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(54) **APPARATUS AND METHOD FOR PRODUCTION OF PULP**

VORRICHTUNG UND VERFAHREN ZUR HERSTELLUNG VON PAPIERSTOFF

APPAREIL ET PROCEDE DE PRODUCTION DE PATE A PAPIER

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(73) Proprietor: **Metso Paper, Inc.**
00101 Helsinki (FI)

(72) Inventor: **LUNDGREN, Baltsar**
S-856 51 Sundsvall (SE)

(74) Representative: **Holmberg, Martin Tor et al**
Bergenstrahle & Lindvall AB
P.O. Box 17704
118 93 Stockholm (SE)

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Description

[0001] The present invention relates to an apparatus for separating steam from a mixture of steam and fibres, and also a method for supplying a mixture of steam and fibres to an apparatus for separating steam from a mixture of steam and fibres.

[0002] Conventionally, a mixture of steam and fibres is supplied to a cyclone that separates a fraction of steam from a fraction of fibres and supplies the fraction of fibres to a feeding machine for further transportation of the fraction of fibres to a refiner in production of pulp. The cyclone has an outlet arranged radially against the circumference of the feeding machine for supplying the fraction of fibres in a direction against the centre of feeding machine. Steam is removed from an outlet in the centre of the cyclone and the fraction of fibres is added to the feeding machine. The feeding machine comprises a conveyor worm that brought the fraction of fibres further to a refiner.

[0003] However, clogging of the cyclone is a problem, although there exists screening devices in the cyclone that should prevent this. One reason is that the loading of fibres is large in the lower part of the cyclone. The clogging also depends on that extractive matters, that are extremely sticky, adheres to the fibres and easily makes them to create deposits in the cyclone. Yet a problem is that the residence time for the fibres in the cyclone might be far too long, whereby the fibres becomes discoloured undesirably much before they reach the subsequent refiner stage. This results in an increased need for bleaching.

[0004] WO-A-8808050 discloses a method and an installation at manufacture of fibre pulp lignocellulose material. The material in form of chips or the like is fed into a preheater. Pulp and steam flows through a blow pipe to a steam separator from which the pulp is discharged and the steam is returned to the preheater.

[0005] The present invention aims to accomplish a simple and improved separation of a mixture of fibres and steam, and thereby a more efficient and favourable feeding of fibres for further transportation to a refiner in production of pulp. Yet another object is to minimize the residence time of the fibres at separation of fibres and stem, and thereby avoid additional need for bleaching.

[0006] This object is achieved with the apparatus for separating steam from a mixture of steam and fibres according to claim 1. The apparatus comprises an elongated feeding compartment having an inlet arranged between the short sides of the elongated feeding compartment and feeding means for feeding a mixture of steam and fibres through said inlet. The feeding means comprises a tubular section which is curved such that the mixture of steam and fibres during passage in the tubular section is separated during influence of centrifugal forces in a substantially relatively heavy steam-less fraction of fibres in a radially outer layer and in a substantially light fibre-free fraction of steam in a radially inner layer. The tubular section is arranged in such a way that heavy fraction of fibres is fed through the inlet peripherally into the elongated feeding compartment of the apparatus, while the separated light fraction of steam is fed through the inlet against the centre of the elongated feeding compartment and removed through an outlet of the apparatus.

[0007] Through the design of the curved portion of the tubular section of the feeding means in accordance with the present invention, a more efficient and improved separation of fibres and steam can be done, without appreciably needing to change the design of apparatus. The invention makes it possible to totally eliminate the need for a cyclone for separation of steam and fibre, and also for supply of fibre to the apparatus. This results in that the residence time during transportation to subsequent refiner can be minimized, whereby the requirement for strengthened bleaching of the fibres can be avoided. Thus, according to the present invention the apparatus works as a combined feeding machine for fibres and simultaneously as a separator of steam.

