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(54) **LAMINATING MACHINE AND LAMINATING METHOD THEREOF**

(57) A coating machine and its coating method are provided. The coating machine includes: a cardboard conveying mechanism (1) with a front end (11) and a back end (12) higher than the front end (11); and a wax dispenser (2) provided above the back end (12) and provided with a wax dispensing roller (3) on each of two lateral sides of the wax dispenser (2). The coating machine

and its coating method are designed to wax not only the surface, but also the edges, of cardboard (10) so that waterproofness of the entire cardboard (10) is ensured. The coating machine is structurally simple and highly automated, and the coating method is easy to perform and highly automated.

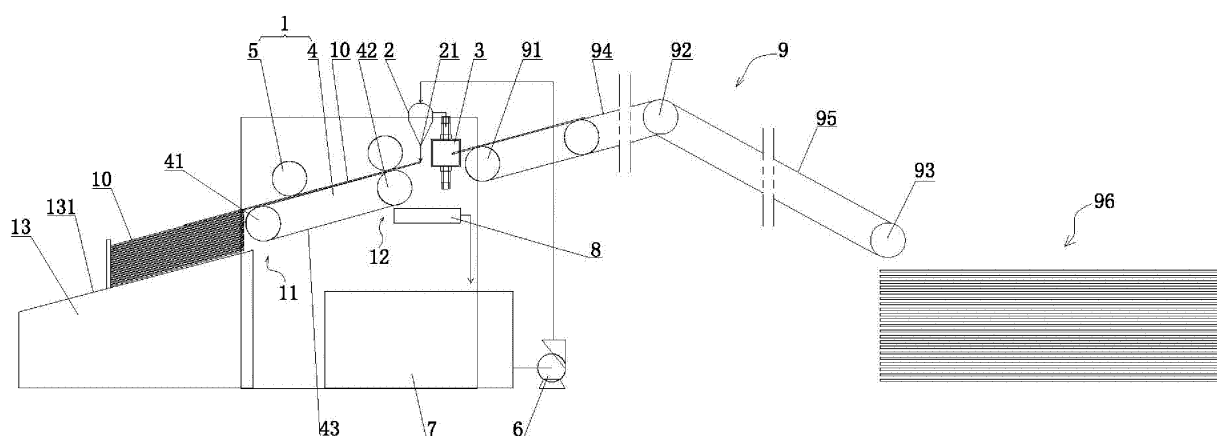


FIG. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a coating machine and a coating method thereof. More particularly, the invention relates to a coating machine and method for use in the manufacture of cardboard boxes to coat heat-insulating cardboard with wax.

BACKGROUND OF THE INVENTION

[0002] Nowadays, marine products such as seafood are typically transported in cardboard boxes. As liquids are sure to be found on the surface of seafood, it is required that cardboard boxes for storing marine products be water-resistant to some extent so that boxed marine products can be transported over long distances.

[0003] To waterproof a cardboard box, it is common practice to coat each of its cardboard components with liquid wax, which forms a wax layer capable of isolating the surface liquids of marine products from the cardboard itself. However, the existing coating machines can effectively coat only the surface, but not the edges, of cardboard with wax. The resulting cardboard boxes, therefore, are flawed in that they are permeable to water and hence prone to break when wet.

[0004] To overcome the foregoing drawback, a novel coating machine for forming a wax layer on cardboard is needed.

BRIEF SUMMARY OF THE INVENTION

[0005] One objective of the present invention is to provide a coating machine that is structurally simple, highly automated, and capable of waxing not only the surface, but also the edges, of cardboard so that waterproofness of the entire cardboard is ensured.

[0006] Another objective of the present invention is to provide a coating method that is easy to perform, highly automated, and capable of waxing not only the surface, but also the edges, of cardboard so that waterproofness of the entire cardboard is ensured.

[0007] The above objectives can be achieved by the following technical solutions:

[0008] The present invention provides a coating machine that includes a cardboard conveying mechanism and a wax dispenser.

[0009] The cardboard conveying mechanism has a front end and a back end, wherein the front end is lower than the back end.

[0010] The wax dispenser is provided above the back end and is provided with a wax dispensing roller on each of two lateral sides of the wax dispenser.

[0011] Preferably, each of the wax dispensing rollers includes a roller body and a felt sleeve.

