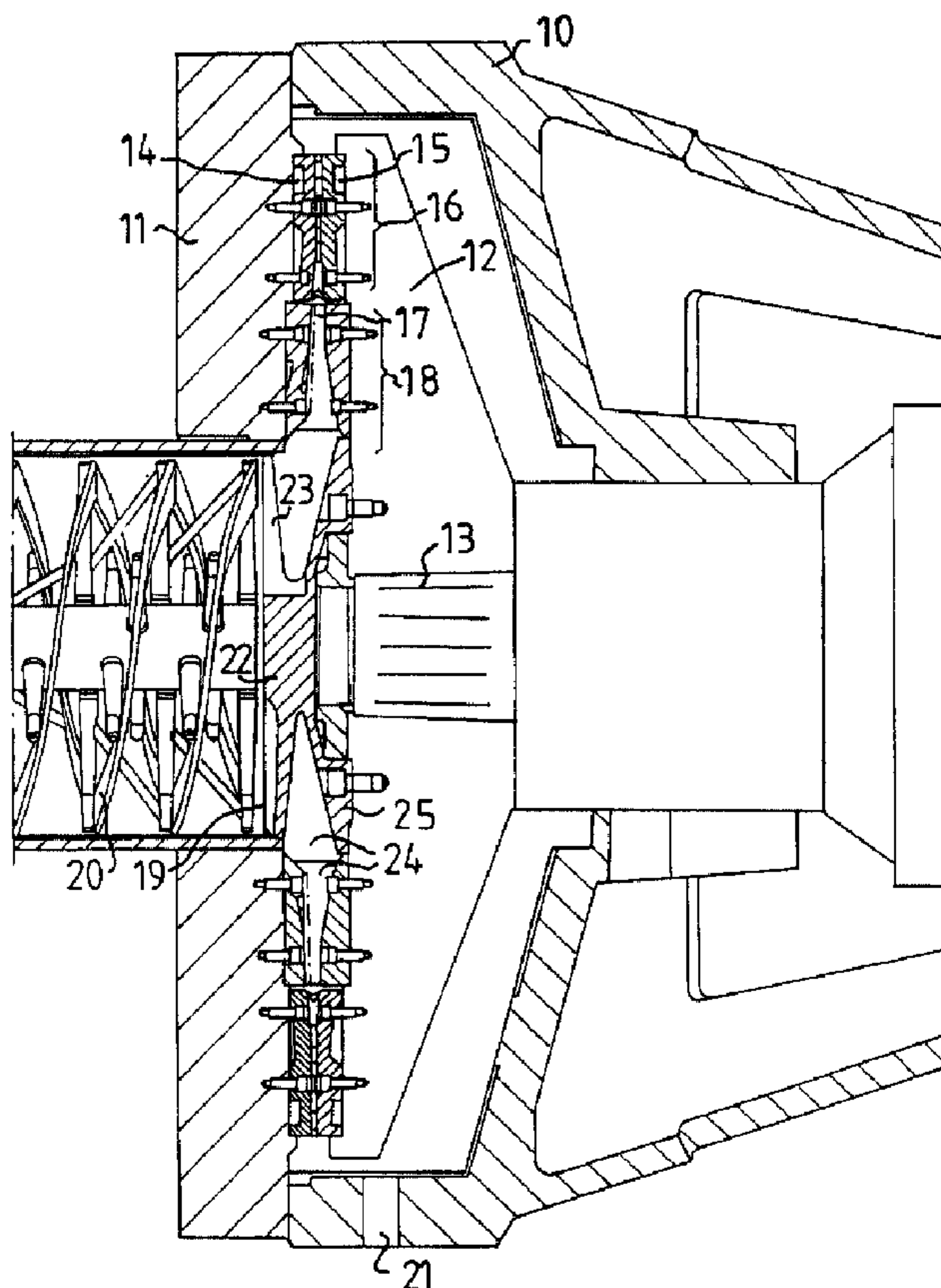




(86) Date de dépôt PCT/PCT Filing Date: 1998/02/03  
 (87) Date publication PCT/PCT Publication Date: 1998/08/27  
 (45) Date de délivrance/Issue Date: 2003/10/28  
 (85) Entrée phase nationale/National Entry: 1999/08/23  
 (86) N° demande PCT/PCT Application No.: SE 1998/000183  
 (87) N° publication PCT/PCT Publication No.: 1998/036836  
 (30) Priorité/Priority: 1997/02/25 (9700676-1) SE

