

(19)



(11)

EP 4 566 461 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.06.2025 Bulletin 2025/24

(51) International Patent Classification (IPC):
A24B 3/14 (2006.01)

(21) Application number: **24208281.6**

(52) Cooperative Patent Classification (CPC):
A24B 3/14

(22) Date of filing: **23.10.2024**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
 GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
 NO PL PT RO RS SE SI SK SM TR**
 Designated Extension States:
BA
 Designated Validation States:
GE KH MA MD TN

(71) Applicant: **HTL-DHT B.V.
5642 JA Eindhoven (NL)**

(72) Inventor: **WIJERS, Steven Dirk
EINDHOVEN (NL)**

(74) Representative: **Algemeen Octrooi- en
Merkenbureau B.V.
P.O. Box 645
5600 AP Eindhoven (NL)**

(30) Priority: **07.12.2023 NL 2036447**

(54) **A METHOD FOR MANUFACTURING A CAST SHEET**

(57) The present invention relates to a method for manufacturing a cast sheet (10), which comprises spreading a thin layer of a slurry (3) on the surface of a movable endless conveyor belt (7), wherein the slurry (3)

is deposited by reverse roll coating means (2,4,5) onto the surface of the endless conveyor belt (7). The present invention also relates to a casting apparatus (1) for manufacturing a cast sheet material (10).

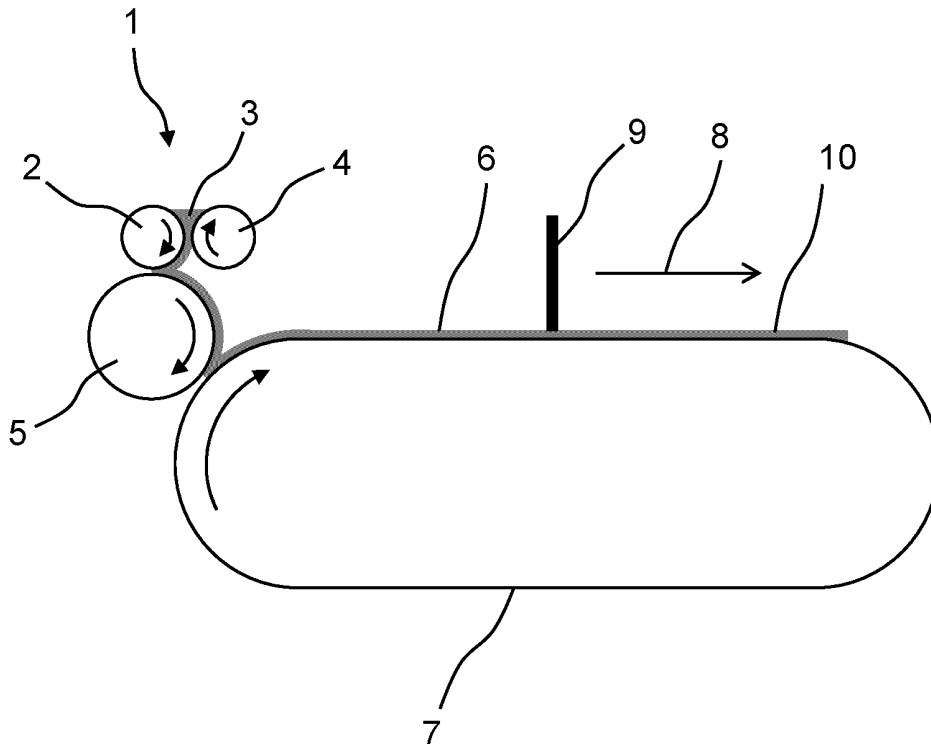


Fig. 1

EP 4 566 461 A1

Description

[0001] The present invention relates to a method for manufacturing a cast sheet, a casting apparatus for manufacturing a cast sheet material.

[0002] Methods for manufacturing a cast sheet are well known in the prior art. For example, EP 1 489 927 in the name of the present applicant discloses a method for manufacturing a top loaded cigarette filler, the method comprising the steps of dosing a slurry composed on a basis of a fraction of fine tobacco and cellulose fibres on a drying conveyor for forming a base layer, spreading over said base layer a fraction of coarse tobacco for forming a top load on said base layer and subsequently subjecting the total to a drying treatment.

