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54 An apparatus for reducing the amount of water in a moist and watery material web.

57 The present invention relates to an apparatus for reducing the amount of water in a moist and watery material web (1), primarily a fiber web in a machine for the manufacture of paper, by means of one or more press nips (4, 6, 7), each being provided between a press roller (3, 8, 9) and a roller-formed body (5), which at least to a certain part being deformable for controlling of the length of said press nips (4, 6, 7).

One object of the present invention is to reduce the inconveniences inherent in prior art methods and arrangements for realizing an extended press nip and, in general terms, to improve the pressing-out of moisture and water from a material web without realizing any deterioration of the quality of the material web.

This object is achieved according to the present invention in that said roller-formed body being a central roller (5) in cooperation with at least three satellite rollers (3, 8, 9) positioned around the central roller (5) for positioning said roller (5) in a balanced condition, in that said press nip (4, 6, 7) being provided between at least one of said satellite rollers (3, 8, 9) and said roller-formed central roller (5) and in that the pressure between said satellite roller (3, 8, 9) and said roller-formed central roller (5) being controllable almost independently of the length of the press nip (4, 6, 7), provided by the deformation, by a change of the pressure inside said roller-formed body (5).

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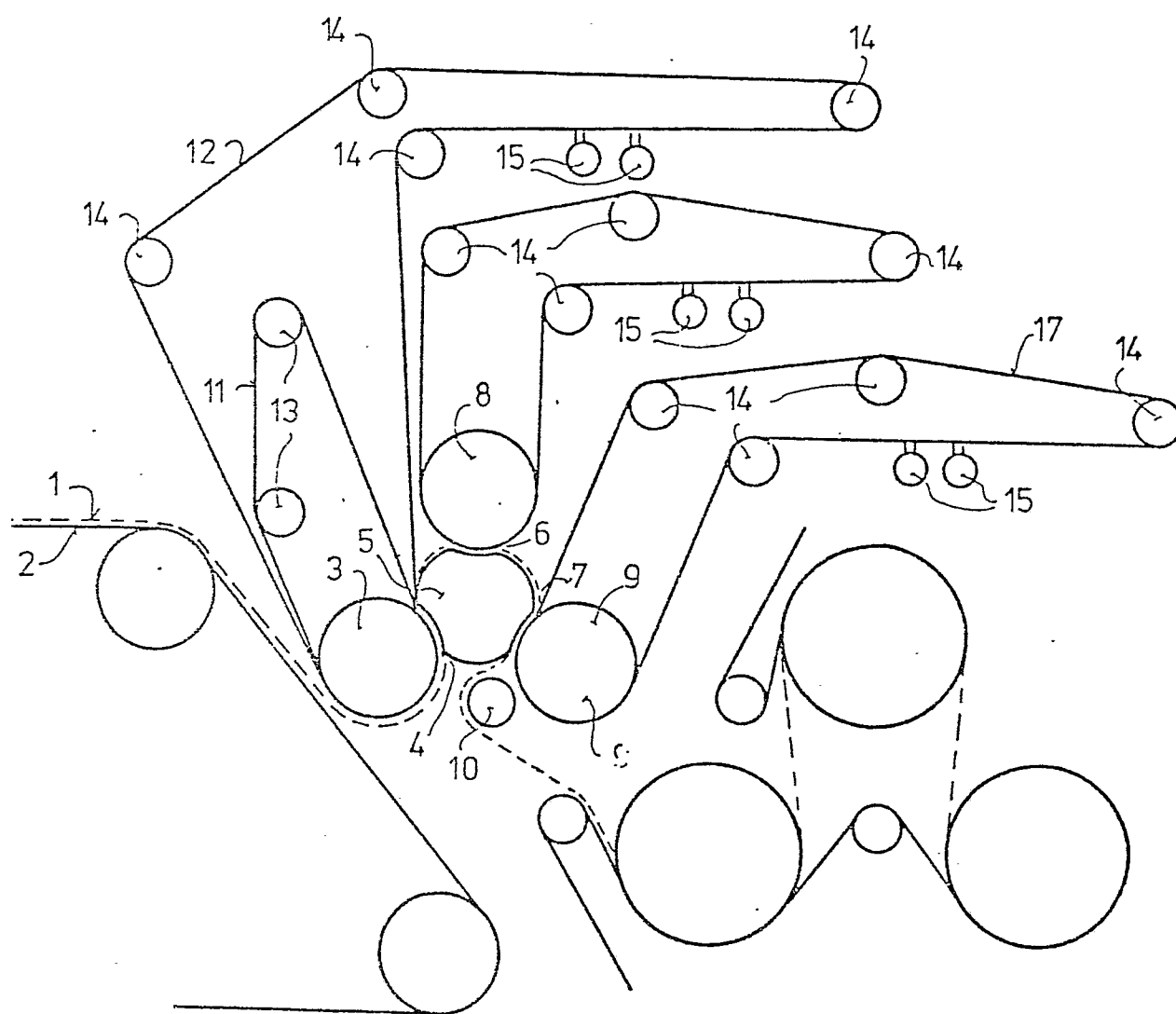