(51) Cl.Int.<sup>6</sup>/Int.Cl.<sup>6</sup> B02C 7/12, D21B 1/14  
 (72) Inventeurs/Inventors:  
 DANIELSSON, OVE, SE;  
 JOHANSSON, OLA, US;  
 SVEDBERG, PETER, SE  
 (73) Propriétaire/Owner:  
 VALMET FIBERTECH AKTIEBOLAG, SE  
 (74) Agent: FETHERSTONHAUGH & CO.

(54) Titre : PROCEDE ET DISPOSITIF DE TRAITEMENT D'UNE MATIERE FIBREUSE  
 (54) Title: METHOD AND DEVICE FOR TREATMENT OF FIBROUS MATERIAL



(57) Abrégé/Abstract:

A method for mechanical working of lignocellulosic fibrous material in a refiner with refining means (11, 12) rotating relative to each other, and a device (22) for feeding the fibrous material into the refiner. The material is accelerated outward without material build-up through a feed zone (18) without mechanical working, and the material density is at maximum 10 kg/m<sup>3</sup>.

**(57) Abrégé(suite)/Abstract(continued):**

Thereafter, the mechanical working is carried out in an outside located refining zone (16). The feeding device (22) comprises a front axial screw (23), which transforms to a least one substantially radial rear wing (24). The feeding device (22) is intended to be placed centrally on the rotary refining means (12).