[0012] Each roller body has a hollow chamber in communication with the wax dispenser through a connecting

tube and is provided with a plurality of through holes in communication with the hollow chamber.

[0013] Each felt sleeve is mounted around the corresponding roller body.

[0014] Preferably, the cardboard conveying mechanism includes a conveyor body and a plurality of pressure rollers.

[0015] The conveyor body has a front-end conveying wheel, a back-end conveying wheel, and a conveyor belt looped around the front-end conveying wheel and the back-end conveying wheel. Cardboard can be placed on the conveyor belt in order to be coated.

[0016] The pressure rollers are provided above the conveyor body such that cardboard can be held between the conveyor belt and the pressure rollers.

[0017] Preferably, the coating machine further includes a wax trough below the wax dispenser and the two wax dispensing rollers.

[0018] Preferably, the front end of the cardboard conveying mechanism is provided with a cardboard holder, and the cardboard holder has an inclined cardboard-supporting table.

[0019] Preferably, the back end of the cardboard conveying mechanism is provided with a transport mechanism that includes a front-end transport wheel, a middle transport wheel, and a rear-end transport wheel. Both the front-end transport wheel and the rear-end transport wheel are lower than the middle transport wheel. A first transport belt is looped around the front-end transport wheel and the middle transport wheel while a second transport belt is looped around the middle transport wheel and the rear-end transport wheel.

[0020] Preferably, the rear-end transport wheel is lower than the front-end transport wheel.

[0021] Preferably, a cardboard collector is provided near the rear-end transport wheel.

[0022] Preferably, the coating machine further includes a wax reservoir for storing liquid wax. The wax reservoir is connected to the wax dispenser through a pump and is below the wax trough.

[0023] The present invention also provides the coating method of the foregoing coating machine, wherein the coating method includes the steps of:

- a) placing cardboard on the cardboard conveying mechanism such that the wax dispenser is vertically aligned with a forward edge of the cardboard;
- b) turning on the wax dispenser and the cardboard conveying mechanism in order for the wax dispenser to dispense wax to the forward edge and an upper surface of the cardboard; and
- c) coating two lateral edges of the cardboard with wax by the wax dispensing rollers on the two lateral sides of the wax dispenser respectively while the cardboard is moved from the front end of the cardboard conveying mechanism to the back end of the cardboard conveying mechanism.

[0024] It is preferable that the cardboard is heat-insulating cardboard, that the heat-insulating cardboard includes a cardboard body and a heat-insulating material adhesively bonded to each other, and that an outer surface of the cardboard body as well as two lateral edges and a forward edge of the heat-insulating cardboard is to be coated with wax.

[0025] It is preferable that the cardboard body is 0.3 mm~9 mm thick.

[0026] It is preferable that the heat-insulating material is 1 mm~6 mm thick.

[0027] The coating machine and coating method of the present invention have the following features and advantages: The two wax dispensing rollers can wax two lateral edges of a sheet of cardboard respectively while the wax dispenser dispenses wax evenly over the upper surface and forward edge of the cardboard, and this effectively ensures that the coated cardboard is waterproofed as a whole. Aside from being able to wax an entire sheet of cardboard, the invention is structurally simple, easy to perform, and highly automated.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0028] To expound the technical solutions provided by embodiments of the present invention, a brief description of the accompanying drawings, to which the following embodiments refer, is given below. It is understood that the accompanying drawings show only some embodiments of the invention, and that a person of ordinary skill in the art may derive other drawings from the accompanying ones without creative labor.

FIG. 1 schematically shows the structure of a coating machine according to the present invention.

FIG. 2 schematically shows the structure of a wax dispensing roller of the coating machine in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0029] The technical solutions provided by embodiments of the present invention are detailed below with reference to the accompanying drawings. It is understood that the embodiments described herein are only some illustrative ones, and do not include all the possible embodiments, of the invention. All other embodiments achievable by a person of ordinary skill in the art without creative labor should fall within the scope of patent protection sought by the present applicant.

Embodiment 1

[0030] As shown in FIG. 1, the present invention provides a coating machine that includes a cardboard conveying mechanism 1 and a wax dispenser 2. The cardboard conveying mechanism 1 has a front end 11 and a back end 12, wherein the front end 11 is lower than the

back end 12. The wax dispenser 2 is provided above the back end 12, and a wax dispensing roller 3 is provided on each of two lateral sides of the wax dispenser 2.