[0003] US 2022/354157 relates to the manufacture of an inductively heatable aerosol-forming substrate, wherein the step of joining the tobacco containing slurry and the inductively heatable continuous sheet-like material comprises supplying the tobacco containing slurry onto the inductively heatable continuous sheet-like material before the so formed inductively heatable aerosol-forming substrate is arranged and transported on the conveyor device. A coater may be provided for supplying the tobacco containing slurry onto the conveyor device or the inductively heatable continuous sheet-like material. Such a coater may be a conventionally available coater, such as, for example, gate coater or reverse roller coater.

[0004] US 2011/083682 relates to a process of manufacturing a reconstituted tobacco material, comprises the steps of: supplying tobacco particles, water and a gum binder to a mixer; supplying a water and sugar mixture to the mixer; supplying a liquid volatile flavorant to the mixer; combining these components in the mixer to form a slurry; supplying the slurry to an arrangement for forming a uniform layer of the slurry; drying the uniform layer of the slurry in a dryer to form a continuous sheet; and shredding or cutting the continuous sheet into pieces. The arrangement for forming a uniform layer of the slurry comprises a reverse roll coater.

[0005] US 4 706 692 relates to an apparatus for applying slurries of coating material to both sides of a web of reconstituted tobacco, the apparatus comprising forward roll coating means for applying a first layer of slurry to one side of the web; and reverse roll coating means adjacent the forward roll coating means for applying a second layer of slurry to the other side of the web; wherein the web is continually supported by the forward roll coating means from the point at which it engages the forward roll coating means to the point at which it leaves the reverse roll coating means, the forward roll coating means adhering to the web, whereby the web is prevented from being torn by the reverse roll coater.

[0006] US 2016286853 relates to a method for manufacturing a film comprising at least two layers, the method comprising the following steps of arranging a first, still liquid bottom layer on an endless belt being performed by applying a coating member of the knife type, arranging a

second, still liquid top layer on top of the still liquid bottom layer after which the composition of bottom layer and top layer is subjected to a drying treatment for obtaining said film comprising at least two layers.

[0007] EP 1055375 relates to a method of producing a sheet of reconstituted tobacco from an aqueous slurry, comprising the steps of depositing an aqueous tobacco slurry on a moving conveyor, heating an underside of the conveyor with steam such that temperature gradients are minimized in the slurry, and subsequently drying the slurry without steam heating to dry the slurry into a sheet form, wherein an exposed surface of the slurry is heated with hot air during the drying step. The casting device may be any suitable device for depositing the slurry on the conveyor such as a casting box, reverse roll coater or other coating apparatus.

[0008] US 2011083682 relates to a process of manufacturing a reconstituted tobacco material, comprises the steps of combining tobacco particles, water, gum binder, sugar mixture and liquid volatile flavorant in a mixer to form a slurry, supplying the slurry to an arrangement for forming a uniform layer of the slurry, drying the uniform layer of the slurry in a dryer to form a continuous sheet, and shredding or cutting the continuous sheet into pieces, wherein the arrangement for forming a uniform layer of the slurry comprises a reverse roll coater, wherein the reverse roll coater comprises a metering roll, a casting roll and a rubber roll.

[0009] From the above publications one may conclude that a reverse roller is a reliable method in view of distribution of the weight per unit area (g/m^2) of slurry cast on the carrier. The slurry is forced by a rotational action through the slit between a metering roll and a casting roll. In another example, wherein the reverse coating means comprise a non-rotating member and a casting roll, the slurry is forced by a rotational action through the slit by the casting roll only. As a result, the effect of gravity, i.e. a hydrostatic pressure of the slurry buffer in the coater, is practically eliminated. Furthermore, variations in rheology of the slurry have a limited effect on the amount of slurry that passes through the slit.

[0010] However, the present inventor found that the method for manufacturing a cast sheet via reversed roll coating has as a disadvantage since the slurry layer that is formed on the carrier often has an orange peel structure. Consequently the final product obtained after drying shows a similar structure. This structure is visible and creates a noticeable surface irregularity, which is undesired in specific cases. In some cases, the internal structure of the final product may be patchy as well, which reduces the mechanical strength of the product.

[0011] It is also known to apply a slurry on a carrier by means of a casting knife, i.e. a non-rotating casting member, such as a knife or a bar, positioned at a certain, but adjustable height above the carrier. The slurry is deposited in a container in front of the casting knife, and via the action of the carrier the slurry is pulled underneath the casting knife thereby forming a smooth layer of

slurry behind the casting knife.