Fig 1

TITLE

An apparatus for reducing the amount of water in a moist and watery material web.

TECNICAL FIELD

5 The present invention relates to an apparatus for reducing the amount of water in a moist and watery material web, by means of one or more press nips, each being provided between a press roller and a roller-formed body, which at least to a certain part being
10 deformable for controlling of the length of said press nip.

THE STATE OF THE ART

 In, for example, a paper or cellulose machine, dewatering or demoisturizing of a moist and watery fibre
15 web, which in such an event consists of a paper web, is carried out in the press section of the machine, after transfer of the web from the forming section of the machine. In the transfer from the forming section to the press section, the paper web has a relatively low dry
20 solids content. It is desirable to remove as much water as possible from the paper web in the press section, since subsequent dewatering by drying in a subsequent drying section in the machine is conserably more expensive.

 In the press section, a plurality of press nips
25 are normally provided which are formed of two cooperating rollers. It is also possible that the one of the rollers is provided with a suction zone for facilitating the removal of water from the fibre web. The moist fibre web is transported and moved through the
30 press nip by means of one or more press felts and possibly also a press fabric. The press nip formed between the two press rollers has, because of the contact between the rollers, theoretically the form of a line in the axial direction of the rollers and, because of a certain
35 compression as a result of the compression pressure, the line has a certain width. Thereby, the press nip may be considered as having a certain length in a direc-



tion at right angles to the axial direction of the rollers and a narrow press zone is thereby formed. The compression pressure in the zone runs from zero rapidly up to a maximum level and thereafter rapidly falls off to zero.

5 Because of the rapidly increasing compression pressure, hydraulic counter-pressure can be built up in the felt because this is not capable of storing and conveying off the amount of water which, during a very short time, is pressed out from the fibre web. When this hydraulic counter-
10 ter-pressure reaches a certain level, so-called crushing occurs in the paper web, and, consequently, the compression pressure and/or the machine speed must be reduced with a consequential reduction of production. The production capacity of a paper machine is, thus, dependent
15 upon the size of the hydraulic counter-pressure in the felt which, in its turn, is dependent upon the compression pressure and the machine speed.

Consequently, several methods have been developed for reducing the hydraulic counter-pressure. The fabric
20 ric press with an incompressible fabric is one method; another method is the application of a combination felt in which the base portion proper is incompressible and is open in order to allow for storage and removal of the pressed-out water.

25 A further method is to extend the press nip or press nip period, that is to say that period during which the fibre web is subjected to compression pressure. According to this method, it is attempted to exercise compression pressure for a longer period of time than in normal press
30 nips. This methodology has also been developed for making possible the application of one-step pressing, that is to say a reduction of the number of press units to a sole unit as a result of the extended pressing period.

In one of the prior art apparatuses, the extended
35 press nip is realised in that one or more press belts cooperate with a press roller. The moist and watery paper web is introduced between the press belt and the press roller together with a press fabric and possibly also a press fabric.

The compression pressure between the press belt and the press roller must amount to approximately 2-3MPa for attaining the desired dewatering effect. For attaining such a high compression pressure, the specific
5 tensile force in the press belt will be very high and great difficulties have been experienced in being able to manufacture a press belt which permits of such high compression pressure. If the diameter of the press roller is 1,5 m, the press belt must, for attaining the above-
10 mentioned compression pressure, be able to tolerate a tensile force of 1,5-2,3 MN/m. This has entailed that such apparatuses for realising extended press nip have not come into practical utilisation. The great tensile force in the press belt also entails a risk for bending
15 the pivot rollers of the press belt, which in its turn entails an uneven distribution of the compression pressure in the press nip.