[0031] More specifically, the cardboard conveying mechanism 1 includes a conveyor body 4 and a plurality of pressure rollers 5. The conveyor body 4 has a front-end conveying wheel 41, a back-end conveying wheel 42, and a conveyor belt 43 looped around the front-end conveying wheel 41 and the back-end conveying wheel 42. Cardboard 10 can be placed on the conveyor belt 43 in order to be coated. The cardboard 10 may be a single- or multi-ply composite cardboard having a thickness ranging from 0.3 mm to 9 mm; the present invention has no limitation in this regard. The pressure rollers 5 are provided above the conveyor body 4 in such a way that the cardboard 10 can be held between the conveyor belt 43 and the pressure rollers 5.

[0032] The wax dispenser 2 is located above the back end 12 of the cardboard conveying mechanism 1 and has a wax outlet 21 lying above the back-end conveying wheel 42 of the cardboard conveying mechanism 1. The wax outlet 21 of the wax dispenser 2 is a slit whose length corresponds to the width of the cardboard 10. When the cardboard 10 is conveyed to the back-end conveying wheel 42 (i.e., when the forward edge of the cardboard 10 is vertically aligned with the wax outlet 21 of the wax dispenser 2), the wax dispenser 2 is turned on, allowing the liquid wax in the wax dispenser 2 to curtain-coat the cardboard 10 through the wax outlet 21. In the present invention, the wax dispenser 2 is connected to a wax reservoir 7 through a pump 6. The wax reservoir 7 contains liquid wax, and the pump 6 can pump the liquid wax in the wax reservoir 7 into the wax dispenser 2.

[0033] Once turned on, the front-end conveying wheel 41 and the back-end conveying wheel 42 of the cardboard conveying mechanism 1 are rotated and thereby move the cardboard 10 from the front end 11 to the back end 12 of the cardboard conveying mechanism 1 via the conveyor belt 43. As the front end 11 is lower than the back end 12 (i.e., the conveyor belt 43 is inclined at a certain angle), the cardboard 10 is conveyed slantingly upward such that the liquid wax in the wax dispenser 2 above the back end 12 falls as a curtain on the forward edge of the cardboard 10. Meanwhile, constant-speed movement of the cardboard 10 along the cardboard conveying mechanism 1 allows the liquid wax falling from the wax dispenser 2 to curtain-coat the entire upper surface of the cardboard 10. As a result, the upper surface as well as the forward edge of the cardboard 10 is evenly coated with liquid wax. It is worth mentioning that, during the conveying process, the pressure rollers 5 hold the cardboard 10 against the conveyor belt 43 to prevent the cardboard 10 from sliding off the conveyor belt 43.

[0034] The two wax dispensing rollers 3, which are provided on the two lateral sides of the wax dispenser 2 respectively, are spaced apart by a distance equivalent to the width of the cardboard 10 so as to contact two lateral edges of the cardboard 10 respectively. In the

present invention, as shown in FIG. 2, each wax dispensing roller 3 includes a roller body 31 and a felt sleeve 32. The roller body 31 has a hollow chamber in communication with the wax dispenser 2 through a connecting tube 33. The roller body 31 is also provided with a plurality of through holes 311 in communication with the hollow chamber. The felt sleeve 32 is mounted around the roller body 31.

[0035] More specifically, the wax dispensing roller 3 has a fixing frame 34. The roller body 31 is rotatably connected to the fixing frame 34 via bearings provided respectively at two ends of the roller body 31. The roller body 31 is generally cylindrical and has its upper end connected to the wax dispenser 2 through the connecting tube 33 in order for the liquid wax in the wax dispenser 2 to flow through the connecting tube 33 into the hollow chamber of the roller body 31. The through holes 311 are provided in the peripheral wall of the roller body 31 and are in communication with the hollow chamber so that the liquid wax flowing into the hollow chamber of the roller body 31 can flow through the through holes 311 to the outer surface of the roller body 31.

[0036] The felt sleeve 32 is generally cylindrical, has an inner diameter slightly larger than the outer diameter of the roller body 31, and is mounted around the outer surface of the roller body 31 so as to rotate along with the roller body 31. While the roller body 31 is rotated, the felt sleeve 32 is in contact with the outer surface of the roller body 31 and can also contact the corresponding lateral edge of the cardboard 10, thereby dispensing the liquid wax on the outer surface of the roller body 31 to (i.e., waxing) the corresponding lateral edge of the cardboard 10.