[0012] A disadvantage of using a casting knife is that the thickness of the cast slurry layer is not solely determined by the distance between the casting knife and the carrier, but is also sensitive to variations in flow properties, such as viscosity, of the slurry applied, as well as sensitive to variations in the height of the slurry buffer in front of the casting knife. For this reason, a casting knife set-up must always be controlled using an automatic system that measures the grammage of the cast slurry layer, wherein that value is compared to a reference number, and the distance between the casting knife and the carrier is adjusted, if needed.

[0013] An object of the present invention is to provide a method for manufacturing a cast sheet in which the cast sheet has a high mechanical strength.

[0014] Another object of the present invention is to provide a method for manufacturing a cast sheet in which the cast sheet has an even top surface structure.

[0015] The present invention thus relates to a method for manufacturing a cast sheet, which method comprises spreading a thin layer of a slurry on the surface of a movable endless conveyor belt, wherein the slurry is deposited by reverse roll coating means onto the surface of the endless conveyor belt, the method further comprising:

a step of recasting the slurry already deposited on the surface of the endless conveyor belt, the recasting being carried out by contacting the slurry already deposited on the surface of the endless conveyor belt with a casting knife located above the endless conveyor belt and downstream of the reverse roll coating means, the casting knife extends along substantially the whole width of the endless conveyor belt.

[0016] One or more of the above objects is achieved by the present method. The present method can be described as "hybrid casting", i.e. reverse roll coating means followed by a casting knife. The present inventor found that with the present method of hybrid casting, a homogenous layer of slurry is deposited on the carrier by means of a reversed roll coater, which does not require an automated control system. The action of the subsequent casting knife eliminates any patchiness, e.g. internal and external orange peel structure, but leaves the good distribution created by the reversed roll coater intact. The reason the distribution by the reversed roll coater is left intact, is that the casting knife layer formation is predominantly taking place lengthwise, whereas cross directional redistribution of the slurry layer is very limited. This has been demonstrated when individual streams of different coloured slurry are fed into the coater. This results in individual bands of cast slurry (and sheet after drying) with very little cross directional intermixing. The present inventor found that by using the reversed roll coater to pre-cast the slurry, a very homogenous layer is effectively fed to the casting knife. This not only mitigates the effect of hydrostatic pressure, but at the same time practically eliminates the influence of rheology on the final cast

slurry grammage. In the present invention the cast sheet prepared by the present method is a single layer sheet, wherein such a single layer sheet differs from the film comprising at least two layers manufactured according to US 2016286853 as discussed above.

[0017] The method according to the present invention further comprises

a step of measuring the amount of slurry on the surface of a movable endless conveyor belt coated by the application roll, comparing the amount of slurry thus measured with a reference value

amending the settings of the reverse roll coating means, such as rotational speed of metering roll, rotational speed of the casting roll and/or the nip between the metering roll and the application roll, in such a way that the amount of slurry on the surface of a movable endless conveyor belt coated by the application roll is equal to the reference value.

[0018] In another example the method further comprises a step of measuring the grammage of the slurry present on the surface of the endless conveyor belt downstream of the casting knife,

comparing the grammage of the slurry thus measured with a reference value, amending the distance between the casting knife and the endless conveyor belt in such a way the grammage of the slurry is equal to the reference value.

[0019] According to such a method the height of the slurry buffer in front of the casting knife is measured and the height of the slurry buffer thus measured is compared with a reference value. The rotating speed of the metering roll and/or the rotating speed of casting roll and/or the distance between metering roll and casting roll, i.e. the nip, is adjusted in such a way that the height of the slurry buffer in front of the casting knife remains practically constant. The result thereof is that the amount of slurry applied onto the movable endless conveyor belt is equal to the amount of slurry on said belt downstream of the casting knife.

[0020] In another example the method further comprises a step of measuring the volume of slurry present on the surface of the endless conveyor belt and upstream of the casting knife, wherein the volume of slurry refers to a built-up buffer of slurry just before the casting knife, comparing the volume of slurry thus measured with a reference value, amending the settings of the settings of the reverse roll coating means in such a way that the volume of slurry mass upstream of the casting knife is constant.