U S Patent Specification No 3 808 096 describes an arrangement with an extended press nip which consists of
20 a press roller and an endless belt. The endless belt forms an enclosed compartment for accommodating a liquid under excess pressure. The pivot rollers are disposed within the belt for retaining it in operative position. The position on the rollers determines the length of
25 the press nip and this cannot be changed without a replacement of the press belt. This entails a great inconvenience in being able to regulate the length of the press nip. Since the press nip is of great length, there is a risk for permanent compression of the paper web,
30 whereby this obtains a resultant poor bulk. When the press nip is of slight length, the specific compression pressure must be raised for obtaining the same dewatering capacity, which entails a risk for crushing both the paper web and the press felt.

35 U S Patent Specification No 3 293 121 describes an arrangement with a deformable roller-like body positioned between two rollers. The deformable roller-like body provides together with one of the rollers an extended press nip controlling in length and pressure. The roller-like

body has to be journalled in the frame of the machine in order to be positioned and the moments provided during the operation of the roller-like body has to be transfered from the envelope surface of the body to the shaft of
5 the body. Because of the deformable nature of the roller-like body the only possible connection between the envelope surface and the shaft is via the gables. These gables has to be flexible in order that their form has to follow the form of the roller-like body. This is one of the main
10 problems with the arrangement described in the above mentioned patent.

TECHNICAL PROBLEM

It is desirable to reduce the inconvenienses inherent in prior art methods and arrangements for realizing an
15 extended press nip and, in general terms, to improve the pressing-out of moisture and water from a fiber web without any resultant deterioration of its quality.

Particulaly it is desirable to cancel the use of press bands because of the high demands on the tension
20 strength of the press band creating both manufacturing problems and problems with the stiffness of the rollers carrying the band in operation.

Furthermore, it is desirable to use a deformable roller-like body without the practical inconvenienses
25 with the tranfering of driving moment from the envelope surface to a journalled shaft.

SOLUTION

According to the present invention the above-outlined technical problem frame work is solved in that
30 the apparatus disclosed by way of introduction is characterized in that said roller-formed body being a central roller in cooperation with at least three satellite rollers positioned around the central roller for positioning said roller in a balanced condition, in that said press nip
35 being provided between at least one of said satellite rollers and said roller-formed central roller and in that the pressure between said satellite roller and said roller-

formed central roller being controllable almost independently of the length of the press nip, provided by the deformation, by a change of the pressure inside said roller-formed body.

5 ADVANTAGES

 In an apparatus according to the present invention, the roller-like body needs no pivot rollers which, as a result of bending, may give rise to uneven compression pressure.

10 According to the present invention, the roller-like body is constructed such that an increase in pressure at normal excess pressure merely entails a very slight change of the size of the press nip. Completely independently of the pressure the length of the press nip is adjustable
15 by a regulation of the distance between the fixed press rollers.

 The arrangement according to the present invention permits that the roller-like body need not be fixedly disposed between the press rollers, by which is meant fixedly
20 journalled. Merely side blocks need be disposed at the ends of the roller-like body in order to prevent it from "wandering" in an axial direction.

 With several press rollers and one roller-like body, the press nip may optionally be divided up into
25 several small press zones or one single long press zone. The different press zones may be individually felted, that is to say different felts run through the different zones, whereby the dewatering capacity is increased.

 The arrangement according to the present invention
30 permits also substantially vibration-free operation and places low requirements on space.

 When three press rollers are placed with equal angular spacing, three press nips will be obtained of the same length and compression pressure. By means of extra support rollers
35 on the roller-like body, the length and pressure in the different press nips may be regulated separately. This can be appropriate for reducing or lowering the length and pressure in the first press nip.

In that the roller-like body is deformable, the risk of burning the felt because of the collection of wadding ahead of the press nip will be reduced, since the passage of wadding is allowed because of the deformation capacity of the roller-like body. The press nip may also be considered as flexible to a certain degree, whereby the felt is not broken up by pulp waste which, in conventional apparatuses, often penetrate into the felt.

The roller-like body according to the invention may be divided into different compartments and these may contain different media. The division of the interior of the roller-like body into different compartments results in spaces of small volume, whereby the risks in possible leakage are to a great extent obviated.

DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Fig 1 schematically shows a side elevation of an embodiment of an apparatus according to the present invention. Fig 2 schematically shows a side elevation of a further embodiment of an apparatus according to the present invention. Fig 3 shows, on a larger scale, a schematic part side elevation of the embodiment of the present invention shown in fig 1. Fig 4 shows, on a larger scale, a schematic side elevation of yet another embodiment of the apparatus according to the present invention. Fig 5 shows, on a larger scale, a schematic side elevation of still a further embodiment of the apparatus according to the present invention. Fig 6 shows, on a larger scale, a schematic side elevation of a further embodiment of the apparatus according to the present invention. Fig 7 shows, on a larger scale, a schematic side elevation of a further embodiment of the apparatus according to the present invention.