[0037] The coating machine further includes a wax trough 8 below the wax dispenser 2 and the two wax dispensing rollers 3 in order to collect excess liquid wax flowing out of the wax dispenser 2 and the wax dispensing rollers 3. The wax trough 8 lies above the wax reservoir 7, and the liquid wax in the wax trough 8 can flow into the wax reservoir 7 through an outlet at the bottom of the wax trough 8.

[0038] In this embodiment of the present invention, the front end 11 of the cardboard conveying mechanism 1 is provided with a cardboard holder 13. The cardboard holder 13 has an inclined cardboard-supporting table 131 on which to place the cardboard 10 to be waxed and that facilitates conveyance of the cardboard 10 by giving the cardboard 10 the same inclination angle as the conveyor belt 43 before the cardboard 10 is fed into the cardboard conveying mechanism 1.

[0039] Moreover, the back end 12 of the cardboard conveying mechanism 1 is provided with a transport mechanism 9. The transport mechanism 9 includes a front-end transport wheel 91, a middle transport wheel 92, and a rear-end transport wheel 93. Both the front-end transport wheel 91 and the rear-end transport wheel 93 are lower than the middle transport wheel 92. A first transport belt 94 is looped around the front-end transport

wheel 91 and the middle transport wheel 92 while a second transport belt 95 is looped around the middle transport wheel 92 and the rear-end transport wheel 93. In this embodiment, the rear-end transport wheel 93 is lower than the front-end transport wheel 91.

[0040] Once turned on, the front-end transport wheel 91, the middle transport wheel 92, and the rear-end transport wheel 93 of the transport mechanism 9 are rotated such that the first transport belt 94 receives the curtain-coated cardboard 10 from the cardboard conveying mechanism 1 and transports the cardboard 10 to the second transport belt 95, which further transports the cardboard 10 to a cardboard collector 96 near the rear-end transport wheel 93 to complete collection of the waxed cardboard 10.

[0041] The coating machine of the present invention is so designed that not only can the wax dispenser 2 coat the upper surface and forward edge of the cardboard 10 evenly with wax, but also the two wax dispensing rollers 3 can wax the two lateral edges of the cardboard 10 respectively to ensure that the cardboard 10 is waterproofed as a whole. In addition to the ability to wax the entire cardboard 10, the coating machine features a simple structure and a high degree of automation.

Embodiment 2

[0042] With continued reference to FIG. 1 and FIG. 2, the present invention further provides the coating method of a coating machine. The structures, working principle, and advantageous effects of the coating machine in embodiment 2 are identical to those of the coating machine in embodiment 1 and hence will not be described repeatedly. The coating method of the coating machine includes the following steps:

- a) Place the cardboard 10 on the cardboard conveying mechanism 1, with the wax dispenser 2 in vertical alignment with the forward edge of the cardboard 10;
- b) Turn on the wax dispenser 2 and the cardboard conveying mechanism 1 so that the wax dispenser 2 dispenses wax to the forward edge and the upper surface of the cardboard 10; and
- c) Wax the two lateral edges of the cardboard 10 with the wax dispensing rollers 3 on the two lateral sides of the wax dispenser 2 respectively while the cardboard 10 is moved from the front end 11 of the cardboard conveying mechanism 1 to the back end 12 of the cardboard conveying mechanism 1.

[0043] More specifically, the cardboard conveying mechanism 1 is inclined at a certain angle such that the cardboard 10 placed thereon is inclined at the same angle.

[0044] Once turned on, the front-end conveying wheel 41 and the back-end conveying wheel 42 of the cardboard conveying mechanism 1 are rotated and thereby move the cardboard 10 from the front end 11 to the back

end 12 of the cardboard conveying mechanism 1 via the conveyor belt 43. As the cardboard 10 is conveyed slantingly upward, the liquid wax in the wax dispenser 2 above the back end 12 falls as a curtain on the forward edge of the cardboard 10, and constant-speed movement of the cardboard 10 along the cardboard conveying mechanism 1 allows the liquid wax falling from the wax dispenser 2 to also curtain-coat the entire upper surface of the cardboard 10. Consequently, the upper surface as well as the forward edge of the cardboard 10 is evenly coated with liquid wax. It is worth mentioning that, during the conveying process, the pressure rollers 5 above the cardboard conveying mechanism 1 hold the cardboard 10 against the conveyor belt 43 to prevent the cardboard 10 from sliding off the conveyor belt 43.