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

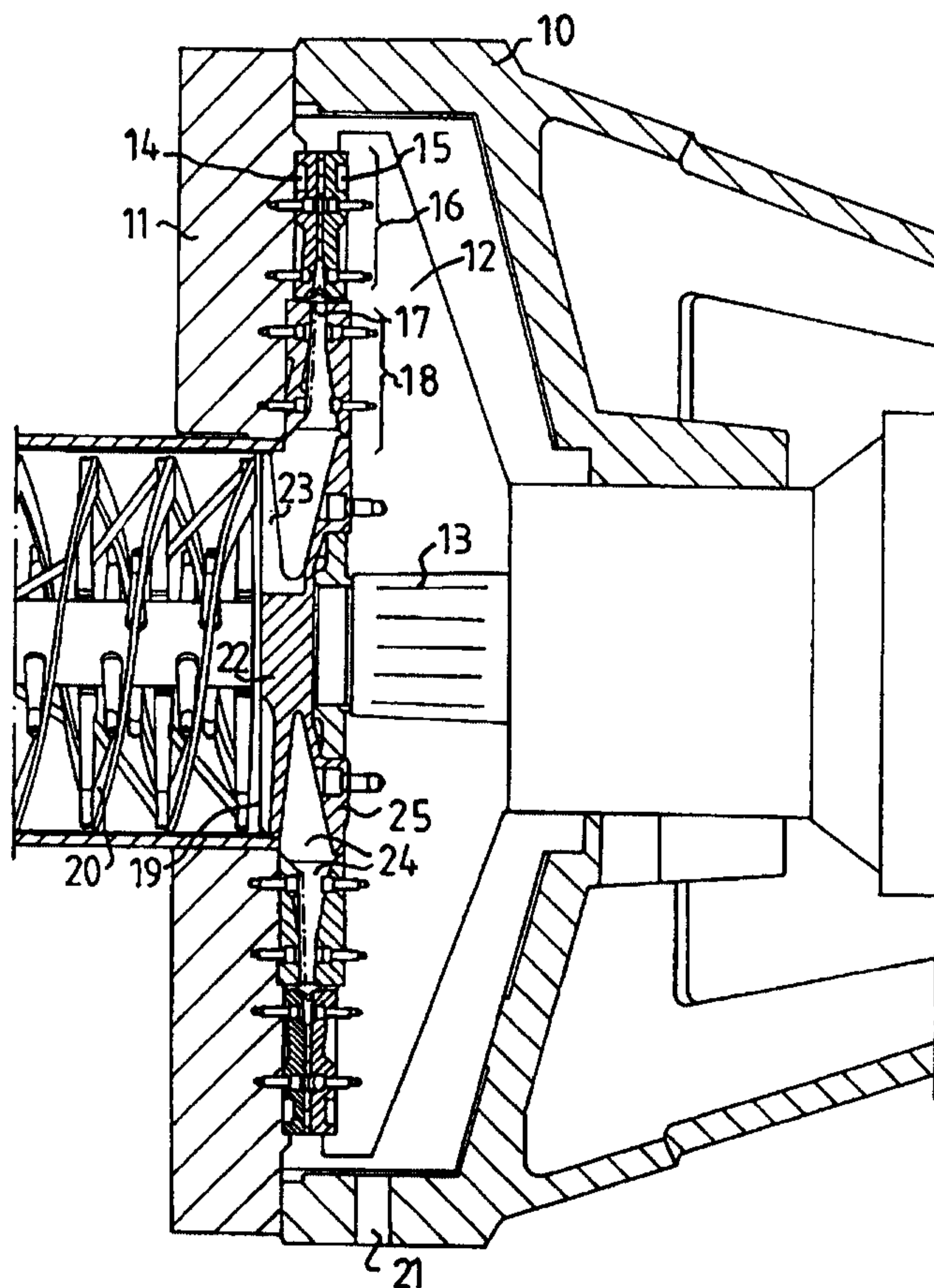
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>6</sup> : <b>B02C 7/12, D21B 1/14</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 98/36836</b></p> <p>(43) International Publication Date: 27 August 1998 (27.08.98)</p>
<p>(21) International Application Number: PCT/SE98/00183</p> <p>(22) International Filing Date: 3 February 1998 (03.02.98)</p> <p>(30) Priority Data: 9700676-1                      25 February 1997 (25.02.97)                      SE</p> <p>(71) Applicant (for all designated States except US): SUNDS DEFIBRATOR INDUSTRIES AB [SE/SE]; S-851 94 Sundsvall (SE).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): JOHANSSON, Ola [SE/SE]; 861 Millvale Place, Lawrenceville, GA 30244 (US). SVEDBERG, Peter [SE/SE]; Glasbruksbacken 1, S-863 33 Sundsbruk (SE). DANIELSSON, Ove [SE/SE]; Nybergsgatan 8, S-114 45 Stockholm (SE).</p> <p>(74) Common Representative: SUNDS DEFIBRATOR INDUSTRIES AB; SUNDQVIST, Hans, Strandbergsgatan 61, S-112 51 Stockholm (SE).</p>		<p>(81) Designated States: AU, BR, CA, JP, NO, NZ, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p><b>Published</b> With international search report. With amended claims.</p>

(54) Title: METHOD AND DEVICE FOR TREATMENT OF FIBROUS MATERIAL

(57) Abstract

A method for mechanical working of lignocellulosic fibrous material in a refiner with refining means (11, 12) rotating relative to each other, and a device (22) for feeding the fibrous material into the refiner. The material is accelerated outward without material build-up through a feed zone (18) without mechanical working, and the material density is at maximum  $10 \text{ kg/m}^3$ . Thereafter, the mechanical working is carried out in an outside located refining zone (16). The feeding device (22) comprises a front axial screw (23), which transforms to a least one substantially radial rear wing (24). The feeding device (22) is intended to be placed centrally on the rotary refining means (12).



Method and device for treatment of fibrous material

This invention relates to a method and a device for treating lignocellulosic fibrous material in a refiner with opposed refining means rotating relative to each other, one of which is stationary and one rotary, which are provided with refining elements, which between themselves form a refining gap with a refining zone for working the material. The material is supplied to a feed zone located radially inside the refining zone. The invention also refers to a feeding device for the material.

The invention, more precisely, refers to the manufacture of various types of mechanical pulps, such as refiner mechanical pulp (RMP), thermo-mechanical pulp (TMP), chemi-mechanical pulp (CMP) and chemi-thermo-mechanical pulp (CTMP). The starting material can be wood chips, one-year plants as wheat, straw, bagasse or more or less worked pulp.

