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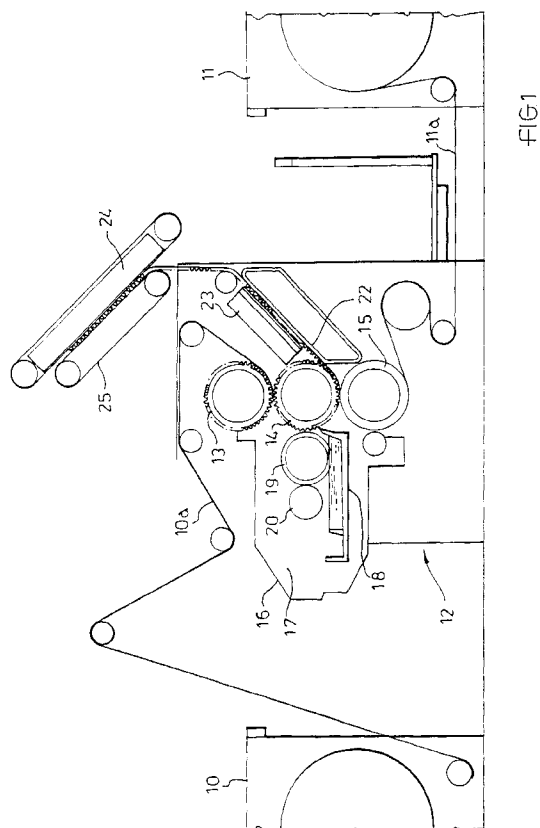
(71) Applicant: **SCM CONTAINER MACHINERY
LIMITED**
Ellesmere Port, South Wirral L66 1ST (GB)

(72) Inventor: **Hardisty, Barrie**
Huyton, Liverpool L39 9TJ (GB)

(74) Representative: **Ajello, Michael John**
207 Moss Lane
Bramhall Stockport Cheshire SK7 1BA (GB)

(54) **Apparatus for producing corrugated paperboard**

(57) Apparatus for producing corrugated paper board comprising a pair of corrugator rolls (13, 14) disposed in mesh to provide a nip through which the first sheet (10a) passes to become fluted and is then combined with a liner sheet (11a) passing around an unfluted roll (15) which is spaced from the second corrugator roll (14) so as not to apply pressure to the combined board which is then transported over a heated surface (22) and held thereagainst by a device (23). A vacuum conveyor (24) draws the combined board over the heated surface (22).



EP 0 753 400 A1

Description

THIS INVENTION concerns apparatus for producing corrugated paperboard of the type used in the manufacture of cartons, and particularly though not exclusively, for producing a single faced corrugated board consisting of one fluted sheet of paperboard bonded to an unfluted liner.

Conventional apparatus for producing single faced corrugated paperboard comprise first and second fluted corrugator rolls forming a nip with the flutes in mesh rather like meshed gears, and a continuous paper web is introduced into the nip to form a fluted web. The fluted web passes around the second corrugator roll usually over an arc of 180° whereupon it passes through a further nip with an unfluted pressure roll around which is passed a second continuous web, or liner. During passage around the second corrugating roll glue, known as starch, is applied to the tips of the fluted web so that when they come into contact with the unfluted liner, a bond is formed.

This bond is assisted by a pressure generated between the second corrugator roll and the pressure roll, under which the starch adhesive is forced into the fibres of the papers, and the pressure roll is heated so that the elevated temperature is transmitted through the paper and bursts the starch molecules to effect a secure bond.

The pressure applied between the second corrugator roll and the pressure roll can in certain cases weaken the fibres in the paper to the extent that, at the resonant frequency, the paper can be actually cut. At best, there is a ridging effect upon the liner which is unsightly in the finished board.

It is an object of the present invention to provide apparatus of this general kind in which pressure between the two webs at the point of contact is reduced thus avoiding or substantially reducing the aforesaid problem.