[0021] In such a method the volume of slurry is preferably measured by the height of the slurry in the built-up buffer of slurry just before the casting knife, the width of

the slurry built-up in the buffer of slurry just before the casting knife, or a combination of both height and width of the slurry built-up in the buffer of slurry just before the casting knife.

[0022] In an example the vertical distance between the casting knife and the endless conveyor belt is simultaneously adjustable across the length of the casting knife.

[0023] In another example the distance between the endless conveyor belt and the casting knife is adjustable at several positions along the length of the casting knife.

[0024] In an example the reverse roll coating means comprises a casting roll, a metering roll and an application roll, the slurry is metered via a nip between the casting roll and the metering roll onto the outer surface of the application roll and the application roll coats the surface of the movable endless conveyor belt.

[0025] According to such an example the settings of the reverse roll coating means comprise the rotational speed of the metering roll and/or the rotational speed of the casting roll and/or the nip between the metering roll and the casting roll.

[0026] In another example the reverse roll coating means comprises a casting roll, a non-rotating member and an application roll, the slurry is metered via a nip between the casting roll and the non-rotating member onto the outer surface of the application roll and the application roll coats the surface of the movable endless conveyor belt.

[0027] According to such an example the settings of the reverse roll coating means comprise the rotational speed of the casting roll and/or the nip between the non-rotating member and the casting roll.

[0028] In an example the casting roll and the application roll rotate in the same direction. When looking in the transport direction of the production line, and perpendicular on that direction, the casting roll and the application roll rotate clockwise, which is in the same direction as that of the endless conveyor belt.

[0029] In an example the rotational speed of the application roll is higher than the rotational speed of the casting roll.

[0030] In an example the rotational speed of the application roll is higher than the rotational speed of the metering roll.

[0031] The present invention also relates to a casting apparatus for manufacturing a cast sheet material, in which the casting apparatus comprises:

- a casting box adapted to contain a slurry,
- reverse roll coating means,
- a movable endless conveyor belt, wherein the slurry contained in the casting box is delivered to the reverse roll coating means, and the reverse roll coating means are adapted to deposit the slurry onto the endless conveyor belt, the apparatus further comprising
- a casting knife located above the endless conveyor belt and downstream of the reverse roll coating

means, the casting knife extending along substantially the whole width of the endless conveyor belt, the casting knife adapted to recast the slurry already deposited on the surface of the endless conveyor belt.

[0032] In an example the casting knife further comprises means for adjusting the distance between the endless conveyor belt and the casting knife.

[0033] In an example the casting apparatus for manufacturing a cast sheet material further comprise a sensor for measuring the grammage of the slurry already deposited on the surface of the endless conveyor belt, a control unit adapted to send and receive signals from the sensor and to send or receive signals from the means for adjusting the distance between the endless conveyor belt and the casting knife, the sensor being located downstream of the casting knife. According to such a construction the height of the slurry buffer in front of the casting knife is measured and the height of the slurry buffer thus measured is compared with a reference value. The rotating speed of the metering roll and/or the rotating speed of casting roll and/or the distance between metering roll and casting roll, i.e. the nip, is adjusted in such a way that the height of the slurry buffer in front of the casting knife remains practically constant. The result thereof is that the amount of slurry applied onto the movable endless conveyor belt is equal to the amount of slurry on said belt downstream of the casting knife.

[0034] In another example the casting apparatus further comprises a sensor for measuring a volume of slurry in a built-up buffer of slurry just before the casting knife, a control unit adapted to send and receive signals from the sensor and to send or receive signals from the means for adjusting the settings of the reverse roll coating means.

[0035] The present invention also relates to the use of a combination of reverse roll coating means for depositing a slurry on a movable endless conveyor belt and a casting knife in contact with the slurry thus deposited onto the movable endless conveyor belt for obtaining a cast sheet being free from an orange peel structure.

[0036] The present method provides a cast sheet of improved product quality. Such a cast sheet is of interest for the manufacturing of Heat Not Burn (HnB) tobacco. A technology for manufacturing HnB tobacco sticks comprises a device for separating a flat web from a web material into a plurality of strips which strips are bundled and wrapped with paper, forming a rod. Such a method is disclosed in for example EP 3 680 078. Variations in the thickness of the strips directly influences the packing density of the rod, and thereby the pressure drop of the rod. Pressure drop in the context of cigarette and HnB consumables is the resistance caused by the packed material when drawing air through a column of packed material. The pressure drop is an important parameter for consumer satisfaction. The pressure drop or resistance can be identified as a quality parameter for the

produced rod. For this reason, the homogeneity of the thickness in both length and width of the cast sheet is an important technical property. Thickness of the cast sheet is closely related to grammage, for which a good control of cast weight is imperative.

