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

(72) Inventors; and
(75) Inventors/Applicants *(for US only) :* JOHANSSON, Johan, Gunnar, Inge [SE/SE]; Falkvägen 61, S-183 50 Täby (SE). REINHALL, Rolf, Bertil [SE/US]; P.O. Box 7299, Bellevue, WA 98007 (US). MOKVIST, Anders, Vilhelm [SE/US]; 9035 Preserve Boulevard, Eden Prairie, MN 55344 (US).

(74) Agent: ILLUM, Leif-Otto; Svenska Cellulosa Aktiebolaget SCA, Kungsgatan 33, S-111 56 Stockholm (SE).

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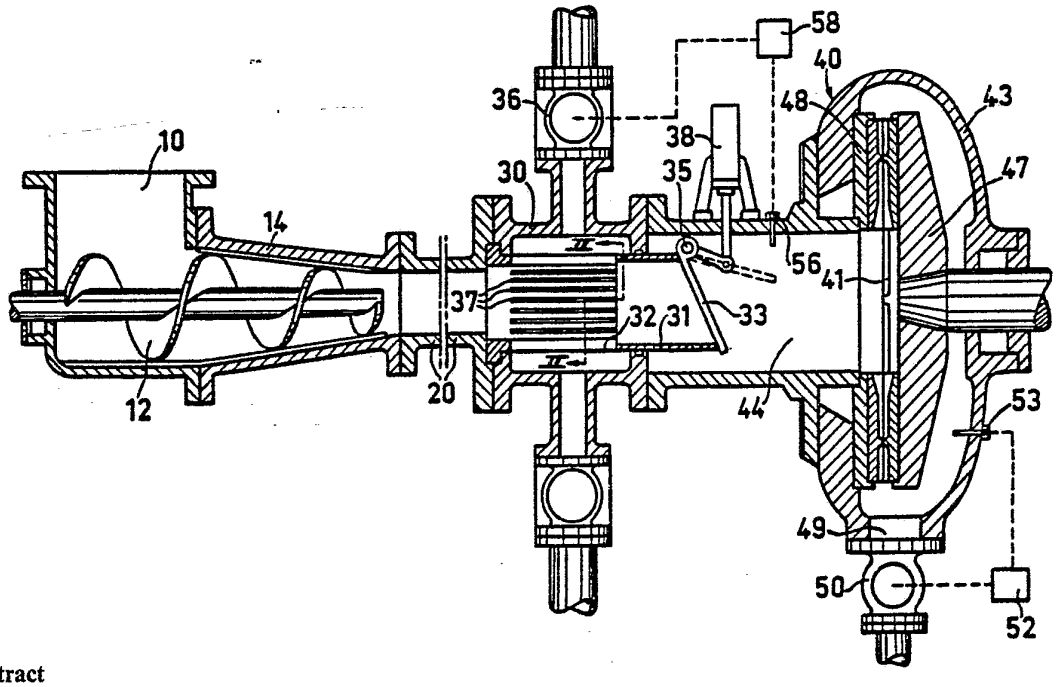
(54) Title: METHOD AND APPARATUS FOR MAKING FIBRE PULP



(57) Abstract

In a refiner (4) with two opposed discs (47, 48) rotatable relative to each other fibre pulp is manufactured from lignocellulose-containing material. The material is advanced in a channel comprising a plug pipe (20), through which the material is fed in compressed state, and a steam screen pipe (32) for discharging steam. The steam screen pipe (32) is located directly after the plug pipe (20) and has a cross-sectional area, which slightly exceeds that of the plug pipe in order to allow a limited expansion of the material plug. The steam is thereby allowed to flow through the material, at the same time as the material plug prevents clogging of the apertures (37, 39) of the steam screen pipe.

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Method and apparatus for making fibre pulp

This invention relates to a method and an apparatus for bleeding and cleaning steam generated or supplied at the making of fibre pulp from lignocellulose--containing material, for example soft- or hardwood chips, bamboo, straw, bagasse etc. The invention comprises mechanic disintegration of chemically processed or unprocessed material at increased temperature to fibrous state in a refiner comprising at least two discs, which are rotatable relative to one another and enclosed in an air-tight casing, and the surfaces of which have plane, conic or spherical design or a combination thereof. Opposed refiner discs, thus, may be rotatable in opposite directions, or one disc may be rotary and the other one stationary.

The mechanic disintegration of the material is carried out after the material has been fed to the refiner by means of a compressing feed screw, which forms the material to a plug capable to resist the stream pressure arising in the refiner. The disintegration or refining of the material requires a varying amount of electric or steam energy (50 - 3500 kWh/ton), depending on the type of fibre pulp being manufactured. The processing temperature normally is 100-250°C.

