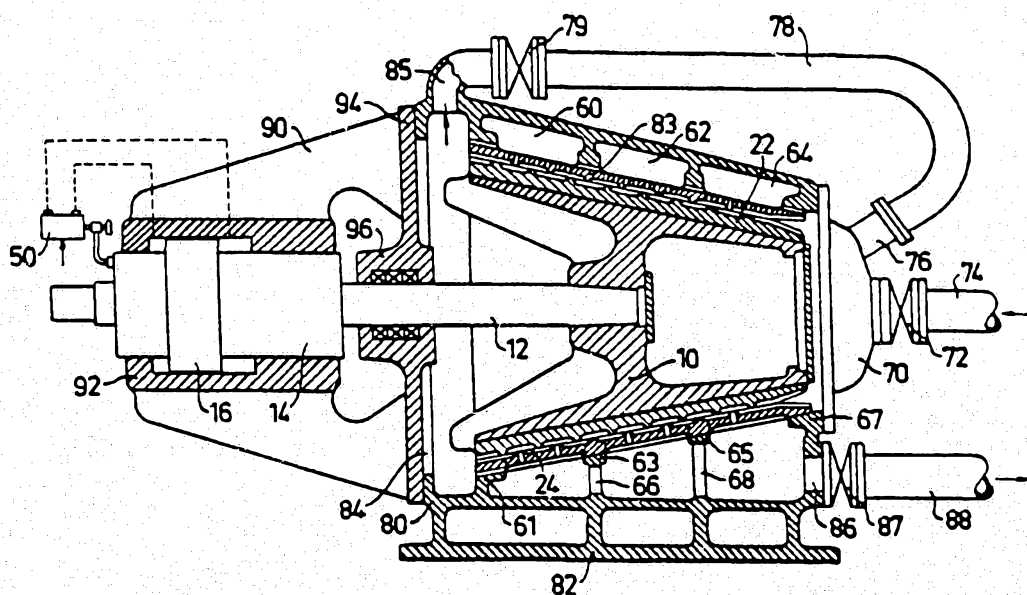
With international search report.

A.O.J.F. 24 MAR 1988



This document contains the
amendments made under
Section 49 and is correct for
printing.

(54) Title: APPARATUS FOR TREATMENT OF FIBRE SUSPENSIONS



(57) Abstract

The apparatus is intended for the screening and mechanical working of fibre suspensions. In an air-tight housing (80) with inlet (74) and accept outlet (86) an outer stator (83, 100, 102) and an inner rotor (10) are located so that between them a gap (24) is formed, in which the treatment takes place. The stator (83, 100, 102) is provided with screen apertures (32-35, 40, 42) along a portion of the gap (24). Both the stator (83, 100, 102) and the rotor (10) are provided with treating members (30, 37 and, respectively, 18, 19) in the gap (24) where the screen apertures (32-35, 40, 42) are located. A return line (78) connects the outlet end of the gap with the inlet end thereof.

Apparatus for treatment of fibre suspensions

Field of the Invention

This invention relates to an apparatus for treating fibre suspensions by screening (centrifugal screening) and fibre-separating mechanical working (refining), for example in water, air or steam, for the manufacture of papermaking pulp.

The treatment has the object to clean the suspension by screening of enclosed coarse particles, as for example fibres not sufficiently separated, fibre bundles (shives), and to subject the coarse fraction to a fibre-separating mechanical treatment, by which this fraction is converted to dimensions acceptable in the cleaned fraction.

Description of the Prior Art

The present state of art has solved the screening problem by using separate screening devices and connected thereto separate devices for the treatment of the separated coarse reject fraction. This combination, however, involves the problem that available screening devices require for optimum function a very low fiber/water concentration (normally 1-4%), while the beating devices require for optimum/development of strength and quality of much higher concentration (normally 10-30%). This necessitates expensive dewatering devices between screening and reject treatment and consequently much space-requiring storage containers and extensive pump work.