[0008] Preferably, in an outer tubular portion of the feeding means, which outer portion is adjacent an opposite end compared to the end of the curved tubular section which is connected to the inlet, the feeding means has a substantially straight, linear and non-curved extension. The feeding means might extend substantially perpendicular to the longitudinal extension of the apparatus. However, the feeding means is suitably arranged with an inclined extension in relation to the longitudinal extension of the apparatus, which extension preferably forms an angle between 75-90°, and most preferable an angle between 80-85°, in relation to the longitudinal extension of the apparatus. The inlet of the feeding means is suitably arranged tangentially at the circumference of the apparatus. The inlet and the feeding means can have a circular, quadratic or rectangular cross-sectional area.

[0009] Preferably, the cross-sectional area of the inlet and the feeding means is quadratic or rectangular. A length of the curved section is adapted such that the velocity difference, between the velocity of the fibres in the feeding means in relation to the velocity of the conveyor worm in the apparatus, is minimized.

[0010] As mentioned above, both fibre and steam are fed to the apparatus. The mixture of steam and fibres is separated at passage in the curved tubular section, whereby a substantial relatively heavy steam-less fibre fraction forms a radially outer layer at the inlet that is fed peripherally in the apparatus. A substantially light fibre-free fraction of steam forms, at a passage in the curved tubular section, a radially inner layer that at the inlet is fed against the centre of the apparatus. Then the steam is removed from the centre of the apparatus through an axial outlet, or alternatively, through a radially outlet, arranged at the apparatus. The fraction of fibres at the circumference of the apparatus is conveyed further by way of a conveyor worm, arranged axially in the apparatus, against a subsequent refiner.

[0011] In the case the steam is discharged through a radially outlet at the apparatus, this is done from a rear

chamber arranged in the apparatus, where steam is flowing through a gap formed between the shaft of the apparatus and an inwards wall section radially extending from an inner surface in the apparatus.

[0012] The present invention also relates to a method for feeding a mixture of steam and fibres to an elongated feeding compartment of an apparatus for separating steam from a mixture of steam and fibres according to claim 8. The mixture of steam and fibres are fed via a feeding means through an inlet arranged between the short sides of the elongated feeding compartment. The feeding means comprises a tubular section which is curved, whereby the mixture of steam and fibres at passage in the tubular section is brought to separate during influence of centrifugal forces in a substantially relatively heavy steam-less fraction of fibres in a radially outer layer and in a substantially light fibre-free fraction of steam in a radially inner layer. The tubular section is arranged in such a way that heavy fraction of fibres is fed through the inlet peripherally into elongated feeding compartment of the apparatus, while the separated light fraction of steam is fed through the inlet against the centre of the elongated feeding compartment and removed through an outlet of the apparatus.

[0013] The present invention will now be described more detailed in embodiments, with reference to the accompanying drawings, without making a restricted interpretation of the invention thereto, where,

fig. 1A shows schematically an apparatus in a partly sectional longitudinal view,
fig. 1B shows schematically an apparatus in a partly sectional longitudinal view according to an alternative embodiment of the apparatus of fig. 1A, and
fig. 1C shows the apparatus according to fig. 1A and 1B in a cross-section A-A.

[0014] Corresponding features of the embodiments illustrated in the figs. have been denoted with the same reference numerals.

[0015] Fig. 1A-C shows an apparatus comprising feeding means 10 for feeding a mixture of steam and fibres to an elongated feeding compartment 12 according to the present invention. The feeding means 10 is arranged to an inlet 14 at the circumference 16 of the compartment 12. The inlet 14 is arranged between the short sides 15, 15' of the elongated feeding compartment 12, through which inlet steam and fibres are fed to the compartment 12. The feeding means comprises a tubular section 18, which is curved. The curved tubular section is arranged directly adjacent to the inlet, in connection to the circumference 16 of the elongated feeding compartment 12. The tubular section extends substantially in the radial direction R of the elongated feeding compartment 12. The mixture of steam and fibres, at passage in the curved tubular section 18 is separated during influence of centrifugal forces, in a direction of flow F, in a substantially relatively heavy steam-less fraction of fibres in a radially outer layer 20 that at the inlet is fed peripherally P in the elongated feeding compartment 12, and in a substantially light fibre-free fraction of steam in a radially inner layer 22 that at the inlet is fed against the centre C of the elongated feeding compartment 12.