The embodiment of the apparatus according to the present invention shown in fig 1 forms a press section in a paper machine, parts of the forming section and a drying section of the paper machine being also shown.

On a forming fabric 2, which comes from the forming section, a fibre web 1 is formed. The continuous fibre

web is removed from the fabric 2 by means of a pick-up roller 3. The fibre web 1 runs around the roller 3 into a first press nip 4 between the press roller 3 and a roller-like body 5. By means of further press rollers 8 and 9, furtherpress nips 6 and 7 are arranged against the roller-like body 5. The fibre web 1 passes the press nips 4, 6 and 7 and leaves the press section by the intermediary of a removal roller 10 and is fed from the press section to a drying section, of which but a part is shown. Apart from the fibre web 1, a press fabric 11 and a press felt 12 pass through the first press nip 4, these running over return rollers 13 and 14, respectively. At the press felt 12, two suction boxes 15 are provided for dewatering the felt. The press fabric 11 is incompressible and, thereby, the first press nip 4 may be considered as forming a so-called fabric press. The fibre web 1 passes through the two otherpress nips 6 and 7 together with press felts 16 and 17, respectively which are disposed on return rollers 14 and at which are provided suction boxes 15.

In fig 2 is shown an embodiment of the present invention which is arranged in a conventional press section. The lower press roller has, according to the present invention, been replaced by a roller-like body 18 which is supported by two support rollers 19 and an upper press roller 20. The fibre web 1 passes through the thus formed press nip 22 together with a press felt 21 which runs over return rollers 14.

In fig 3 is shown the embodiment according to the present invention shown in a press section in fig 1, on a larger scale.

In fig 4 is shown a simialar embodiment to that of fig 3 but with a further small press roller 23 for forming a further small press nip 24 against the roller-like body 5. The press nip 24 forms a so-called prepress nip.

It is, naturally, not necessary that all of the contact zones between the roller-like body 5 and the circumjacent rollers constitute press nips; one or more of the contact zones may instead constitute support zones. The pressure rollers 3, 8, 9 may have different diameters and

be positioned with different angular spacing. The pressure inside the roller-like body 5, the angular spacing of the pressure rollers and the distance between the pressure rollers are adjustable during operation in order to control the specific compression pressure and the length of the press nip independently of each other. The different press nips can but do not have to be individually felted. One and the same felt may pass through several press nips. Furthermore, several felts may be disposed in one or more of the press nips, the paper web passing through the press nip located between, for example, two felts.

In fig 5 is shown a part of an embodiment of an apparatus according to the present invention, according to which a fibre web 1 runs through a press nip 25 between two press felts 26 and 27. The press nip 25 is formed between a roller-like body 5 and three press rollers 3, 8 and 9.

In fig 6 is shown an arrangement of an apparatus according to the present invention, which arrangement is of principally the same type as the arrangement shown in fig 3 with the only exception that the angular spacing between the rollers is different. The angular spacing between the rollers 3 and 8 is less, while the angular spacing between the rollers 3 and 9 is larger and largest between the rollers 8 and 9.

The invention is not limited to the arrangement of three press rollers or satellite rollers. In fig 7 is shown an embodiment of the present invention with a central roller-formed body 28 and for satellite rollers 29, 30, 31, 32. There are press nips 33, 34 between the central roller 28 and the satellite rollers 29, 30 and it is possible to arrange press nips between the central roller 28 and the other satellite rollers 31, 32.

An apparatus according to the present invention may also be used for other types of treatment of a fibre web

than dewatering. For example, the apparatus may be used in calendering, in which it is not necessary to include the felts in the system.

It should further be pointed out that it is desirable
5 that the roller-like body 5 be of a construction which permits expansion to a certain diameter, in which a further pressure increase within the roller-like body 5 should not result in any appreciable increase of the diameter of the roller-like body, but should merely give rise to an
10 increased specific pressure in the different press nips.

Obviously the roller-like body 5 may be called a central roller and the pressure rollers 3, 8, 9 may be called satellite rollers in the different embodiments described and shown.