According to the present invention there is provided apparatus for producing corrugated paper board comprising first and second fluted corrugator rolls forming a nip through which a first continuous paper web is passed to form a fluted web, means for coating the tips of the fluted web with a liquid adhesive, an unfluted roll around which is transported a second continuous paper web to be brought into contact with the fluted coated web, and a heated surface over which the so-formed corrugated paper board is passed to produce a bond between the two webs; characterised by means to maintain the formed and bonded corrugated paper board under controlled tension.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying schematic drawings in which:-

Fig. 1 is a side view of apparatus made in accordance with the invention;

and Figs. 2 and 3 are similar views of second and third embodiments thereof.

Referring now to Fig. 1, the apparatus generally comprises a pre-conditioner drum 10 and a pre-heater 11 from which, respectively, a pair of continuous paper webs 10a and 11a are received. Each web is transported to a corrugating station 12 which includes a pair of driven enmeshed fluted corrugator rolls 13 and 14 disposed with their rotational axes parallel and in superimposed relationship, and an unfluted third roll 15 having its rotational axis parallel to and beneath that of the second corrugator roll 14.

The first corrugator roll 13 and the unfluted roll 15, together with an enclosure 16 form a sealed plenum chamber 17 which is maintained, in use, at a superatmospheric pressure in the region of 430 mm water gauge.

Disposed within the plenum chamber 17 is a starch applicator assembly consisting of a tray 18 an applicator roll 19 and a doctor roll 20. The applicator roll 19 is adjus-
tably positioned immediately adjacent the peripheral surface of the second corrugator roll 14.

The vertical disposition of the unfluted roll 15 is adjustable towards and away from the adjacent peripheral surface of the second corrugator roll 14, and is internally heated, preferably with steam.

The corrugating station 12 so far described operates generally by introducing the two continuous webs from reels 10 and 11, the first web passing through the nip between the two corrugator rolls 13 and 14 to form a fluted web, and the second web passing, in tension, around the heated third roll 15 to be brought into contact with the fluted web passing around roll 14. As described, a liquid adhesive known as starch is applied to the tips of the fluted web as they pass over the applicator roll 19, and after the fluted and unfluted webs are brought together they are wrapped around an arc of approximately 50° and subsequently pass onto an inclined surface of a heated plate 22. This surface effectively forms a tangent to the periphery of the second corrugator roll 14. During its passage upwardly along the plate 22 the so-formed corrugated paperboard web passes beneath a device 23 which applies a pre-determined light pressure thus holding the web against the heated surface 22. Passage over this heated surface causes curing of the starch to form a secure bond between the two webs.

Preferably, the device 23 includes a flexible sack which may be filled with a gas or liquid to a predetermined and adjustable extent thus to control the pressure applied to the board.

The heated and bonded board then leaves the upper end of plate 22 and is transported vertically and subsequently onto the undersurface of an inverted vacuum conveyor 24 which, by suction, retains and draws the board upwardly through and from the corrugating station 12. A belt conveyor 25 is located beneath the vacuum conveyor and disposed with its surface approximately 3

mm clear of the fluted board.

The presence of the vacuum conveyor 24 in drawing the formed board from the corrugating station thus imposes a force in tension on the board. This is necessary in order to balance the tension required in the liner web 11a, which is imposed to ensure that the liner is held taut around a number of pre-heating rolls prior to passage to the corrugating station.

In a conventional corrugating machine, the tension in the liner web is maintained by the pressure usually applied to the web at the nip between the unfluted roll and the second corrugator roll, but in the present arrangement that pressure is removed or at least substantially reduced and so adequate tension must be applied to the single-faced board after its formation.

The heated surface 22 is located as near as possible to the second corrugator roll and at such an angle as to maximise the wrap of the board around the surface of the latter. The inclined angle of the heated plate 22 permits efficient condensate removal.

Preferably, the pressure applied by the device 23 is adjustable and controlled to maintain uniform heat transfer from the heated plate 22. In addition, the plate 22 may be provided with a mechanism for lowering it at slow operational speeds when too high a temperature would be detrimental to the quality of the finished board.

The vacuum conveyor 24 provides a non-slip grip upon the liner sheet while the opposite fluted surface is prevented from damage, there being a clearance between the surface and the belt conveyor 25.

The positive tension control provided by the vacuum conveyor 24 may be adjustable with speed of operation and as an additional method of controlling board temperature and ensuring constant tension. The respective tensile forces applied to the liner web and the corrugated board are preferably monitored and mutually controlled.