[0016] As evident from the embodiment of the feeding machine 12 in fig. 1A, the steam that is brought towards the centre of the feeding machine is removed out through an axial outlet 23 arranged at the feeding machine. The fraction of fibres at the periphery of the feeding machine is conveyed further against a subsequent refiner, by way of a conveyor worm 25 arranged in the feeding machine

[0017] The feeding means has an elongated outer tubular portion 30 (see fig. 1C), which is adjacent an opposite end 31 compared to the end of the curved tubular section 18 that is connected to the inlet 14. Said outer tubular portion 30 has a substantially straight, linear non-curved extension H that, in the direction of flow F, passes into the curved section towards the inlet 14. The feeding means may extend substantially perpendicular to the longitudinal direction L of the elongated feeding compartment 12 of the apparatus, as shown in the drawings. However, the feeding means can suitably be arranged with a slightly obliquely extension in relation to the longitudinal extension of the apparatus. The inlet 14 is arranged tangentially at the periphery 16 of the elongated feeding compartment 12.

[0018] The curved tubular section 18 of the feeding means should have at least a curvature length that results in that all fibres that pass the straight outer portion 30 are caught by the curved section 18. The velocity of the fibres at the inlet may not be too high. By designing the curved section with a certain length of curvature, the curved section is thereby utilized to decrease the velocity of the fibres. Also the length B of the curved section is adapted such that the difference in velocity, between the velocity of the fibres in the feeding means in relation to the velocity of the conveyor worm in the elongated feeding compartment 12, is minimized. In order to provide for an effective separation of steam and fibres it is desirable, at ideal conditions, that a peripheral velocity for the fraction of steam and fibres at the inlet is substantially equal to the peripheral velocity of steam and fibres in the elongated feeding compartment 12.

[0019] Fig. 1B shows an alternative embodiment of the elongated feeding compartment 12 of the apparatus where the steam is removed through a radial outlet 24, instead of the axial outlet 23 in fig. 1A. In that respect the apparatus of fig. 1B comprises an inwards radially extending wall section 26 from an inner surface 16' in the elongated feeding compartment 12, that defines a rear chamber 27 arranged in the elongated feeding compartment 12 to which the radial outlet 24 is connected. The wall section is extending towards the shaft of elongated feeding compartment 12. There is a gap 28, between the outer end of the wall section and the shaft where the steam is flowing by and further out through the radial outlet 24. The fraction of fibres are fed in the opposite

direction by means of the conveyor worm 25 and are restrained to be brought into the rear chamber by the wall section.

Claims

1. Apparatus for separating steam from a mixture of steam and fibres, comprising an elongated feeding compartment (12) having an inlet (14) arranged between the short sides (15, 15') of the elongated feeding compartment (12) and feeding means (10) for feeding a mixture of steam and fibres through said inlet (14) and a conveyor worm (25) arranged axially in the feeding compartment (12) for feeding of fibres, **characterized in that** the feeding means (10) comprises a tubular section (18) which is curved such that the mixture of steam and fibres during passage in the tubular section (18) is separated during influence of centrifugal forces in a substantially relatively heavy steam-less fraction of fibres in a radially outer layer (20) and in a substantially light fibre-free fraction of steam in a radially inner layer (22), the tubular section is arranged in such a way that the heavy fraction of fibres is fed through the inlet (14) peripherally (P) into the elongated feeding compartment (12) of the apparatus, where the separated fraction of fibres is conveyed further by means of the conveyer worm (25), while the separated light fraction of steam is fed through the inlet (14) against the centre (C) of the elongated feeding compartment (12) and removed through an outlet (23,24) of the apparatus.

2. Apparatus according to claim 1, **characterized in that** the tubular section (18) is adapted such that the difference in velocity, between the velocity of the fibres in the feeding means (10) in relation to the velocity of the conveyor worm (25) arranged in the elongated feeding compartment (12), is minimized.

3. Apparatus according to claim 1 or 2, **characterized in that** the apparatus comprises an inwards radially extending wall section (26) from an inner surface (16') in the elongated feeding compartment (12), that defines a rear chamber (27) in the apparatus to which the radial outlet (24) is connected, through which outlet (24) the steam is removed.