CLAIMS

1. Apparatus for reducing the amount of water in a moist and watery material web, primarily a fibre web in a machine for the manufacture of paper, by means of one or more press nips, each being provided between a press roller and a roller-formed body, which at least to a certain part being deformable for controlling of the length of said press nip, characterized in that said roller-formed body being a central roller in cooperation with at least three satellite rollers positioned around the central roller for positioning said roller in a balanced condition, in that said press nip being provided between at least of said satellite rollers and said roller-formed central roller and in that the pressure between said satellite roller and said roller-formed central roller being controlling almost independently of the length of the press nip, provided by the deformation, by a change of the pressure inside said roller-formed body.
2. Apparatus according to claim 1, characterized in that the press rollers are of different diameters for forming several press nips with mutually different lengths.
3. Apparatus according to claim 1, characterized in that the moist and watery material web is located on, against or between a press wire and/or a press felt in at least one press nip.
4. Apparatus according to claim 1, characterized in that the roller-formed body is disposed freely between the rollers located in contact therewith, and that side blocks are provided for counter acting wandering of the roller-like body in an axial direction.

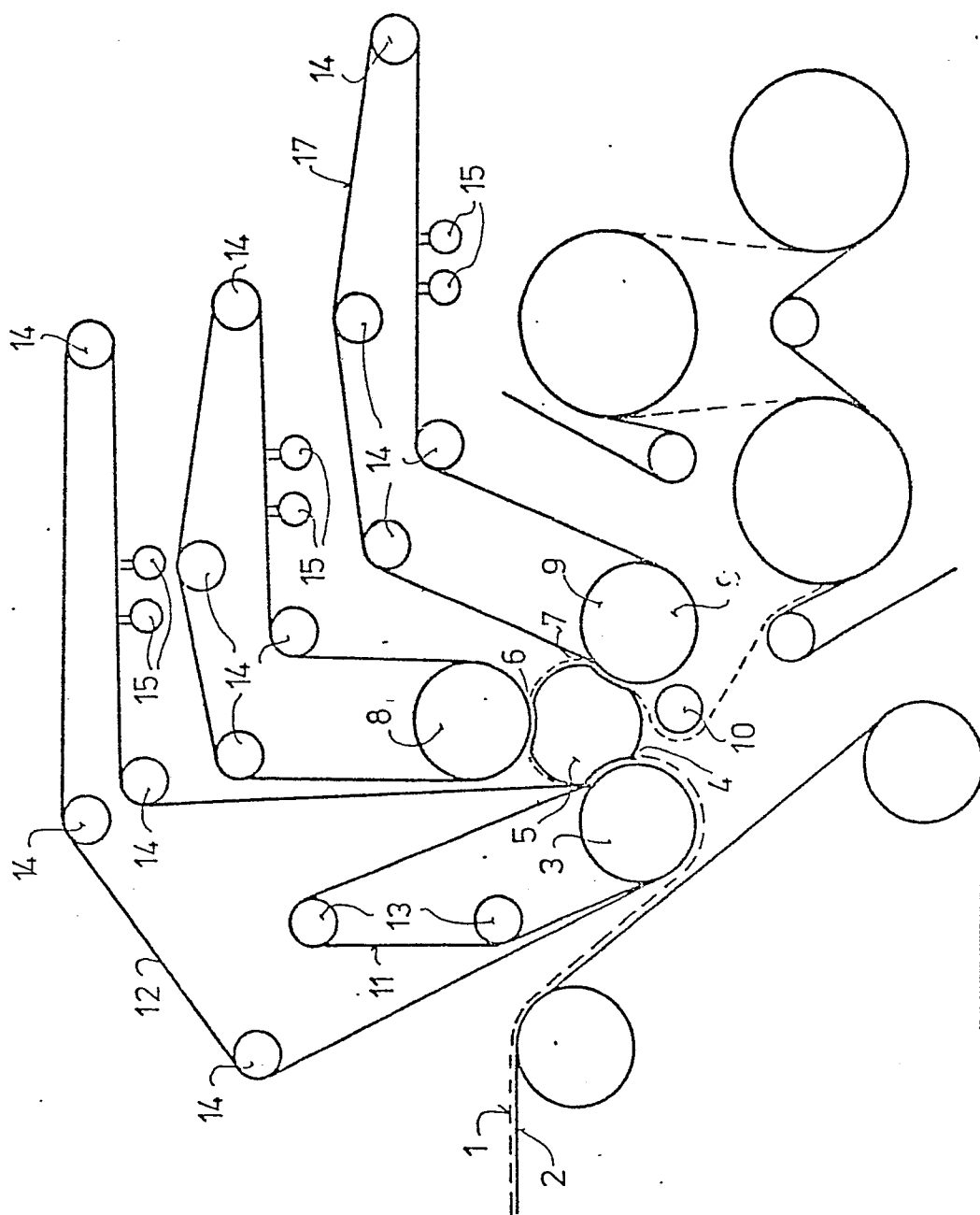


Fig 1

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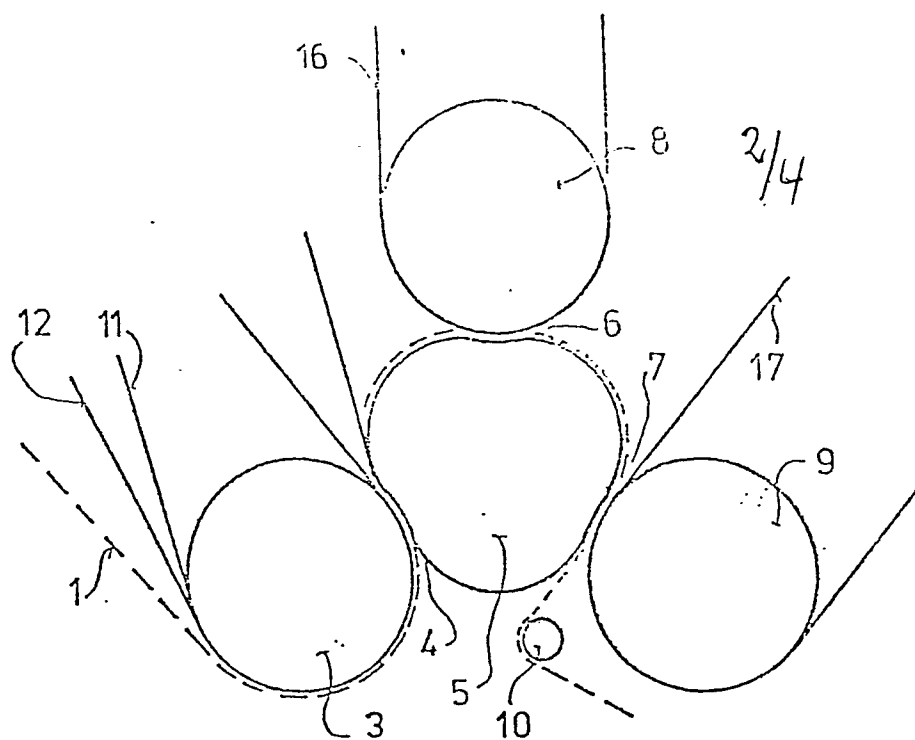