[0037] The invention is further described with regard to embodiments, which are illustrated by means of the following drawings, wherein:

The sole figure is a schematic illustration of an embodiment of a method for manufacturing a cast sheet according to the present invention.

Example

[0038] A highly viscous tobacco slurry having a viscosity of 65.000 cPs was cast on a movable stainless steel carrier of a cast sheet manufacturing line via using a reversed roll coater process identified with reference number 1.

[0039] The reverse coater comprises a metering roll 4, a casting roll 2 and an application roll 5. A highly viscous tobacco slurry 3 is dosed between the nip of metering roll 4 and casting roll 2. Slurry 3 is transported via the outer surface of casting roll 2 onto the outer surface of application roll 5. The rotation direction of metering roll 4, casting roll 2 and application roll 5 is given by arrows. Application roll 5 deposits slurry 3 onto a movable stainless steel carrier 7. The transport direction of movable stainless steel carrier 7 is shown by arrow 8. Slurry 6 thus deposited is recasted by contacting the slurry 6 already deposited on the surface of the endless conveyor belt 7 with a casting knife 9 located above the endless conveyor belt 7 and downstream of application roll 5. The recasted slurry is identified with reference number 10. Although the sole figure refers to reverse roll coating means comprising casting roll 2, metering roll 4 and application roll 5, the reverse roll coating means may also comprise a casting roll 2, a non-rotating member (not shown) and application roll 5, wherein the slurry is metered via a nip between casting roll 2 and non-rotating member onto the outer surface of application roll 5 and application roll 5 coats the surface of movable stainless steel carrier 7.

[0040] In an example of a method for manufacturing a cast sheet according to the prior art, i.e. without the step of recasting the slurry, the slurry deposited on the movable stainless steel carrier cast as well as the finally dried sheet showed a clear orange peel structure, both on the outer surface as internally in the sheet.

[0041] According to an embodiment of a method for manufacturing a cast sheet according to the present invention a casting knife was positioned directly after the reversed roll coater. The casting knife did initially not touch the cast slurry deposited onto the movable stainless steel carrier, but the casting knife was in a subsequent step lowered into the direction of the slurry until it touched the surface of the slurry layer deposited onto the movable stainless steel carrier. At the moment the casting knife touched the slurry, two effects were

noticeable

- The layer of slurry downstream of the casting knife was significantly, visibly, smoother as a result of the action of the casting knife, and
- Before the slit of the casting knife, a rolling buffer of slurry formed. This is a solid indication that the casting knife is not just smoothing the layer, but actually reforming the layer over practically the complete thickness of the layer.

Claims

1. A method for manufacturing a cast sheet, which comprises spreading a thin layer of a slurry on the surface of a movable endless conveyor belt, wherein the slurry is deposited by reverse roll coating means onto the surface of the endless conveyor belt, the method further comprising:
 - a step of recasting the slurry already deposited on the surface of the endless conveyor belt, the recasting being carried out by contacting the slurry already deposited on the surface of the endless conveyor belt with a casting knife located above the endless conveyor belt and downstream of the reverse roll coating means, the casting knife extends along substantially the whole width of the endless conveyor belt, said method further comprising:
 - a step of measuring the amount of slurry on the surface of a movable endless conveyor belt coated by the reverse roll coating means, comparing the amount of slurry thus measured with a reference value
 - amending the settings of the reverse roll coating means in such a way that the amount of slurry on the surface of a movable endless conveyor belt coated by the application roll is equal to the reference value.
2. A method according to claim 1, further comprising:
 - a step of measuring the grammage of the slurry present on the surface of the endless conveyor belt downstream of the casting knife, comparing the grammage of the slurry thus measured with a reference value, amending the vertical distance between the casting knife and the endless conveyor belt in such a way the grammage of the slurry is equal to the reference value.
3. A method according to one or more of the preceding claims, further comprising:
 - a step of measuring the volume of slurry present on the surface of the endless conveyor belt and