The known working of the fibrous material in the refiner most often is carried out in an ineffective way. A very essential part of the energy input is used for transporting the fibrous material through the refiner, whereby friction losses and heat losses are caused, which do not result in the changes of the fibrous material required for developing the pulp quality and for making the refining effective. This implies, that the energy consumption is higher than it need to be for achieving the desired mechanical working, i.e. desired pulp quality.

The present invention offers a solution of this problem, in that the staytime of the material in the feed zone is shortened, and the material substantially without mechanical working passes through the feed zone to the radially outside located refining zone. The staytime should be less than 2,5 sec, preferably less than 1 sec.

The ingoing material is by means of a central feeding device fed in and accelerated outward without material build-up in the feed zone. Thereby

28229-100

2

the material density in the feed zone is restricted to at maximum 10 kg/m<sup>3</sup>, preferably to at maximum 1 kg/m<sup>3</sup>. In this way, the contact of the material with the refining means in the feed zone is reduced, and thereby also the energy consumption in the form of friction heat is reduced. Any proper mechanical working in the feed zone, thus, shall not take place, and the energy consumption in this zone preferably should be less than 5% of the total energy consumption.

10           The energy input, instead, shall be transferred to the refining zone, where the relative speed between the refining elements shall be high and preferably exceed 50 m/sec already in the inner portion of the refining zone.

15           The characterizing features of the invention are apparent from the attached claims.

          In accordance with the present invention, there is provided a method for refining lignocellulosic material between a pair of relatively rotary refining elements forming an annular outer refining zone and a central feed zone therebetween, said method including feeding said lignocellulosic material to said central feed zone at a first rate, accelerating said lignocellulosic material from said central feed zone into said annular outer refining zone at a second rate without lignocellulosic material build up in said central feed zone and substantially without working said lignocellulosic material in said central feed zone, the density of said lignocellulosic material in said central feed zone being a maximum of about 10 kg/m<sup>3</sup>, said second rate being substantially greater than said first rate, and mechanically working said lignocellulosic material in said annular outer refining zone wherein said relatively rotary

28229-100

2a

refining elements have a relative speed of greater than about 50 m/sec.

In accordance with the present invention, there is further provided apparatus for feeding lignocellulosic material to a refiner including a pair of relatively rotary refining members including a corresponding pair of refining elements forming a refining gap and comprising an annular outer refining zone, and a central feed zone therebetween, a central feed conduit having a predetermined diameter for feeding said lignocellulosic material to said refiner, said apparatus including a feed member for mounting in said central feed zone in front of said central feed conduit for feeding lignocellulosic material at a first rate, said feed member including a front axial screw and at least one substantially radial rear wing displaced rearwardly from said front axial screw for feeding lignocellulosic material at a second rate, said front axial screw having a diameter substantially corresponding to said predetermined diameter, and said at least one rear wing adapted to extend into said refining gap substantially to said annular outer refining zone.

The invention is described in greater detail in the following, with reference to an embodiment thereof illustrated in the accompanying drawings, in which

**Fig. 1** is a cross-section through a refiner for treating fibrous material according to the invention;

**Fig. 2** shows a feed device according to the invention;

**Fig. 3** show a diagram from comparing experiments where the freeness is stated as a function of the energy consumption.

28229-100

2b

The refiner shown in Fig. 1 comprises a refiner housing 10, in which a stationary refining means 11 and an opposed rotary refiner means 12 attached on a rotary shaft 13 are provided. The refining means 11, 12 are provided with refining elements 14 and, respectively, 15 which between themselves form a refining zone 16 in a refining gap 17. The refining gap 17 comprises also an inside located feed zone 18. The stationary refining means 11 is formed with a central

feed opening 19 for the material to be worked. A screw feeder 20 for the material is connected to the feed opening 19. The refiner housing 10 is provided with an outlet 21 for the material passing through the refining gap where the material is worked to pulp.

On the rotary refining means a central feeding device 22 is located which is formed with a front axial screw 23 and at least one substantially radial rear wing 24 on a rear wall 25 in the device 22. The diameter of the axial screw 23 corresponds to the diameter of the feed opening 19. The rear wing or wings 24 extend into the refining gap 17 through the feed zone 18 out to the refining zone 16.