The present invention has an object the elimination of these problems by combining the screening device with the refining device, which during the passage of the fibre suspension over the screen surface continuously carries out an adjustable selective refining work on the coarse fibre fraction thereby separated.



Summary of the Invention

Therefore, according to one aspect of the invention there is provided apparatus for treating a fibre suspension comprising a housing having an inlet and an outlet, a
 5 rotor arranged within said housing, a stator surrounding said rotor within said housing, the inner surface of said stator cooperating with the outer surface of said rotor to define a refining gap therebetween for the treatment of fibre suspension being supplied thereto, a portion of said
 10 stator including a plurality of screening apertures therein to permit the outward passage therethrough of at least a portion of the fibre suspension being treated within said refining gap for discharge from said apparatus through said outlet of said housing, said refining gap
 15 providing a first treating zone having an inlet and a second treating zone having an outlet arranged along a portion of the length of said rotor, and adjusting means for adjusting the width of the refining gap within the first treating zone independently of the width of the
 20 refining gap within the second treating zone.

The invention, thus, renders it possible that the fibre suspension can be processed further without fibres already sufficiently treated being subjected to additional
 25 undesirable energy-requiring treatment, and that at the same time the fibre concentration in the refining/screening device can be maintained at a high level and thereby permits optimum strength-increasing
 30 treatment of separated coarse fibre bundles (reject).

By carrying out the mechanical treatment on the inside of a cylindric or conic rotation body at relatively high rotation speed and by utilizing the intensive fluidization
 35 resulting from the refining of the reject, while at the same time the centrifugal force generated at the rotation acts substantially in perpendicular direction to apertures



or slits in the screen/refining surface, the screening can be performed effectively at the higher concentration required for optimum effective treatment of the separated fraction (reject).

- 5 By using an apparatus according to the invention, the treatment can be carried out in direct connection to a so-called thermomechanical pulp manufacture when the fibre pulp produced is obtained in steam suspension. The fibre suspension can be screened and processed in steam phase at
 10 concentrations up to those resulting from the pulp manufacturing process (50% or higher).

This processing can also suitably be combined with an additional final treatment of the entire pulp flow for
 15 increasing the strength and quality, whereby fibres completely worked during the refining continuously are discharged as accept. According to the invention, the requirement of separate screening systems and separate reject treatment, including dewatering devices, storage
 20 containers with pumps and piping etc., is entirely eliminated.

Brief Description of the Drawings

In order that the invention may be more clearly
 25 understood, an example of a preferred embodiment will now be described with reference to the accompanying drawings wherein:

30 Fig. 1 is an axial cross-section of the apparatus,

Fig. 2 is a radial cross-section of the apparatus,

Figs. 3-6 show different embodiments and combination of
 35 refining/screening surface and rotor device,



Fig. 7 is an axial cross-section of a different embodiment.

Description of Preferred Embodiments

A refining/screening device according to the embodiment
 5 comprises a rotor 10 supported on a shaft 12, which is mounted rotatably in a bearing housing 14. Said bearing housing is axially displaceable by means of a piston 16 attached thereon, which piston is enclosed by a combined cylinder and bearing bracket 92, which in its turn is
 10 supported by a yoke 90 with a sealing plane end wall 94. this end wall also supports a packing box 96, by which the shaft 12 extends air-tight through the end wall 94.

The bearing bracket 92 with yoke 90 is connected air-tight
 15 through the end wall 94 to a housing 80 enclosing the machine and combined with a stand 82 supporting the machine.

The interior of the housing 80 is designed as a truncated
 20 cone with two openings, the greater one 84 of which is connected to the end wall 94, and the smaller one to a curved end wall 70, which supports a feed line 74 with a control valve 72.