In order to produce good corrugated board with uniform characteristics, it is preferable to ensure constant tension in the liner paper 11a, not only at constant machine speeds but also during periods of acceleration and deceleration and when splicing. For this purpose, a tension sensing device (not shown) is provided between the liner pre-heater 11 and the unfluted roll 15. This device is adapted to transmit signals representative of the liner tension, to a speed control device for vacuum conveyor 24. In use, any change in tension in the liner paper 11a is sensed and, if necessary, compensated for by an appropriate adjustment in speed of the vacuum conveyor 24.

Referring now to Fig. 2, in a second embodiment, the combination of inclined flat heated plate 22 and pressure device 23 is replaced by a curved heated plate 30 providing additional wrap around the second corrugator roll 14 and adequate bonding pressure by virtue of the curvature of the plate. Once again, the generally inclined angle of the heated plate 30 extending to the vertical at the lower end, provides for efficient disposal of conden-

sate.

In the third embodiment illustrated in Fig. 3, the fixed heated surfaces of plates 22 and 30 are replaced by a free-running heated drum 40 and an idler roll 41, adequate heat transfer being assured by the extent of wrap of the board around the heated drum.

Claims

1. Apparatus for producing corrugated paper board comprising first and second fluted corrugator rolls forming a nip through which a first continuous paper web is passed to form a fluted web, means for coating the tips of the fluted web with a liquid adhesive, an unfluted roll around which is transported a second continuous paper web to be brought into contact with the fluted coated web, and a heated surface over which the so-formed corrugated paper board is passed to produce a bond between the two webs; characterised by means to maintain the formed and bonded corrugated paper board under controlled tension.
2. Apparatus according to Claim 1, wherein the peripheral surface of the unfluted roll is spaced from the tips of the flutes of the second corrugator roll, the means to maintain controlled tension in the corrugated paper board being disposed after the heated surface in the direction of travel of the board.
3. Apparatus according to Claim 1 or Claim 2, wherein the rotational axes of the first and second corrugator rolls are parallel and in superimposed relationship, the unfluted third roll having its rotational axis parallel to and beneath that of the second corrugator roll.
4. Apparatus according to any preceding claim, wherein the first corrugator roll and the unfluted roll together with an enclosure, form a sealed plenum chamber maintained at superatmospheric pressure and containing a starch applicator roll and doctor roll.
5. Apparatus according to any preceding claim, wherein the unfluted roll is internally heated and adjustable in position towards and away from the adjacent peripheral surface of the second corrugator roll.
6. Apparatus according to any preceding claim, wherein the corrugated paper board is wrapped around the fluted surface of the second corrugator roll through an angle in excess of 45°, and said heated surface has an inclined attitude and is disposed to form a tangent to the periphery of the second corrugator roll.

7. Apparatus according to any preceding claim, wherein the corrugated paper board, during passage over said heated surface is held against the latter by a device adapted to apply a predetermined light pressure on the face of the board remote from the heated surface. 5
8. Apparatus according to Claim 7, wherein said pressure applying device includes a flexible sack adapted to be filled with a gas or liquid to a predetermined extent thus to control the pressure applied to the board. 10
9. Apparatus according to any preceding claim, wherein said means to maintain the corrugated paper board under controlled tension includes an inverted vacuum conveyor disposed to draw the board over said heated surface, there being a belt conveyor located beneath the vacuum conveyor and disposed with its surface spaced from the vacuum conveyor thus to be approximately 3mm clear of the board. 15 20
10. Apparatus according to any preceding claim, including means to tension the second continuous paper web prior to its passage around the unfluted roll, there being means to monitor respective tensile forces applied to said second web and the board. 25
11. Apparatus according to Claim 7 or Claim 8, including means to adjust and control the relative positions of said heated surface and the pressure applying device. 30
12. Apparatus according to Claim 9, including means to adjust and control the speed of operation of the inverted vacuum conveyor. 35
13. Apparatus according to any preceding claim, wherein said heated surface is curved about an axis normal to the direction of passage of the board. 40
14. Apparatus according to Claim 1, wherein said heated surface is a free-running heated drum over which the board is drawn by the tension maintaining means. 45
15. Apparatus according to Claim 9 or Claim 12, wherein the vacuum conveyor is disposed above the corrugator rolls, the unfluted roll and the heated surface. 50