The feeding device 22 can be formed with an axial screw 23 and wings 24 as one unit or as separate parts, which are attached individually on the rotary refining means 12.

The number of wings 24 preferably is 2-4, and they can be radial or formed with their radially outer ends curved from the rotation direction of the device.

The material to be treated is advanced to the refiner by means of the screw feeder 20. The design of the feeding device 22 with a front axial screw 23 implies, that the transfer of the material from the screw feeder 20 to the refiner is ensured in that the material is prevented from rebounding out into the screw feeder 20. The rear wing or wings 24, furthermore, imply that the material, which is fed by the axial screw 23 between the refining means 11,12, rapidly passes through the feed zone 18 to the radially outside located refining zone 16 where the working of the material to pulp takes place. The wings 24, thus, accelerate the material outward without material build-up in the feed zone 18, in that the material is locked up in a space, which first is defined by the axial screw 23 and thereafter by the rear wall 25 of the feed device 22, an opposed substantially smooth portion on the stationary refining means 11 and

wings 24. The material thus locked is subjected to an increasing centrifugal force, which throws the material outward to the refining zone. The material density in the feed zone 18 can thereby be restricted to at maximum  $10 \text{ kg/m}^3$ , preferably at maximum  $1 \text{ kg/m}^3$ . The contact of the material with the refining means in the feed zone, and thereby the energy consumption in the form of friction heat is reduced. No proper mechanical working, thus, takes place in the feed zone 18, but it takes place in the refining zone 16. The energy consumption in the feed zone preferably is less than 5% of the total energy consumption.

In the refining zone 16, where substantially the entire energy input occurs, the relative speed between the refining elements 14,15 must be high and preferably exceed 50 m/sec already in the inner portion of the refining zone.

#### EXAMPLE

A refiner of the type shown in Fig. 1 was operated partially with a conventional feeding device and partially with a feeding device according to the invention for the manufacture of tissue pulp. See the following Table.

Regarding the load on the screw feeder 20, it was observed that it was about 40% lower with the feeding device according to the invention, which indicates that this feeding device effectively draws in the material into the refiner and moves it out to the refining zone.

TABLE

	Conventional feed			Feed according to the invention		
Production ton/hour	7,2	7,2	7,2	7,7	7,7	7,7
Spec. energy kWh/hour	1417	1333	1250	1013	974	974
CSF ml	469	542	612	514	574	596
Tensile index kNm/kg	15,6	17,3	15,3	19,0	16,5	16,1
Tear index Nm <sup>2</sup> /kg	5,87	6,48	5,68	6,22	6,17	6,27

It can be stated that the quality of the produced pulp was substantially equivalent according to both alternatives.

The specific energy consumption, however, was reduced considerably by using the feeding device according to the invention.

For a corresponding freeness value, a reduction of the energy consumption by about 25% was observed. See Fig. 3.

The invention, of course, is not restricted to the embodiment shown, but can

28229-100

6

CLAIMS:

1. A method for refining lignocellulosic material between a pair of relatively rotary refining elements forming an annular outer refining zone and a central feed zone therebetween, said method including feeding said lignocellulosic material to said central feed zone at a first rate, accelerating said lignocellulosic material from said central feed zone into said annular outer refining zone at a second rate without lignocellulosic material build up in said central feed zone and substantially without working said lignocellulosic material in said central feed zone, the density of said lignocellulosic material in said central feed zone being a maximum of about  $10 \text{ kg/m}^3$ , said second rate being substantially greater than said first rate, and mechanically working said lignocellulosic material in said annular outer refining zone wherein said relatively rotary refining elements have a relative speed of greater than about  $50 \text{ m/sec}$ .
2. The method of claim 1 wherein said density of said lignocellulosic material in said central feed zone is a maximum of about  $1 \text{ kg/m}^3$ .
3. Apparatus for feeding lignocellulosic material to a refiner including a pair of relatively rotary refining members including a corresponding pair of refining elements forming a refining gap and comprising an annular outer refining zone, and a central feed zone therebetween, a central feed conduit having a predetermined diameter for feeding said lignocellulosic material to said refiner, said apparatus including a feed member for mounting in said central feed zone in front of said central feed conduit for feeding lignocellulosic material at a first rate, said feed member including a front axial screw and at least one

28229-100

7

substantially radial rear wing displaced rearwardly from said front axial screw for feeding lignocellulosic material at a second rate, said front axial screw having a diameter substantially corresponding to said predetermined diameter, and said at least one rear wing adapted to extend into said refining gap substantially to said annular outer refining zone.