4. Apparatus according to any of the preceding claims, **characterized in that** the feeding means (10) has a substantially straight, linear elongated outer tubular portion (30), having an extension (H), which outer portion (30) is positioned adjacent an opposite end (31) compared to the end of the curved tubular section (18) that is connected to the inlet (14).

5. Apparatus according to claim 4, **characterized in that** the extension (H) of the feeding means (10) forms an angle between 75-90° in relation to the longitudinal extension (L) of the apparatus.

6. Apparatus according to any of the preceding claims, **characterized in that** the inlet (14) is arranged tangentially at the periphery (16) of the apparatus.

7. Apparatus according to any of the preceding claims, **characterized in that** the cross-sectional area of the inlet (14) and the feeding means (10) is quadratic or rectangular.

8. A method for feeding a mixture of steam and fibres to an elongated feeding compartment (12) of an apparatus for separating steam from a mixture of steam and fibres, where the mixture of steam and fibres are fed via a feeding means (10) through an inlet (14) arranged between the short sides (15, 15') of the elongated feeding compartment (12), and where the fibres are conveyed further by means of a conveyor worm (25) arranged axially in the feeding compartment (12), **characterized in that** the feeding means (10) comprises a tubular section (18) which is curved, whereby the mixture of steam and fibres at passage in the tubular section (18) is brought to separate during influence of centrifugal forces in a substantially relatively heavy steam-less fraction of fibres in a radially outer layer (20) and in a substantially light fibre-free fraction of steam in a radially inner layer (22), the tubular section is arranged in such a way that the heavy fraction of fibres is fed through the inlet (14) peripherally (P) into the elongated feeding compartment (12) of the apparatus, where the separated fraction of fibres is conveyed further by means of the conveyer worm (25), while the separated light fraction of steam is fed through the inlet (14) against the centre (C) of the elongated feeding compartment (12) and removed through an outlet (23,24) of the apparatus.

Patentansprüche

1. Vorrichtung zum Abscheiden von Dampf aus einem Gemisch von Dampf und Fasern, umfassend ein längliches Zuführabteil (12) mit einem Einlass (14), der zwischen den kurzen Seiten (15, 15') des länglichen Zuführabteils (12) angeordnet ist, und Zuführmittel (10) zum Zuführen eines Gemisches von Dampf und Fasern durch den Einlass (14) und eine Förderschnecke (25), die axial in dem Zuführabteil (12) zum Zuführen von Fasern angeordnet ist, **dadurch gekennzeichnet, dass** das Zuführmittel (10) einen rohrförmigen Abschnitt (18) umfasst, welcher derart gekrümmt ist, dass das Gemisch von Dampf und Fasern während des Durchtritts in dem rohrförmigen Abschnitt (18) unter Einfluss von Zentrifugal-

kräften in einen im Wesentlichen relativ schweren dampflosen Anteil von Fasern in einer radial äußeren Lage (20) und in einen im Wesentlichen leichten faserfreien Anteil von Dampf in einer radial inneren Lage (22) getrennt wird, wobei der rohrförmige Abschnitt in solch einer Weise angeordnet ist, dass der schwere Anteil von Fasern durch den Einlass (14) peripher (P) in das längliche Zuführabteil (12) der Vorrichtung zugeführt wird, wo der abgetrennte Anteil der Fasern weiter mittels der Förderschnecke (25) gefördert wird, während der abgetrennte leichte Anteil von Dampf durch den Einlass (14) gegen das Zentrum (C) des länglichen Zuführabteils (12) zugeführt wird und durch einen Auslass (23, 24) der Vorrichtung entfernt wird.

2. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der rohrförmige Abschnitt (18) derart angepasst ist, dass die Geschwindigkeitsdifferenz zwischen der Geschwindigkeit der Fasern in dem Zuführmittel (10) in Bezug auf die Geschwindigkeit der Förderschnecke (25), die in dem länglichen Zuführabteil (12) angeordnet ist, minimiert ist.