The housing 80 is provided with two outlet openings. One
 25 opening 85 at the greater diameter of the housing is connected to a return line 78 with control valve 79. The return line 78 is connected to the inlet end of the
 30 apparatus via the pipe socket 76. An opening 86 at the smaller diameter of the housing is connected to an outlet pipe 88 via a control valve 87.

The rotor 10 supports refining fluidization devices 22,
 35 which are attached to the rotor by bolt or key connection.

The conical inner surface of the housing is formed of four annular supports 61,63,65,67, which carry a stator 83



comprising combined refining and screening devices, which also are attached by means of bolt or key connections. The rotor 10 and stator 83 define a gap 24 between themselves.

The outer volume of the housing 80 is divided by the stator 83 and the annular supports 61,63,65,67 into three annular chambers 60,62,64, which in their lower portions communicate with the outlet opening 86 by means of the openings 66,68.

The space of the housing inside the stator communicates at the feed end via the end wall 70 with the feed line 74 and return line 78,76, and at the outlet end of the rotor with the opening 85 and return line 78.

The refining and fluidization devices 22 of the rotor 10 are designed with bars 18,19 and grooves 20,21, which can vary both in division and configuration. Some examples are shown in Figs. 3,4,5,6. The longitudinal direction of the grooves can coincide with the generatrix of the cone or be angled therefrom both in and against the rotation direction, whereby the pumping action of the rotor in axial direction can be increased or reduced. The bars 18,19 extend at least along a portion of the rotor 10 and gap 24. According to the embodiment shown, the bars extend along the entire gap 24.

The stator 83 is provided with bars 30,37 and grooves 31, 39, which also can be designed with different division and configuration. Some examples are shown in Figs. 3,4,5,6. The stator further is provided with perforations 32-35, 40,42 either round or slit-shaped, preferably with widening area in the direction from the rotor 10 to the space 60,62,64. Some examples are shown in Figs. 3,4,5,6. The bars 30,37 of the stator shall be located along at least a portion of the gap 24. This applies also to the perforations 32-35, 40,42. The bars 18, 19 and, respectively, 30, 37 of the rotor and stator 83 preferably extend subst-

antially along the entire gap 24. The screen openings 32-35, 40, 42 also are arranged preferably substantially along the entire gap 24.

The design with screen openings 32, 34 in the bottom of the grooves 31 or 39, which are enclosed by the bars 30 or 37, is intended for higher rotation speeds, while the design with screen openings 33, 35 on the top of the bars 30 or 37 is intended for lower numbers of revolution of the rotor 10. According to Fig. 6, the screen openings 40, 42 are located on the sides of the bars 30. Such a design is suitable for all rotation speeds.

The axial position of the rotor and therewith the gap 24 between the rotor 10 and stator 83 are controlled at operation by a conventional hydraulic control valve 50, which is affected by the movement of the bearing housing 14 in axial direction. Such control devices are described, for example, in the patent specifications SE 183 750 and 214 707.

In operation, the pulp suspension is supplied by means of pump, or by gravity from overlying level box, through the feed pipe 74, whereby the pulp suspension is distributed about the inlet opening at the refining/screening devices 22, 83. The refining and turbulence procedure at the passage of the suspension through the gap maintained between the rotor 10 and stator 83 is the same as in the case of usual refiners of conic or cylindric type.

Due to the generated high centrifugal forces (corresponding to acceleration 600-2500 g), which for example at a cone angle of rotor, stator of 15° are utilized to corresponding $\cos 15^\circ$ (0.96593), i.e. to about 96% in perpendicular direction, coinciding with the direction of the perforations in the stator, very high pressure pulsations arise in the stator 83 with a frequency and size determined by the groove division of the rotor 10 and the number of revolutions

used. At an inlet diameter of 800 mm and an outlet diameter of 1200 mm and at 1500 rpm, the centrifugal force in perpendicular direction to the stator corresponds to about 1000 g at the inlet and about 1500 g at the outlet diameter.