4. The apparatus of claim 3 wherein said pair of relatively rotary refining members includes a stationary refining member and a rotary refining member, said central feed conduit being disposed in said stationary refining member and said feed member being disposed on said rotary refining member.

5. The apparatus of claim 4 including between about 2 and 4 of said substantially radial rear wing members.

6. The apparatus of claim 4 wherein said at least one rear wing member includes an outer end which is curved from the intended direction of rotation of said rotary refining member.

FETHERSTONHAUGH &amp; CO.

OTTAWA, CANADA

PATENT AGENTS

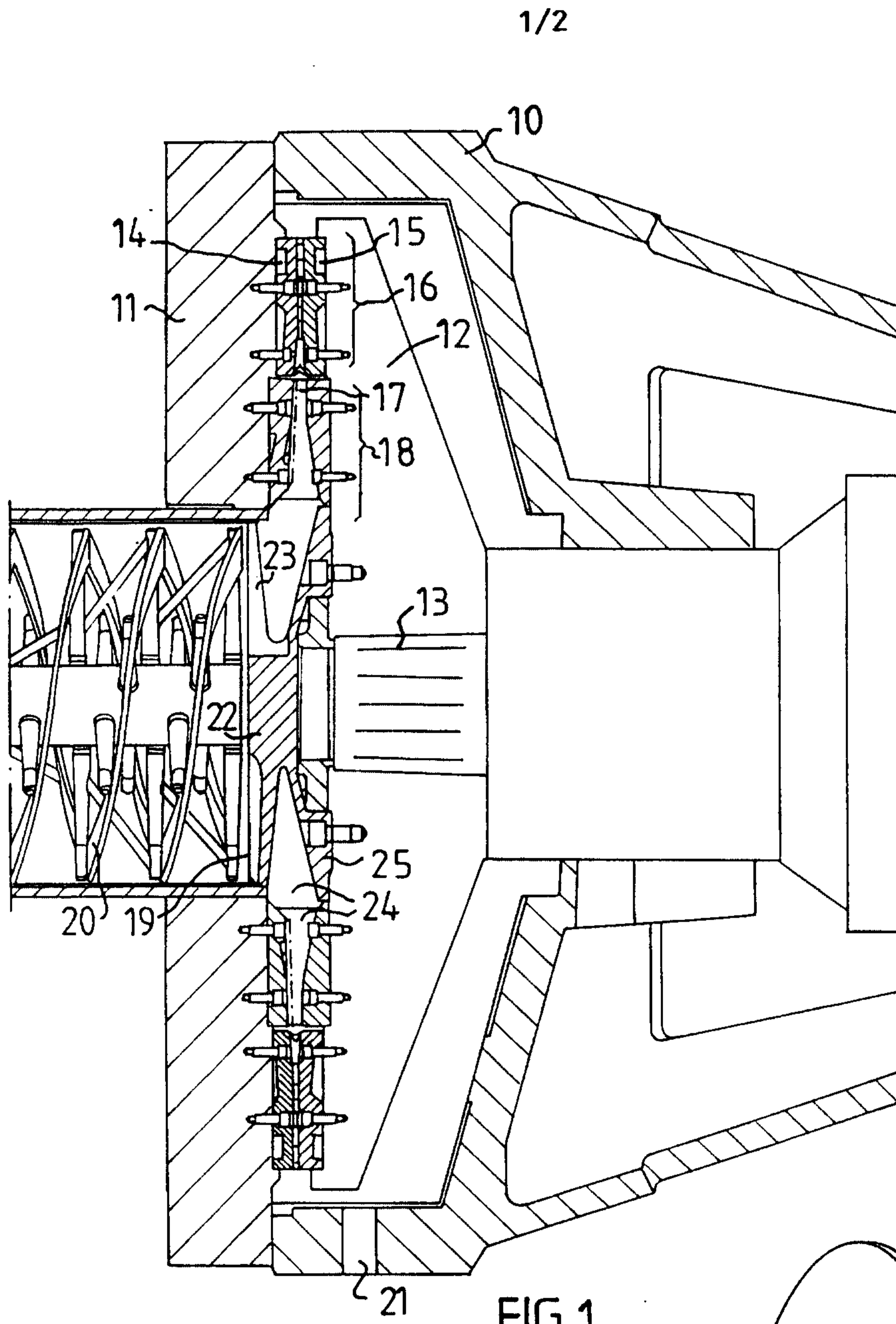


FIG. 1

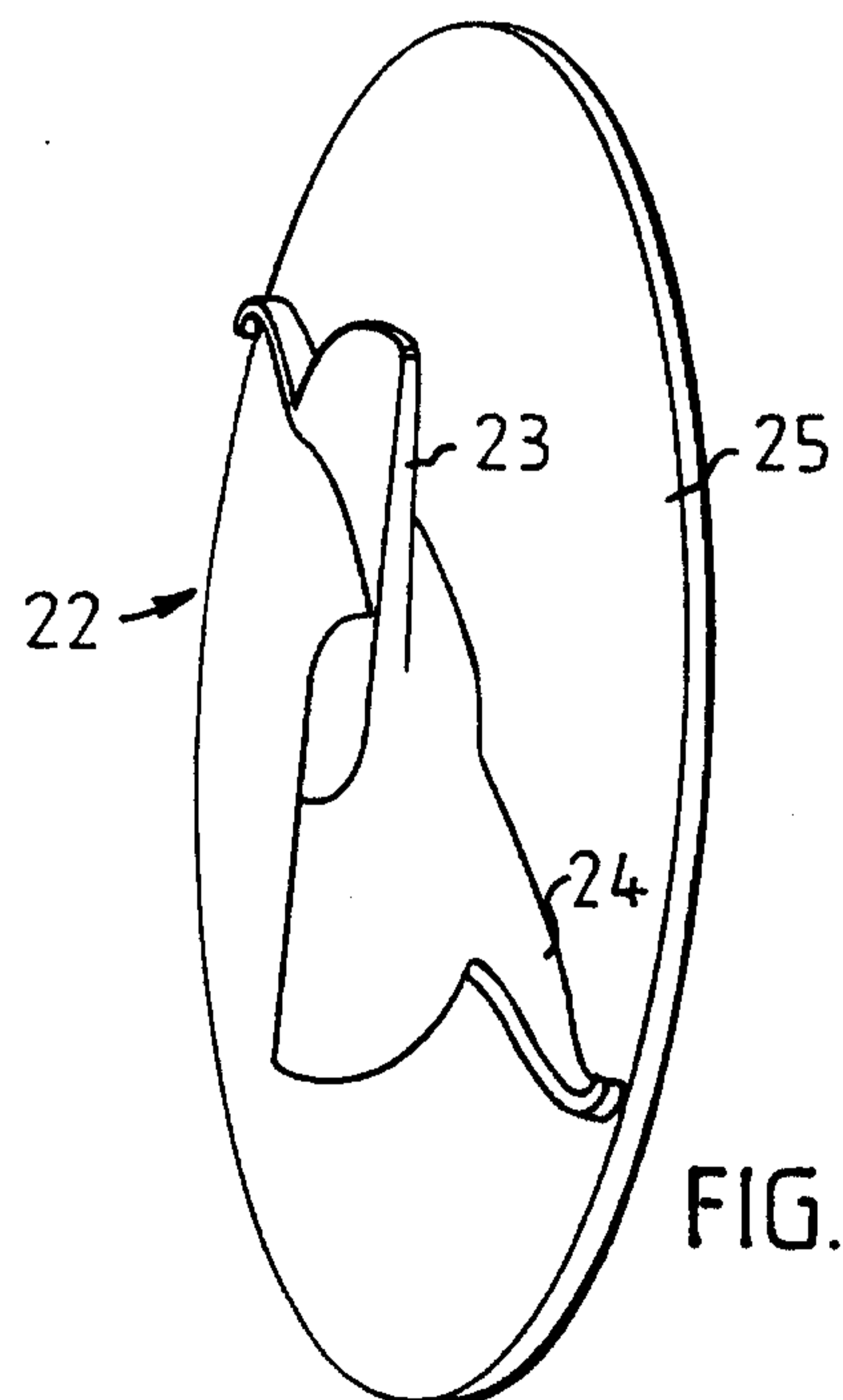


FIG. 2

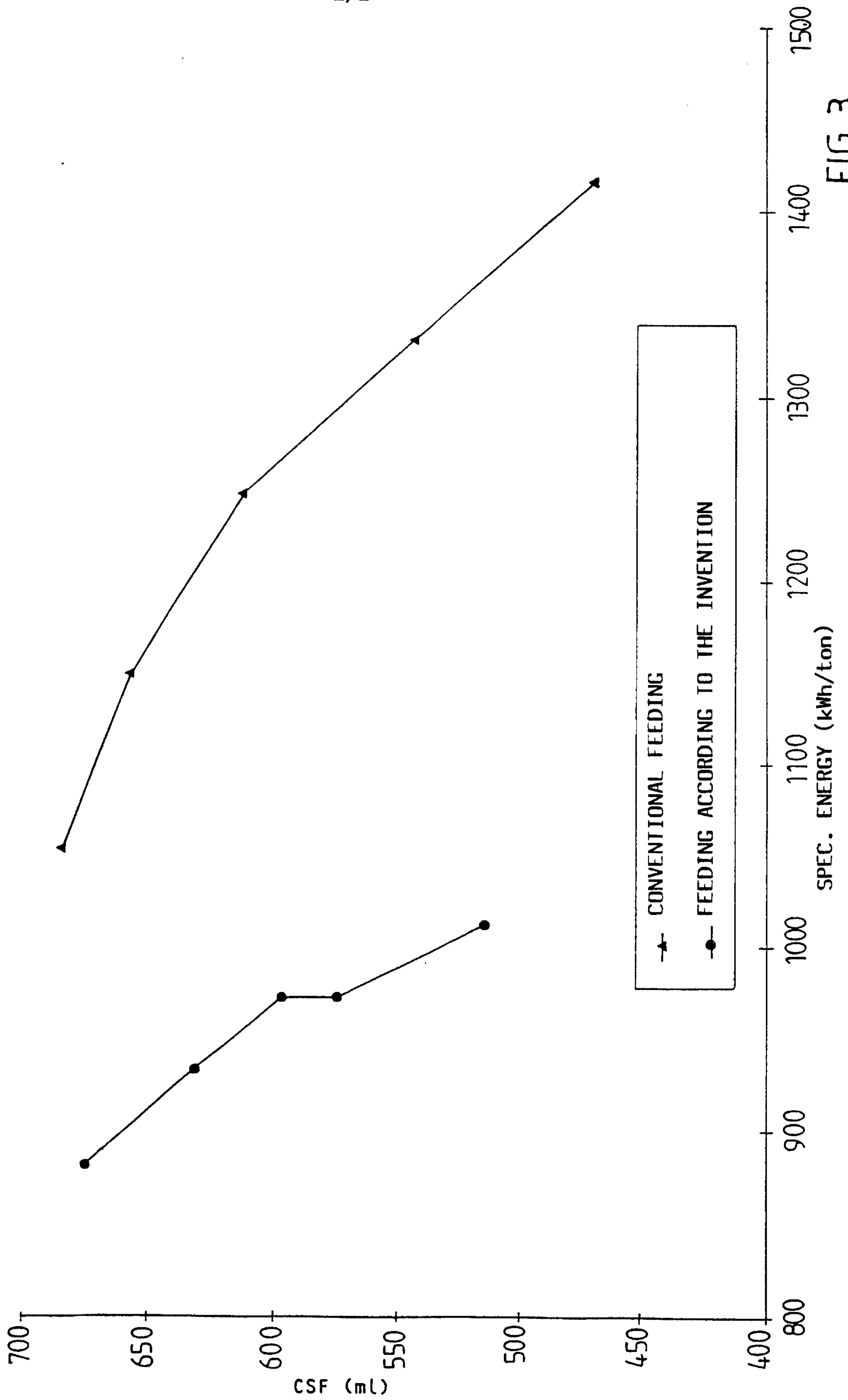


FIG. 3