Fig 3

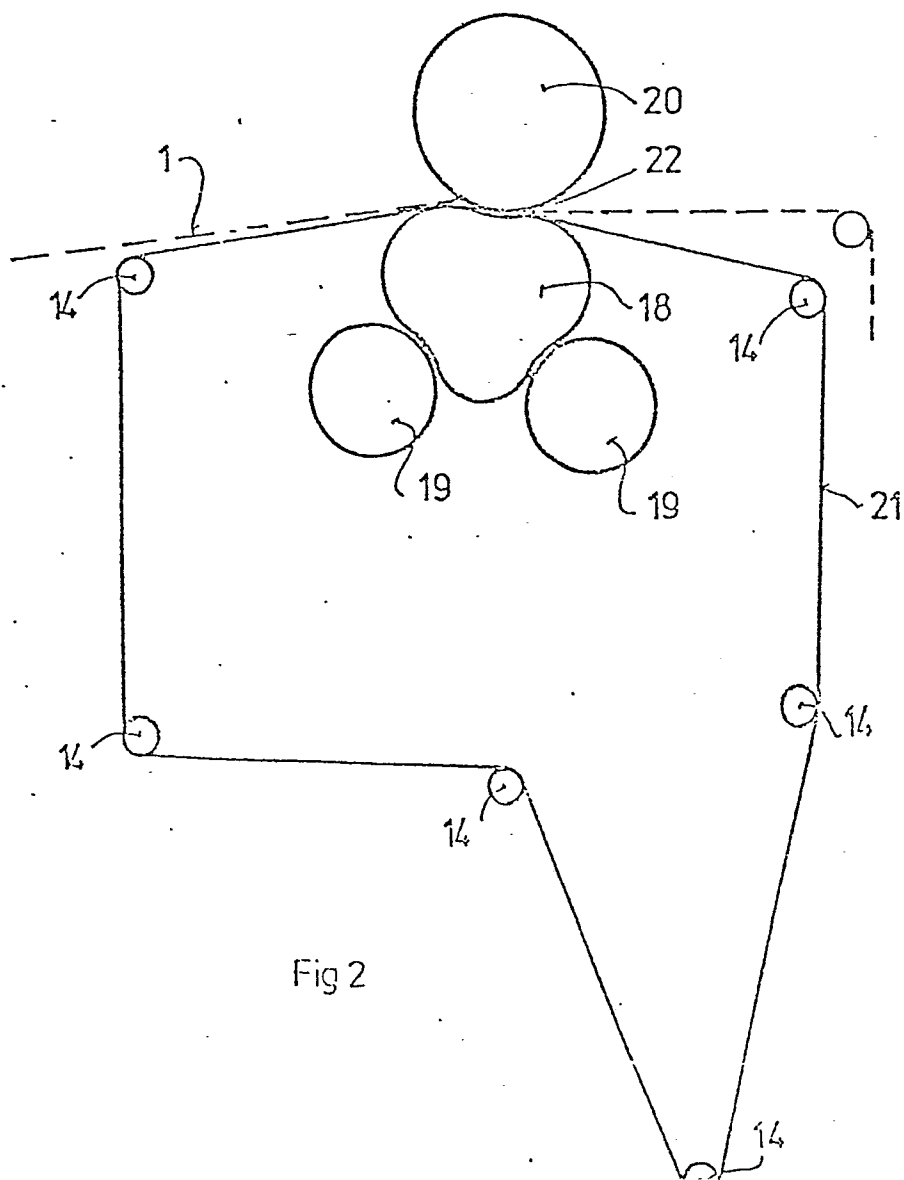
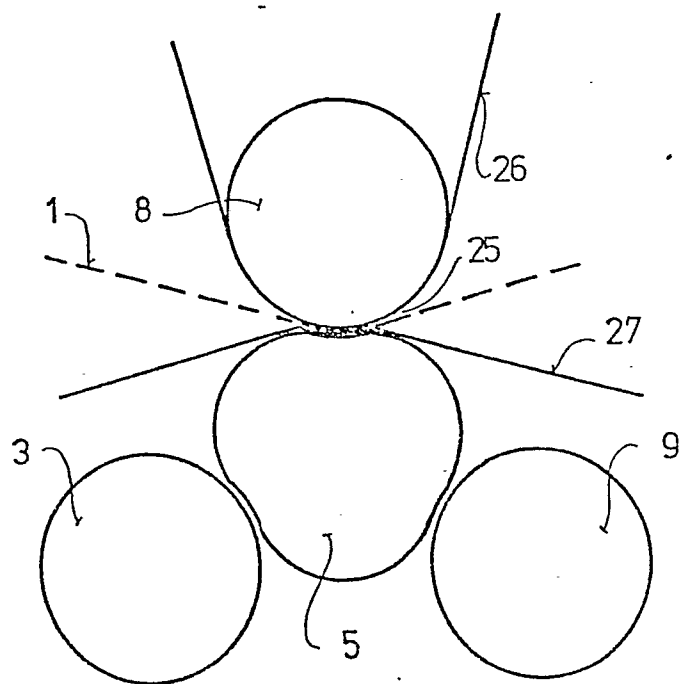
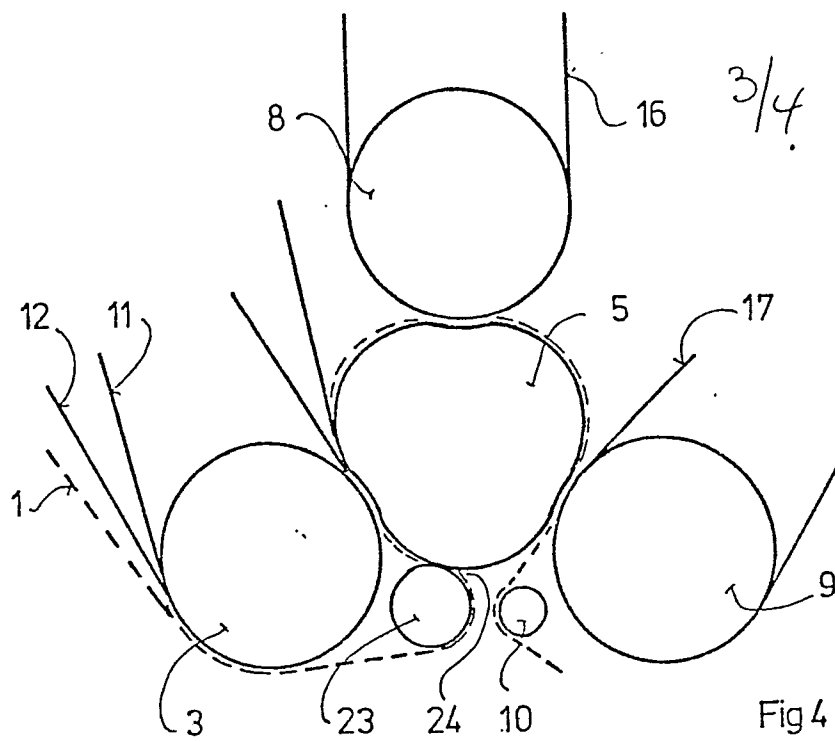