The energy amount supplied to the refiner for separating the material to fibres and, respectively, fibrils to a great extent is converted into heat whereby, owing to the evaporation of the water following along with the material, steam is generated in the disc gap. The steam amount generated at the higher energy charges is very great. In order to prevent the material thereby from assuming too high a dry content, it is known during the refining process proper to supply water to the disc

gap, so that a desired water content in the material is maintained and the material is not damaged by overheating.

It is also known to allow part of the steam amount generated at the refining to flow rearward, against the direction of the supplied material, through the feed opening of the refiner and to bleed the excess of this steam amount. Steam and material can thereby be separated by means of a steam screen, which is provided with mechanic scrapers for removing material particles, which have deposited on the steam screen, as disclosed in SE-PS 7700047-9.

According to the invention, the requirement of these scrapers is eliminated and has been replaced by a charging device, at which the supplied material itself removes fibres and other particles desposited on the steam screen.

The characterizing features of the invention become apparent from the claims.
In the following, some embodiments of the invention are described in greater detail, with reference to the accompanying drawings, in which

Fig. 1 is a schematic section of a refiner with a feed channel according to the invention,
Fig. 2 is a section according to II-II in Fig. 1 on an enlarged scale, and
Fig. 3 shows an alternative design of a portion of the feed channel.

In Fig. 1 the numeral 10 designates an inlet opening for the material to a screw feeder 14 comprising a feed screw 12, which compresses the material and feeds the material supplied to the process in comprssed state to a plug pipe 20. The said feed screw 12 thereby produces in known manner a sealing plug of the material,

so that a steam and/or gas pressure above atmospheric pressure can be maintained in the continuation of the feed channel extending to the refiner.

The material continuously supplied pushes the material compressed in the plug pipe 20 over to a steam screen pipe 32, which has a slightly greater area and is provided with apertures in the form of slits 37 or perforations 39. Steam can flow through these apertures out to an outer casing 30.

At the transfer of the material from the outer plug pipe 20 to the steam screen pipe 32 with slightly greater area, the material plug supplied is somewhat loosened, due to the increase in area. Steam can thereby flow rearward from the refiner and be discharged through the apertures 37,39, while the supplied material, owing to its remaining compression, presses against the slitted or perforated surfaces in the steam screen pipe 32. Material screened there and accumulated is thereby scraped off efficiently and flows along with the material to the refiner.

This scraping effect can be adjusted to desired contact pressure by means of a holder-on member 33 in the form of a cover, which co-operates with a pipe portion 31 in direct connection to the feed pipe 32. By means of a pressing device 38 and a lead-in axle 35, the holder-on member 33 can be pressed against the material fed-in. Said holder-on member 33 also acts as a protection against sudden steam outflow in rearward direction through the screw feeder 14, which outflow may be caused by disturbances in the material supply giving rise to too low a compression in the plug pipe 20.

The material supplied is thereafter pushed on into the inlet opening 44 of the refiner 40, from where it is

introduced by means of a central ejection wing 41 to the refiner discs 47 and 48 and the gap maintained therebetween. The material to be refined passes through the gap in outward direction to a surrounding air-tight refiner casing 43 and is thereby disintegrated so that the individual fibres and, respectively, fibrils are separated from each other entirely or partially.

The completely processed fibres and the greater part of the steam supplied or generated during the refining process are discharged from the refiner casing 43 through a discharge opening 49, to which a discharge device 50 is connected, which is controlled so that a desired steam pressure is maintained outside the refiner discs. This control is effected by a pressure-scanning member 53 and a control member 52 actuating the discharge device 50.

Part of the steam generated at the refining process flows from the inlet zone of the gap inward to the rotation centre and continues against the direction of the material entering the inlet opening 44. This steam is led away from the steam screen pipe 32 to the enclosing casing 30 through the slits 37 or perforations 39.

Particles of processed or unprocessed material which are taken along by the rearward directed steam flow are separated on the slitted or perforated inner screen surface of the steam screen pipe 32. At the same time, the material slidingly advancing on the screen surface and pressed against the same ensures, that the particles separated and deposited on the screen surface are scraped off and returned to the refining process. The apertures 37,39 in the steam screen pipe 32 are hereby maintained open all the time, so that clogging is prevented.

The casing 30 is provided with a discharge and pressure control valve 36, which by means of a pressure-scanning member 56

and a control member 58 maintains the steam pressure desired in the inlet zone of the refiner. The steam amount bleeding through the apertures 37,39 simultaneously has been freed from solid impurities, which may give rise to problems when the steam is being recycled in or outside the process.