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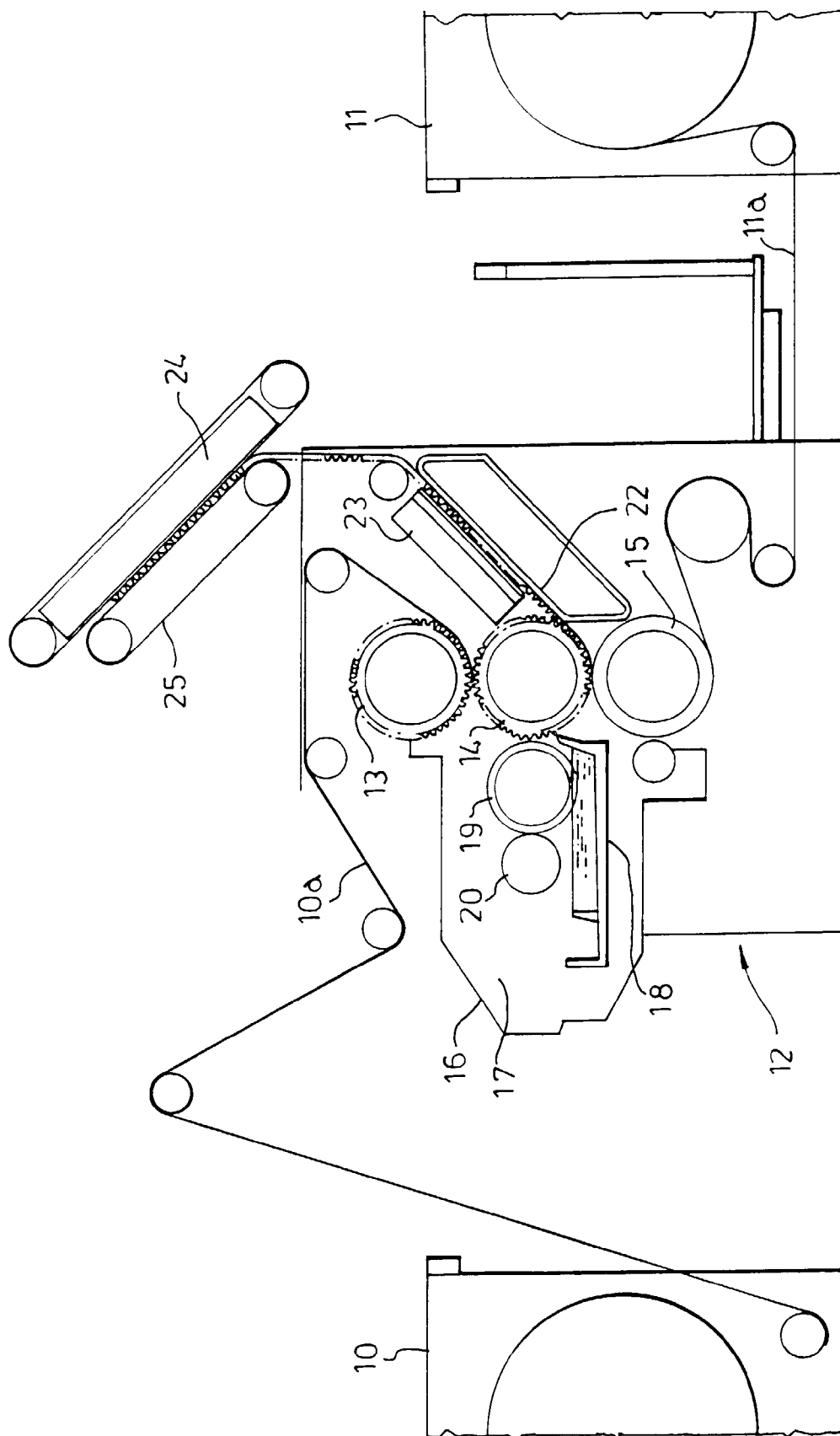