Fig 2



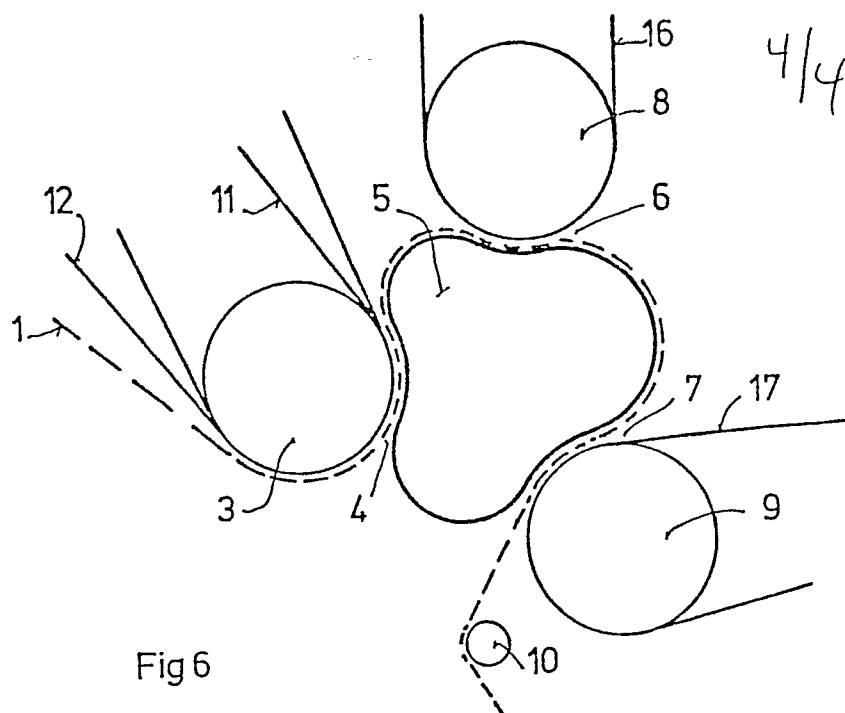


Fig 6

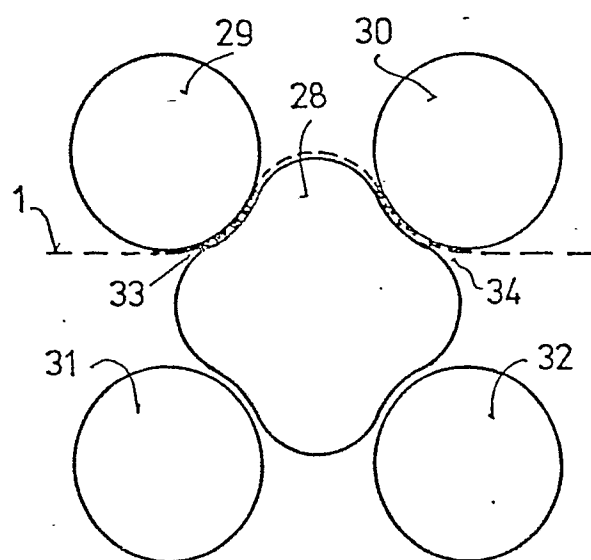


Fig 7



European Patent
Office

EUROPEAN SEARCH REPORT

0018954

Application number

EP 80 85 0049

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>FR - A - 1 094 585</u> (WILLMES) * Page 4, column 2, line 13 - page 7, column 1, line 39 *	1	D 21 F 3/02 D 21 G 1/00
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D	<u>US - A - 3 293 121</u> (MARTIN) * Whole *	1,3	
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D	<u>US - A - 3 808 096</u> (BUSKER et al.) * Whole *	1,3	TECHNICAL FIELDS SEARCHED (Int.Cl. ³)
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A	<u>US - A - 1 563 130</u> (WESTON) * Whole *	1	D 21 F D 21 G B 30 B

			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
X The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 12-08-1980	Examiner DE RIJCK