In those cases when the steam screen pipe 32 is provided with slits 37, the slits preferably are designed axially so as to extend in parallel with the feed direction of the material. The slits further should be designed so that the slit width inward to the material is smaller than the slit width outward to the enclosing casing 30. Due to the fact, that the pipe portion 31 connected to the steam screen pipe 32 is designed with a slightly greater area than the steam screen pipe, and the slits 37 extend all the way to the pipe portion 31, the risk is reduced that particles accumulate at the end of the slits. Subsequent particles, thus, unobstructed by the pipe portion 31, take along from the end of the steam screen pipe 32 those particles, which may have penetrated a distance into the slits 37.

When the steam screen pipe 32 is designed with apertures in the form of perforations 39, the perforations should have an area increasing radially outward. The perforations, further, should be directed obliquely rearward, seen in the feed direction of the material. Hereby the risk of clogging is reduced. In order to reduce this risk still more, the perforations can be designed so that the leading edge of the hole is higher than the trailing edge, seen in the feed direction of the material.

The invention, of course, is not restricted to the embodiments described above, but can be varied within the scope of the invention idea.

Claims

1. A method of making fibre pulp from lignocellulose--containing material in a refiner comprising at least two opposed refäner discs rotatable relative to each other, where the material is fed through a channel all the way to the discs and disintegrated to fibre pulp while passing outward through a gap defined between the discs, and where by means of an air-tight material plug an overpressure is maintained in the channel before the gap, c h a r a c t e r i z e d i n that the material during its feed first is compressed to an air-tight plug, that the material plug thereafter is allowed to expand to a limited extent so that steam is allowed to flow through the material outward through apertures in the channel wall, whereby the advancement of the material along said wall prevents clogging of the apertures.

2. A method as defined in claim 1, c h a r a c t e r - i z e d i n that the expanded material plug presses against the channel wall, and this pressure is adjusted by throttling the material flow from said expanded plug.

3. An apparatus for making fibre pulp from lignocellulose--containing material, comprising a refiner (40) with at least two opposed refiner discs (47,48), which are rotatable relative to each other and between themselves form a gap, a feed channel for feeding the material to the gap comprising a plug pipe (20), through which the material is intended to be fed in compressed state, c h a r a c t e r i z e d i n that a steam screen pipe (32) provided with apertures (37,39) for leading away steam is located directly after the plug pipe (20), and the steam screen pipe (32) has a cross-sectional area, which slightly exceeds the cross-sectional area of the plug pipe (20).

4. An apparatus as defined in claim 3, c h a r a c t - e r i z e d i n that after the steam screen pipe (32) an adjustable holder-on member (33) is located, which controls the material flow and thereby the contact pressure of the material against the walls of the steam screen pipe (32).

5. An apparatus as defined in claim 3 or 4, c h a r - a c t e r i z e d i n that the apertures (37) are designed as slits directed axially and extending all the way to a subsequent channel portion (31) with greater cross-sectional area.

6. An apparatus as defined in claim 3 or 4, c h a r - a c t e r i z e d i n that the apertures (39) are designed as perforations with radially outward increasing hole area.