The pressure pulse density at a groove division of 8 mm at the inlet of the rotor is about 8 kcs, which together with the high pressure maximum for each pulse yields a very effective fluidization even at very high fibre concentrations.

In Fig. 7 an alternative embodiment of the stator is shown, which renders it possible to adjust the gap width (24) separately at the inlet and outlet zone. This is achieved in that the stator 83 shown in Fig. 1 is divided into two parts 100 and 102, shown in Fig. 7, of which parts the part 100 is rigidly secured in the housing 80, while the part 102 is displaceably mounted in axial direction on the annular supports 106 and 108 connected to the housing 80.

The axial movement of the stator part 102 is controlled by threaded adjusting means 110 connected to the part 102, which means 110 are provided with sprockets 112, which by means of a chain 118 connected to the sprockets and driven by a shifting motor 116 via a sprocket 114 rotate the adjusting means until the desired position on the stator part 102 is achieved, which rotation is carried out simultaneously.

This arrangement renders it possible to separately adjust the gap width at the two stator parts 100 and 102, whereby the width at the stator part 100 is adjusted by means of the hydraulic piston 16 and its setting means 50, and the gap at the stator part 102 is adjusted by the adjusting means 116 to desired size equal to or different of the gap at the stator part 100. The two gap widths at 100 and 102 are adjusted thereafter, increased or reduced simultaneously, by the hydraulic adjusting means 16 and the means 50.

By this arrangement the combined intensity screening/refining can be varied between the two zones. The gap width at the inlet zone 102, for example, can be increased for obtaining predominantly screening effect, while the secondary zone is adjusted to a smaller gap width for increased refining effect, by means of which coarse fibre bundles, shives etc. not accepted in the primary zone are treated to a dimension rendering possible their passage through the screening perforated surface of the stator part to the accept flow from the apparatus.

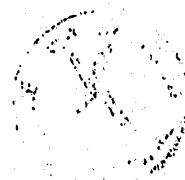
It is, of course, also possible to divide the stator into more zones for separate adjustment of the gap width in each zone, but two zones are preferable.

~~The invention is not restricted to the embodiments shown, but can be varied within the scope of the invention idea.~~



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Apparatus for treating a fibre suspension comprising a housing having an inlet and an outlet, a rotor arranged within said housing, a stator surrounding said rotor within said housing, the inner surface of said stator cooperating with the outer surface of said rotor to define a refining gap therebetween for the treatment of fibre suspension being supplied thereto, a portion of said stator including a plurality of screening apertures therein to permit the outward passage therethrough of at least a portion of the fibre suspension being treated within said refining gap for discharge from said apparatus through said outlet of said housing, said refining gap providing a first treating zone having an inlet and a second treating zone having an outlet arranged along a portion of the length of said rotor, and adjusting means for adjusting the width of the refining gap within the first treating zone independently of the width of the refining gap within the second treating zone.
2. Apparatus as claimed in claim 1, wherein the screen apertures are located in the bottom of the grooves.
3. Apparatus as claimed in claim 1, wherein the screen apertures are located on the top of the bars.
4. Apparatus as claimed in claim 1, wherein the screen apertures are located on the sides of the bars.
5. Apparatus as claimed in any one of the preceding claims, wherein the rotor is axially movable for adjusting the gap width.



6. Apparatus as claimed in any one of the preceding claims, and substantially as herein described with reference to any one of the examples shown in the accompanying drawings.