3. Vorrichtung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Vorrichtung einen sich einwärts radial von einer inneren Oberfläche (16') erstreckenden Wandabschnitt (26) in dem länglichen Zuführabteil (12) umfasst, der eine hintere Kammer (27) in der Vorrichtung begrenzt, an welchem der radiale Auslass (24) angeschlossen ist, durch welchen Auslass (24) der Dampf entfernt wird.

4. Vorrichtung gemäß irgendeinem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Zuführmittel (10) einen im Wesentlichen geraden, linear länglichen äußeren rohrförmigen Abschnitt (30) aufweist, der eine Verlängerung (H) aufweist, wobei der äußere Abschnitt (30) neben einem gegenüberliegenden Ende (31) gegenüber dem Ende des gekrümmten rohrförmigen Abschnitts (18) positioniert ist, das an dem Einlass (14) angeschlossen ist.

5. Vorrichtung gemäß Anspruch 4, **dadurch gekennzeichnet, dass** die Verlängerung (H) des Zuführmittels (10) einen Winkel zwischen 75-90° in Relation zu der Längserstreckung (L) der Vorrichtung ausbildet.

6. Vorrichtung gemäß irgendeinem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Einlass (14) tangential an dem Umfang (16) der Vorrichtung angeordnet ist.

7. Vorrichtung gemäß irgendeinem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Querschnittsfläche des Einlasses (14) und des Zuführmittels (10) quadratisch oder rechteckig ist.

8. Verfahren zum Zuführen eines Gemisches von Dampf und Fasern zu einem länglichen Zuführabteil (12) einer Vorrichtung zum Abscheiden von Dampf aus einem Gemisch von Dampf und Fasern, wobei das Gemisch von Dampf und Fasern über ein Zuführmittel (10) durch einen Einlass (14) zugeführt wird, der zwischen den kurzen Seiten (15, 15') des länglichen Zuführabteils (12) angeordnet ist, und wobei die Fasern ferner mittels einer Förderschnecke (25) gefördert werden, die axial in dem Zuführabteil (12) angeordnet ist, **dadurch gekennzeichnet, dass** das Zuführmittel (10) einen rohrförmigen Abschnitt (18) umfasst, welcher gekrümmt ist, wodurch das Gemisch von Dampf und Fasern beim Durchtritt in den rohrförmigen Abschnitt (18) zur Abscheidung während des Einflusses von Zentrifugalkräften in einen im Wesentlichen relativ schweren dampflosen Anteil von Fasern in einer radial äußeren Lage (20) und in einen im Wesentlichen leichten faserfreien Anteil von Dampf in einer radial inneren Lage (22) gebracht wird, wobei der rohrförmige Abschnitt in solch einer Weise angeordnet ist, dass der schwere Anteil von Fasern durch den Einlass (14) peripher (P) in das längliche Zuführabteil (12) der Vorrichtung zugeführt wird, wo der abgeschiedene Anteil von Fasern weiter mittels der Förderschnecke (25) gefördert wird, während der abgeschiedene leichte Anteil von Dampf durch den Einlass (14) gegen das Zentrum (C) des länglichen Zuführabteils (12) zugeführt und durch einen Auslass (23, 24) der Vorrichtung entfernt wird.

Revendications

1. Appareil pour séparer la vapeur d'eau d' un mélange de vapeur d'eau et de fibres, comprenant un compartiment d'alimentation de forme allongée (12) comportant un orifice d'admission (14) disposé entre les petits côtés (15, 15') du compartiment d'alimentation de forme allongée (12) et des moyens d'alimentation (10) pour fournir un mélange de vapeur d'eau et de fibres par ledit orifice d'admission (14) et une vis sans fin transporteuse (25) disposée axialement dans le compartiment d'alimentation (12) pour une alimentation en fibres, **caractérisé en ce que** les moyens d'alimentation (10) comportent une section tubulaire (18) qui est courbée de telle sorte que le mélange de vapeur d'eau et de fibres pendant un passage dans la section tubulaire (18) est séparé sous l'influence des forces centrifuges en une fraction essentiellement dépourvue de vapeur, relativement lourde, de fibres dans une couche extérieure de façon radiale (20) et en une fraction légère, essentiellement exempte de fibres, de vapeur dans une couche intérieure de façon radiale (22), la section