FIG. 1

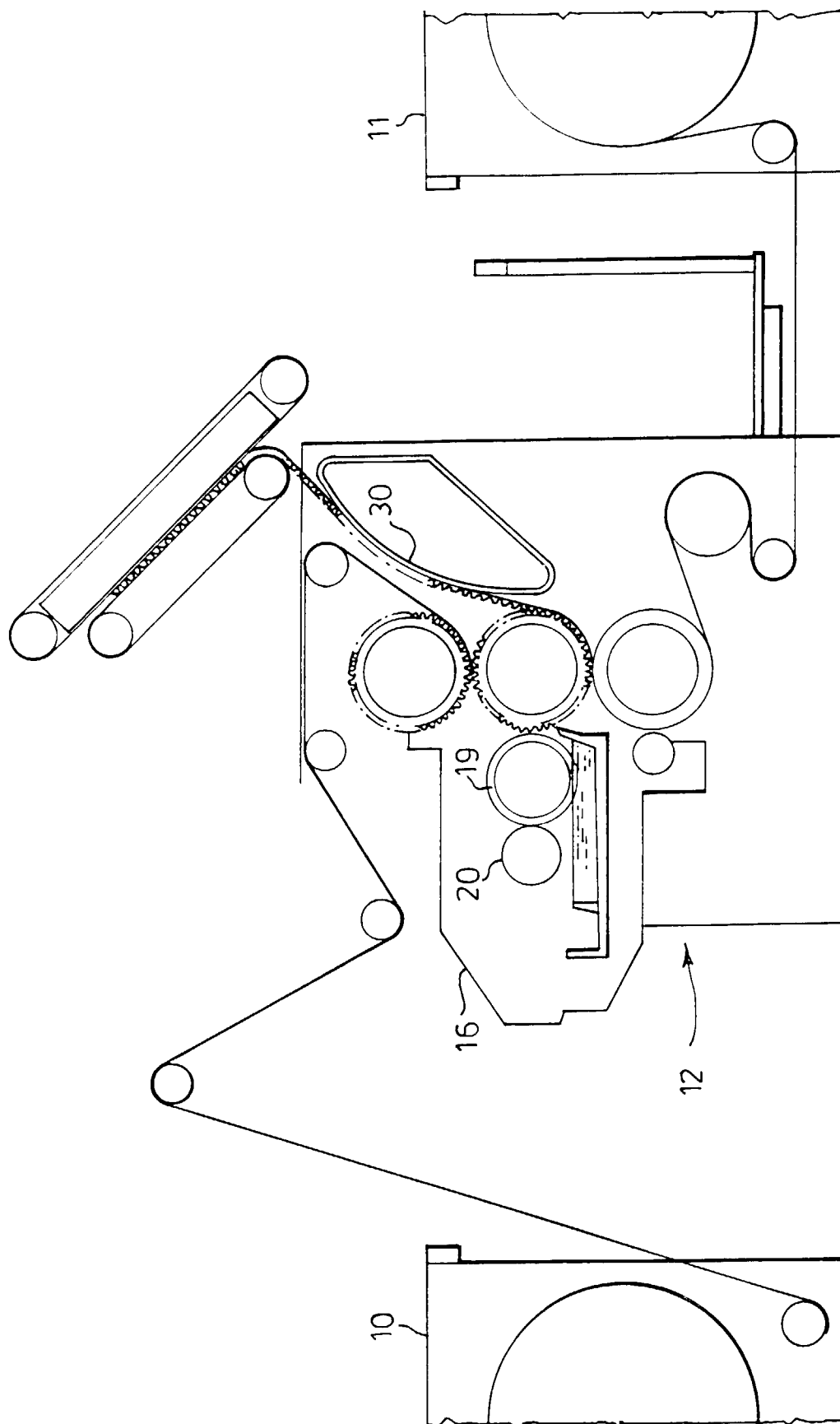
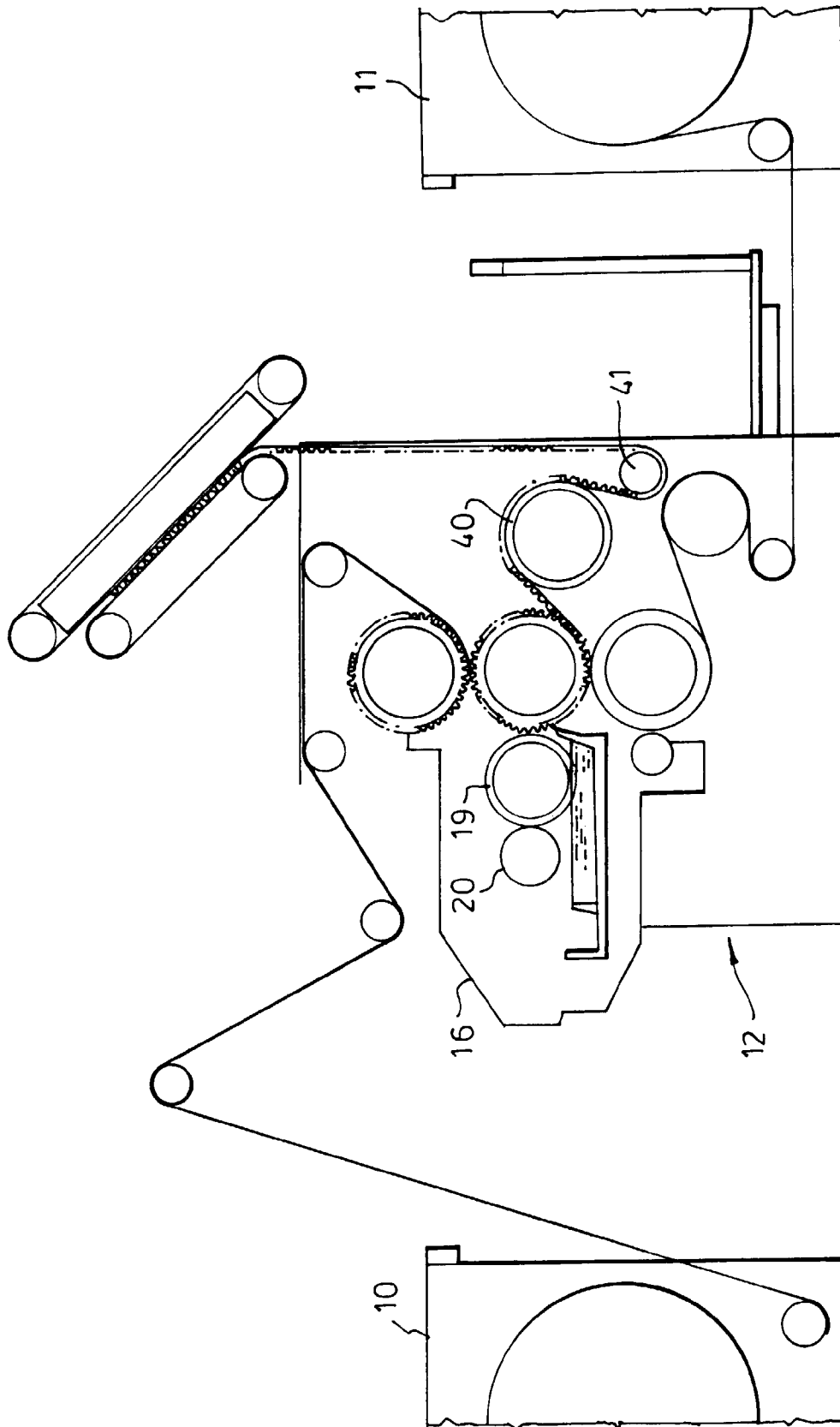


FIG. 2





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EUROPEAN SEARCH REPORT

Application Number
EP 96 30 5177

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 559 556 (TORRES MARTINEZ M) 8 September 1993 * column 6, line 35 - column 7, line 36; figure 6 *	1-15	B31F1/28
X	FR-A-2 708 011 (OTOR SA) 27 January 1995 * page 5, line 22 - page 6, line 24 * * page 11, line 20 - line 26; figure 4 *	1-15	
A	WO-A-93 03913 (AMCOR LTD) 4 March 1993	1	
A	GB-A-2 211 216 (RENGO CO LTD) 28 June 1989	1	
A	EP-A-0 229 338 (EUROPA CARTON AG) 22 July 1987	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B31F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		22 November 1996	Roberts, P
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