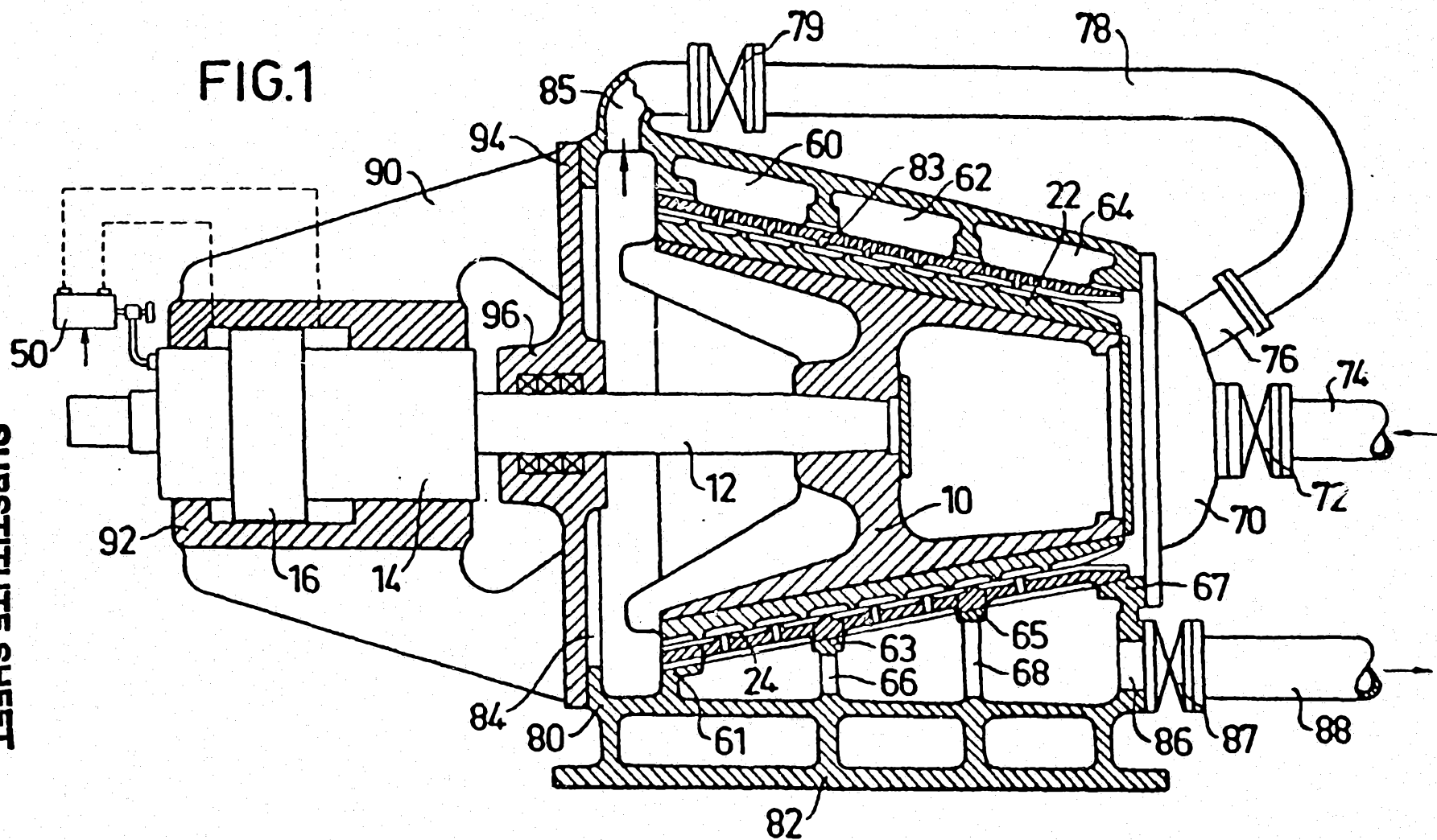
DATED THIS 5th DAY OF April, 1990

SUNDS DEFIBRATOR AKTIEBOLAG
By Its Patent Attorneys

GRIFFITH HACK & CO.