tubulaire est agencée de telle manière que la fraction lourde de fibres soit fournie à travers l'orifice d'admission (14) de façon périphérique (P) dans le compartiment d'alimentation de forme allongée (12) de l'appareil, dans lequel la fraction séparée de fibres est, de plus, acheminée au moyen de la vis sans fin transporteuse (25), tandis que la fraction légère séparée de vapeur est fournie par l'orifice d'admission (14) contre le centre (C) du compartiment d'alimentation de forme allongée (12) et évacuée par un orifice de sortie (23, 24) de l'appareil.

2. Dispositif selon la revendication 1, **caractérisé en ce que** la section tubulaire (18) est adaptée de telle façon que la différence de vitesse, entre la vitesse des fibres dans les moyens d'alimentation (10) par rapport à la vitesse de la vis sans fin transporteuse (25) disposée dans le compartiment: d'alimentation de forme allongée (12), soit réduite au minimum.

3. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** le dispositif comporte une section de paroi s'étendant radialement vers l'intérieur (26) à partir d'une surface intérieure (16') du compartiment d'alimentation de forme allongée (12), laquelle définit une chambre arrière (27) dans l'appareil à laquelle l'orifice de sortie radial (24) est raccordé, orifice de sortie (24) par lequel la vapeur d'eau est évacuée.

4. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les moyens d'alimentation (10) possèdent une partie tubulaire extérieure, de forme allongée, linéaire essentiellement rectiligne comportant une extension (H), laquelle partie extérieure (30) est placée de façon adjacente à une extrémité opposée (31) par rapport à l'extrémité de la section tubulaire courbe (18) qui est raccordée à l'orifice d'admission (14).

5. Appareil selon la revendication 4, **caractérisé en ce que** l'extension (H) des moyens d'alimentation (10) forme un angle compris entre 75 et 90° par rapport à l'extension longitudinale (L) de l'appareil.

6. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'orifice d'admission. (14) est disposé tangentiellement au niveau de la périphérie (16) de l'appareil.

7. Appareil selon l'une quelconque des revendications précédentes; **caractérisé en ce que** la surface de section transversale de l'orifice d'admission (14) et des moyens d'alimentation (10) est carrée ou rectangulaire.

8. Procédé pour fournir un mélange de vapeur d'eau et de fibres à un compartiment d'alimentation de forme allongée (12) d'un appareil permettant de séparer la vapeur d'eau d'un mélange de vapeur d'eau et de fibres, dans lequel le mélange de vapeur d'eau et de fibres est fourni par l'intermédiaire de moyens d'alimentation (10) à travers un orifice d'admission (14) disposé entre les petits côtés (15, 15') du compartiment d'alimentation de forme allongée (12), et dans lequel les fibres sont transportées, de plus, au moyen d'une vis sans fin transporteuse (25) disposée axialement dans le compartiment d'alimentation (12), **caractérisé en ce que** les moyens d'alimentation (10) comportent une section tubulaire (18) qui est courbe, de sorte que le mélange de vapeur d'eau et de fibres au niveau du passage dans la section tubulaire (18) est amené à se séparer sous l'influence des forces centrifuges en une fraction de fibres essentiellement dépourvue de vapeur d'eau, relativement lourde, dans une couche extérieure de façon radiale (20) et en une fraction légère de vapeur d'eau, essentiellement dépourvue de fibres, dans une couche intérieure de façon radiale (22), **en ce que** la section tubulaire est agencée de telle sorte que la fraction lourde de fibres est fournie à travers l'orifice d'admission (14) de façon périphérique (P) dans le compartiment d'alimentation de forme allongée (12) de l'appareil, dans lequel la fraction séparée de fibres est acheminée, de plus, au moyen de la vis sans fin transporteuse (25), tandis que la fraction légère séparée de vapeur d'eau est fournie à travers l'orifice d'admission (14) contre le centre (C) du compartiment d'alimentation de forme allongée (12) et évacuée par un orifice de sortie (23, 24) de l'appareil.