- upstream of the casting knife, wherein the volume of slurry refers to a built-up buffer of slurry just before the casting knife, comparing the volume of slurry thus measured with a reference value, amending the settings of the settings of the reverse roll coating means in such a way that the volume of slurry mass upstream of the casting knife is constant, especially wherein the volume of slurry is measured by the height of the slurry in the built-up buffer of slurry just before the casting knife, the width of the slurry built-up in the buffer of slurry just before the casting knife, or a combination of both height and width of the slurry built-up in the buffer of slurry just before the casting knife.
4. A method according to one or more of the preceding claims, wherein in the reverse roll coating means comprises a casting roll, a metering roll and an application roll, the slurry is metered via a nip between the casting roll and the metering roll onto the outer surface of the application roll and the application roll coats the surface of the movable endless conveyor belt, especially wherein the settings of the reverse roll coating means comprise the rotational speed of the metering roll and/or the rotational speed of the casting roll and/or the nip between the metering roll and the casting roll.
5. A method according to one or more of claims 1-3, wherein in the reverse roll coating means comprises a casting roll, a non-rotating member and an application roll, the slurry is metered via a nip between the casting roll and the non-rotating member onto the outer surface of the application roll and the application roll coats the surface of the movable endless conveyor belt.
6. A method according to any one or more of claims 1-3 and 5, wherein the settings of the reverse roll coating means comprise the rotational speed of the casting roll and/or the nip between the non-rotating member and the casting roll.
7. A method according to one or more of the preceding claims, wherein the vertical distance between the casting knife and the endless conveyor belt and is simultaneously adjustable across the length of the casting knife, especially wherein the vertical distance between the casting knife and the endless conveyor belt is adjustable at several positions along the length of the casting knife.
8. A method according to one or more of claims 4 and 7, wherein the casting roll and the metering roll rotate in the same direction.
9. A method according to any one or more of claims 4-8,
- wherein the application roll rotates in a direction equal that of the endless conveyor belt.
10. Casting apparatus for manufacturing a cast sheet material, the casting apparatus comprising
- a casting box adapted to contain a slurry,
 - reverse roll coating means,
 - a movable endless conveyor belt, wherein the slurry contained in the casting box is delivered to the reverse roll coating means, and the reverse roll coating means are adapted to deposit the slurry onto the movable endless conveyor belt, the apparatus further comprising
 - a casting knife located above the endless conveyor belt and downstream of the reverse roll coating means, the casting knife extending along substantially the whole width of the endless conveyor belt, the casting knife adapted to recast the slurry already deposited on the surface of the endless conveyor belt, especially wherein the casting knife further comprises means for adjusting the distance between the endless conveyor belt and the casting knife.
11. Casting apparatus according to claim 10, further comprising a sensor for measuring the grammage of the slurry already deposited on the surface of the endless conveyor belt, a control unit adapted to send and receive signals from the sensor and to send or receive signals from the means for adjusting the vertical distance between the endless conveyor belt and the casting knife, the sensor being located downstream of the casting knife.
12. Casting apparatus according to any one or more of claims 10-11, further comprising a sensor for measuring a volume of slurry in a built-up buffer of slurry just before the casting knife, a control unit adapted to send and receive signals from the sensor and to send or receive signals from the means for adjusting the settings of the reverse roll coating means.
13. Casting apparatus according to any one or more of claims 10-12, wherein the reverse roll coating means comprise a casting roll, a metering roll and an application roll, wherein the slurry is metered via a nip between the casting roll and the metering roll onto the outer surface of the application roll and the application roll coats the surface of the movable endless conveyor belt.
14. Casting apparatus according to any one or more of claims 10-13, wherein the reverse roll coating means comprise a casting roll, a non-rotating member and an application roll, wherein the slurry is metered via a nip between the casting roll and the non-rotating member onto the outer surface of the application roll

and the application roll coats the surface of the movable endless conveyor belt.

15. The use of a combination of reverse roll coating means for depositing a slurry on a movable endless conveyor belt and a casting knife in contact with the slurry thus deposited onto the movable endless conveyor belt for obtaining a cast sheet being free from an orange peel structure.