Fellows Institute of Patent
Attorneys of Australia



FIG.1



SUBSTITUTE SHEET

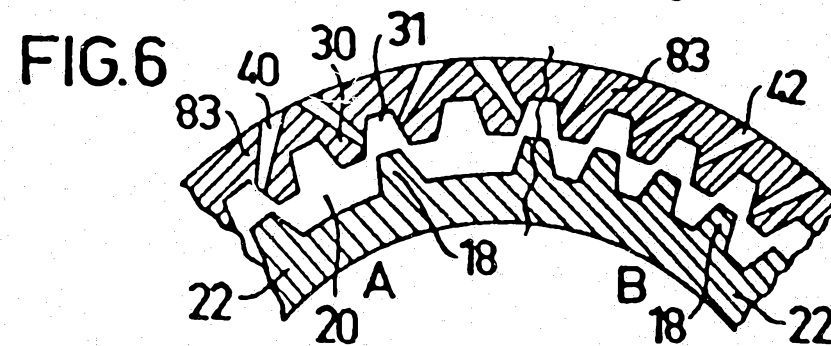
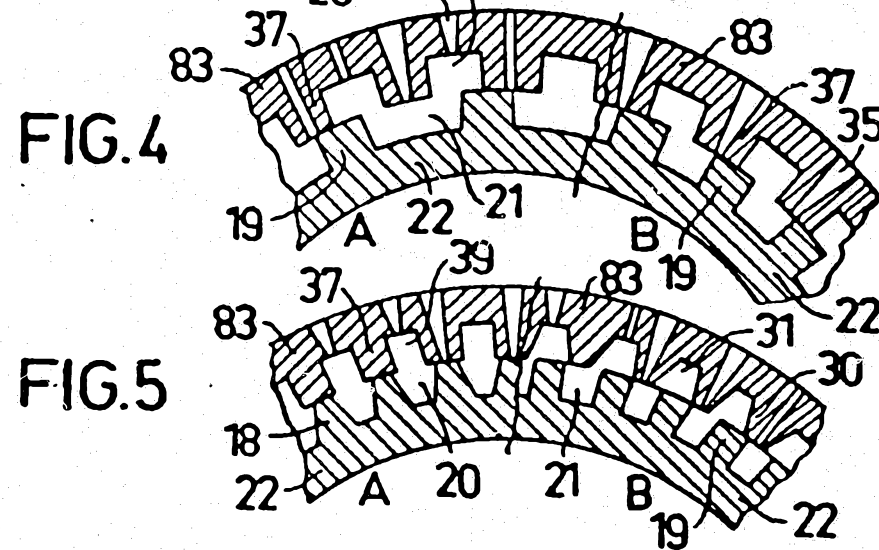
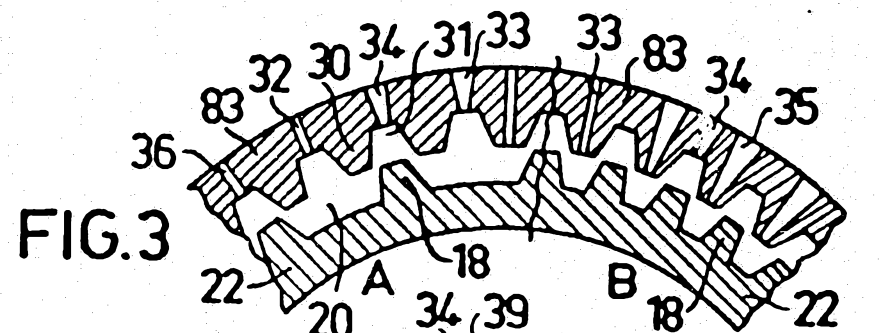
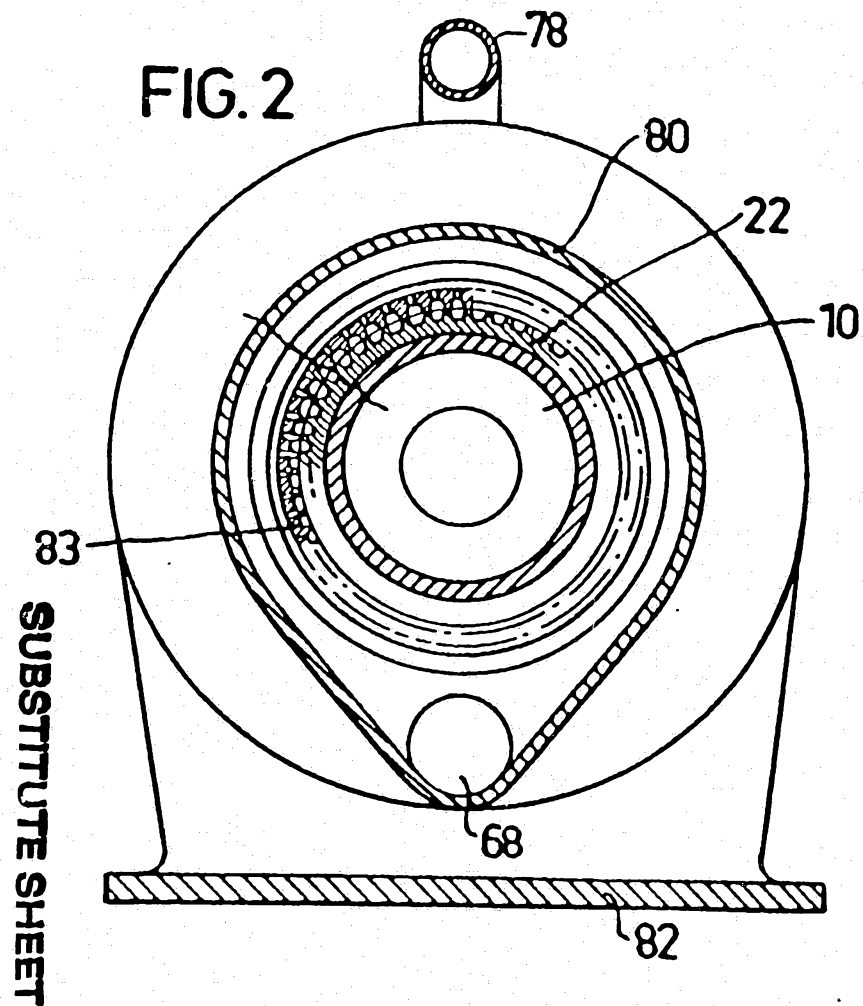
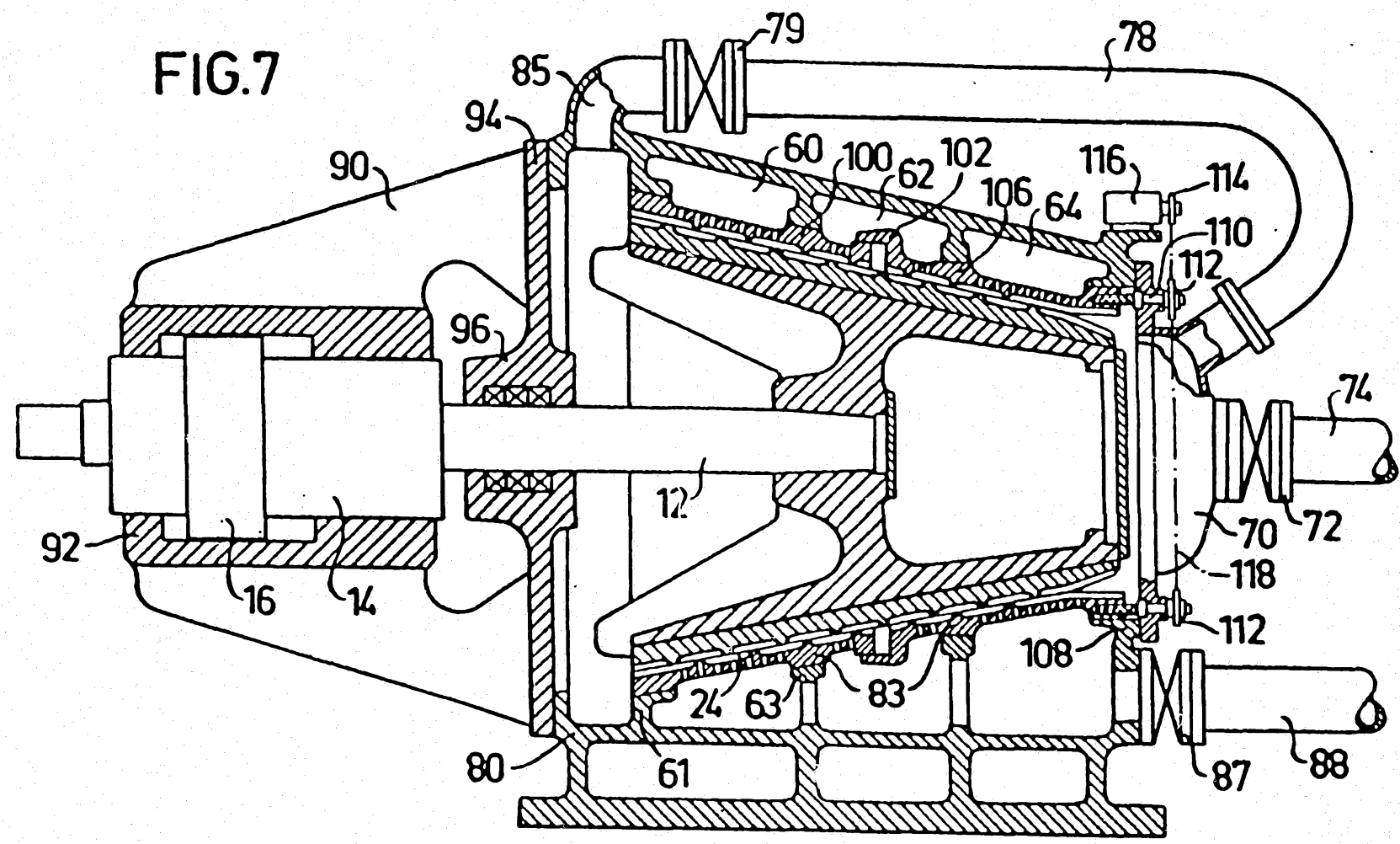