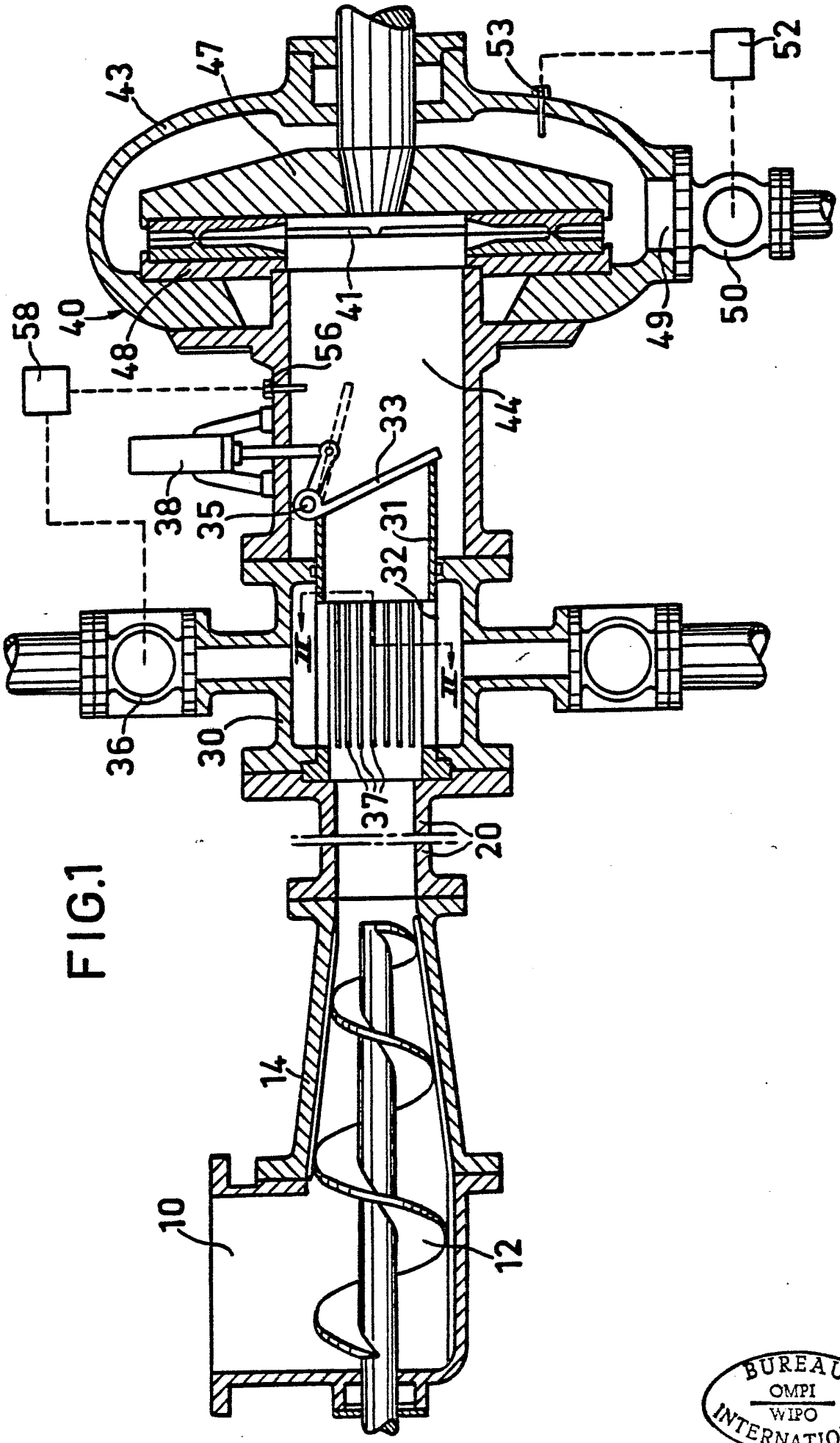


FIG.1

FIG.2

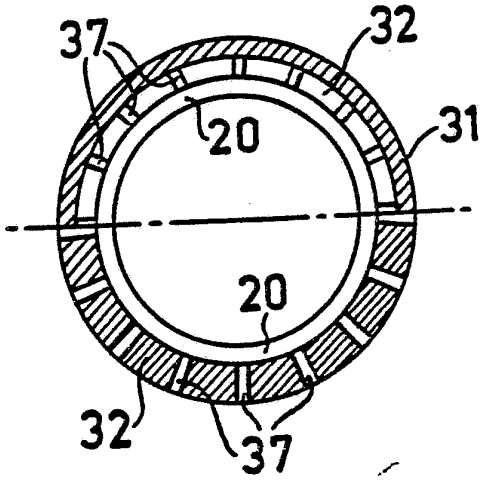
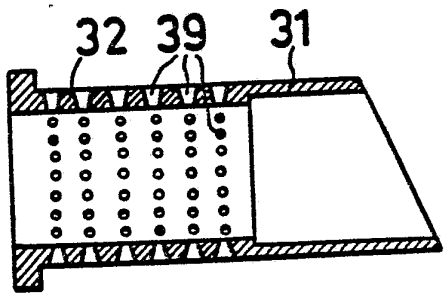


FIG.3



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE84/00120

I CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC 3

D 21 B 1/14, D 21 D 1/30

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	D 21 B 1/00, 1/02, 1/04, 1/12, 1/14, 1/26; D 21 D 1/00, 1/20, 1/30
National C	150c:16/01; 55c:9/01, 9/10 .../...

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	US, A, 4 037 792 (V.P. PETERSON) 26 July 1977 & SE, 368595	1, 3
A	US, A, 4 163 525 (R.B. REINHALL) 7 August 1979 & DE, 2757797 SE, 413522	1, 3, 5, 6
A	US, A, 4 283 252 (R.B. REINHALL) 11 August 1981 & DE, 2711567 SE, 419659	1, 2, 3, 4

* Special categories of cited documents: [15]

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

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"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 [3]	Date of Mailing of this International Search Report [3]
1984-07-12	1984 -07- 20
International Searching Authority [1]	Signature of Authorized Officer [20]
Swedish Patent Office	Klaus-Christian Korn

L.E.

Form PCT/ISA/210 (second sheet) (October 1981)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II Fields searched (cont).

US Cl 162:17, 23, 26, 46, 47, 261;
241:18, 21, 28, 146, 244-248, 251,
259.1-259.3, 261-261.3

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [10]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers....., because they relate to subject matter [13] not required to be searched by this Authority, namely:

2. ☐ Claim numbers....., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [13], specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.