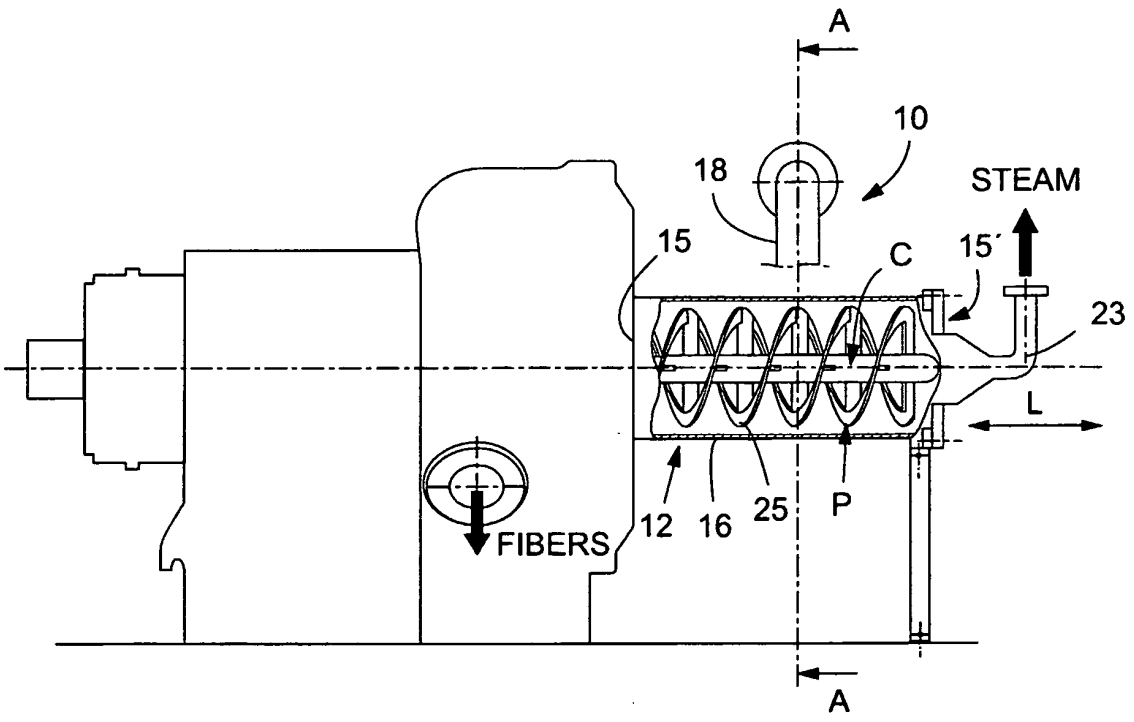
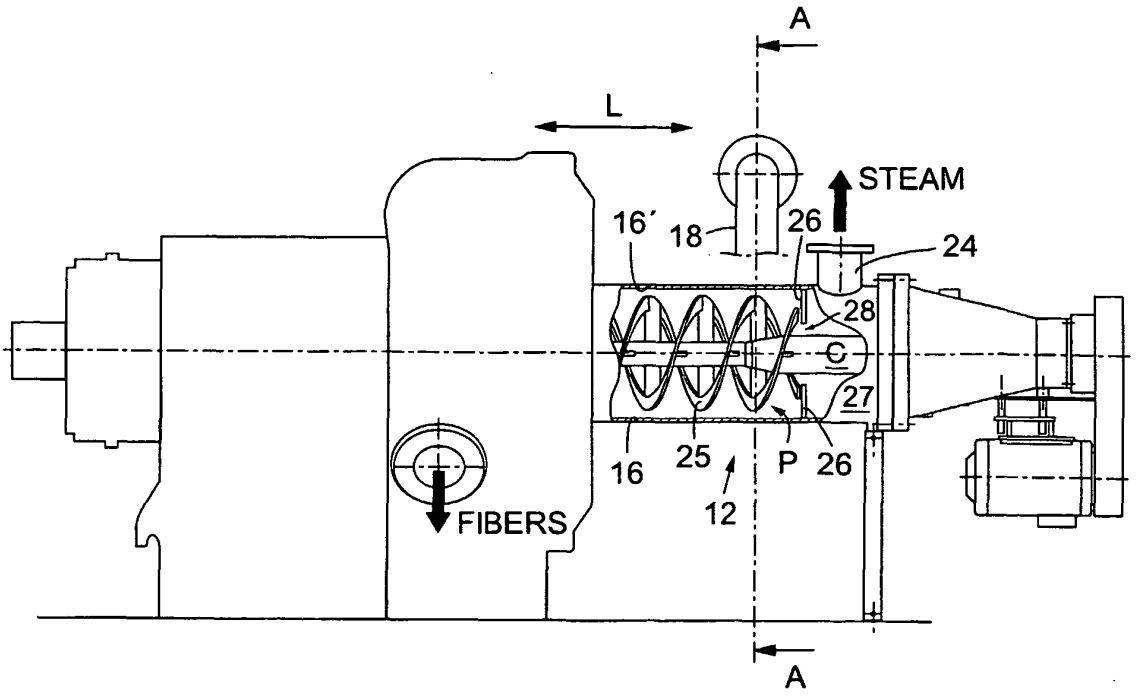