FIG.7

SUBSTITUTE SHEET



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE87/00341

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
D 21 B 1/30, D 21 D 1/20		4
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC 4	D 21 B 1/30; D 21 D 1/20, /22, /34-38; B 02 C 7/00-/12	
Nat C1	55c:9/10, /20, /12	
US C1	241: 28, 46, 69, 73, 74, 81, 89.3, 247, 251, 259-261.3, 296	
Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched ⁸		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ¹⁰	Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	SE, C, 86 309 (J. A. WIENER) 12 March 1936	1
X	SE, C, 134 912 (C. LAVISTE) 18 March 1952	1, 2, 3, 6
Y	SE, B, 441 758 (SUNDS DEFIBRATOR) 4 November 1985	1
A	DE, C, 438 247 (C. F. LINDSTRÖM) 1 April 1925	
A	DE, A, 2 611 886 (E. HOLZ) 29 September 1977	
Y	US, A, 2 741 954 (A L H ALLIBE) 20 January 1954	1, 6, 7
A	US, A, 2 909 334 (N.G.H. NILSSON) 8 December 1955	1
A	US, A, 3 138 336 (E. LEJEUNE) 10 July 1961	2
¹⁰ 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 "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		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
1987-10-21		1987 -10- 27
International Searching Authority		Signature of Authorized Officer
Swedish Patent Office		Catarina Forssén

L.E.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 3 144 994 (D.W. DANFORTH) 29 August 1960	2
A	US, A, 3 427 690 (A. J. HAUG) 18 February 1969	7