5

10

15

20

25

30

35

40

45

50

55

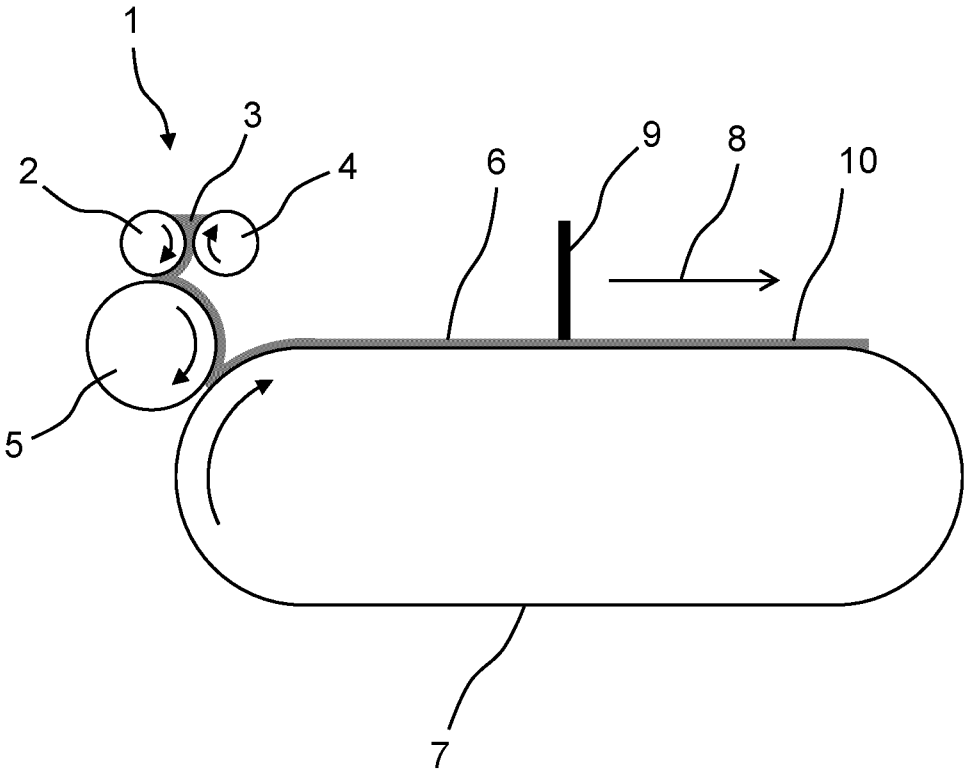


Fig. 1



EUROPEAN SEARCH REPORT

Application Number

EP 24 20 8281

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2016/286853 A1 (WIJERS STEVEN DIRK [NL]) 6 October 2016 (2016-10-06) * paragraphs [0013], [0014], [0016]; claims 1-3 *	1-15	INV. A24B3/14
A	EP 1 055 375 A2 (PHILIP MORRIS PROD [US]) 29 November 2000 (2000-11-29) * paragraphs [0012] - [0014]; figure 1 *	1-15	
A	US 2011/083682 A1 (YANG SZU-SUNG [US] ET AL) 14 April 2011 (2011-04-14) * paragraphs [0090] - [0092], [0097]; figure 3 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			A24B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 March 2025	Examiner Schwarzer, Bernd
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

1
EPO FORM 1503 03.82 (F04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 24 20 8281

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

31-03-2025

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016286853 A1	06-10-2016	EP 3075267 A1	05-10-2016
		NL 2014556 A	14-10-2016
		US 2016286853 A1	06-10-2016

EP 1055375 A2	29-11-2000	BR 0002374 A	02-01-2001
		EP 1055375 A2	29-11-2000
		MY 122660 A	29-04-2006
		US 6216706 B1	17-04-2001

US 2011083682 A1	14-04-2011	AT E453337 T1	15-01-2010
		BR PI0617454 A2	26-07-2011
		EP 1937092 A2	02-07-2008
		ES 2339057 T3	14-05-2010
		PL 1937092 T3	30-06-2010
		PT 1937092 E	07-04-2010
		SI 1937092 T1	30-04-2010
		US 2007084476 A1	19-04-2007
		US 2011083682 A1	14-04-2011
		WO 2007046005 A2	26-04-2007

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1489927 A [0002]
- US 2022354157 A [0003]
- US 2011083682 A [0004] [0008]
- US 4706692 A [0005]
- US 2016286853 A [0006] [0016]
- EP 1055375 A [0007]
- EP 3680078 A [0036]