Fig.1A


A
L
STEAM
16'
18
26
24
28
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27
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25
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26
12
FIBERS
A

Fig.1B

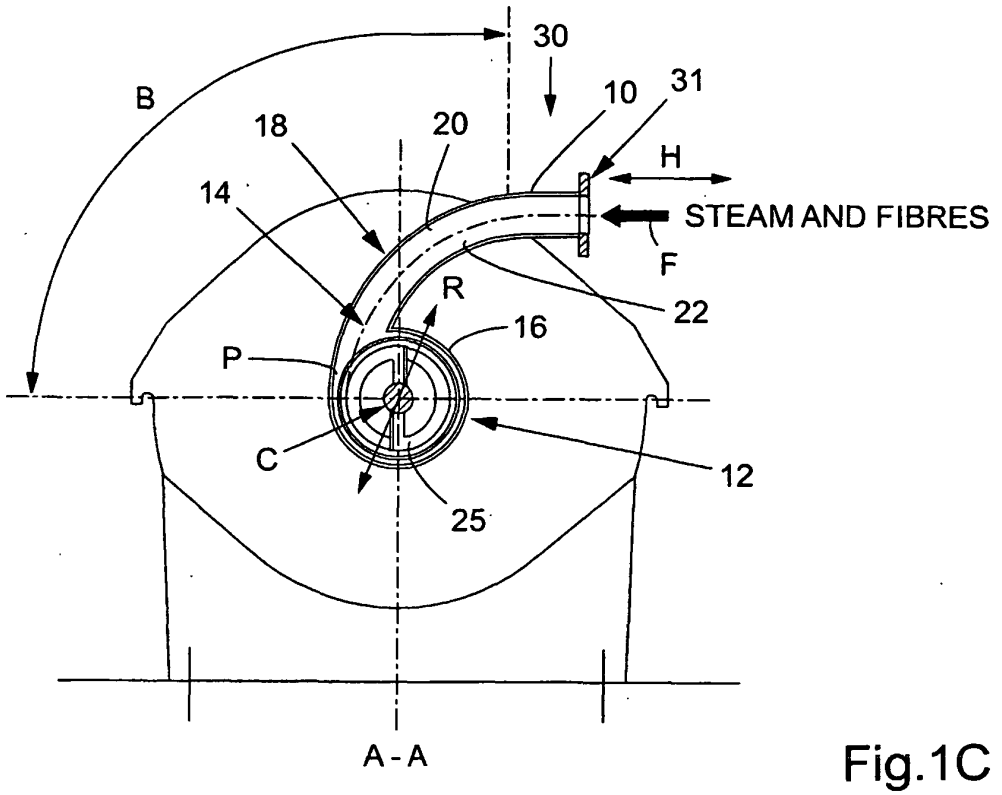
30
B
10
31
18
20
H
14
STEAM AND FIBRES
F
R
22
16
P
C
12
25
A - A

Fig.1C

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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