[0045] In the present invention, the cardboard 10 is heat-insulating cardboard that includes a cardboard body and a heat-insulating material adhesively bonded to each other. The liquid wax falling from the wax dispenser 2 can curtain-coat the outer surface of the cardboard body and the forward edge of the heat-insulating cardboard, and each of the two lateral edges of the heat-insulating cardboard can be coated by the wax dispensing roller 3 on one of the two lateral sides of the wax dispenser 2. In the present invention, the cardboard body has a thickness of 0.3 mm~9 mm, and the heat-insulating material has a thickness of 1 mm~6 mm.

[0046] The coating method of the present invention not only dispenses wax to the upper surface and forward edge of the cardboard 10, but also waxes the two lateral edges of the cardboard 10 to effectively ensure waterproofness of the entire cardboard 10. Aside from being capable of waxing the whole cardboard 10, the coating method is easy to perform and features a high degree of automation.

[0047] The foregoing is only a couple of embodiments of the present invention. A person skilled in the art may modify or change the disclosed embodiments in many ways according to the disclosure of the present specification without departing from the scope of the invention.

Claims

1. A coating machine, **characterized by** comprising:

a cardboard conveying mechanism (1) having a front end (11) and a back end (12), wherein the front end (11) is lower than the back end (12); and

a wax dispenser (2) provided above the back end (12) and provided with a wax dispensing roller (3) on each of two lateral sides of the wax dispenser (2).

2. The coating machine of claim 1, **characterized in that** each of the wax dispensing rollers (3) comprises:

a roller body (31) having a hollow chamber in communication with the wax dispenser (2) through a connecting tube (33), the roller body (31) being provided with a plurality of through holes (311) in communication with the hollow chamber; and
a felt sleeve (32) mounted around the roller body (31).

3. The coating machine of claim 1, **characterized in that** the cardboard conveying mechanism (1) comprises:

a conveyor body (4) having a front-end conveying wheel (41), a back-end conveying wheel (42), and a conveyor belt (43) looped around the front-end conveying wheel (41) and the back-end conveying wheel (42) such that cardboard (10) is placeable on the conveyor belt (43) in order to be coated; and

a plurality of pressure rollers (5) provided above the conveyor body (4) such that the cardboard (10) is able to be held between the conveyor belt (43) and the pressure rollers (5).

4. The coating machine of claim 1, **characterized by** further comprising a wax trough (8) below the wax dispenser (2) and the two wax dispensing rollers (3).

5. The coating machine of claim 1, **characterized in that** the front end (11) of the cardboard conveying mechanism (1) is provided with a cardboard holder (13), and that the cardboard holder (13) has an inclined cardboard-supporting table (131).

6. The coating machine of claim 1, **characterized in that** the back end (12) of the cardboard conveying mechanism (1) is provided with a transport mechanism (9); that the transport mechanism (9) comprises a front-end transport wheel (91), a middle transport wheel (92), and a rear-end transport wheel (93); that the front-end transport wheel (91) and the rear-end transport wheel (93) are lower than the middle transport wheel (92); and that there are a first transport belt (94) looped around the front-end transport wheel (91) and the middle transport wheel (92) and a second transport belt (95) looped around the middle transport wheel (92) and the rear-end transport wheel (93).

7. The coating machine of claim 6, **characterized in that** the rear-end transport wheel (93) is lower than the front-end transport wheel (91).

8. The coating machine of claim 6, **characterized in that** a cardboard collector (96) is provided near the rear-end transport wheel (93).

9. The coating machine of claim 4, **characterized by** further comprising a wax reservoir (7) for storing liquid wax, wherein the wax reservoir (7) is connected to the wax dispenser (2) through a pump (6) and is below the wax trough (8). 5
10. A coating method of the coating machine of any of claims 1-9, **characterized by** comprising the steps of: 10
- a) placing the cardboard (10) on the cardboard conveying mechanism (1) such that the wax dispenser (2) is vertically aligned with a forward edge of the cardboard (10);
 - b) turning on the wax dispenser (2) and the cardboard conveying mechanism (1) in order for the wax dispenser (2) to dispense wax to the forward edge and an upper surface of the cardboard (10); and 15
 - c) coating two lateral edges of the cardboard (10) with wax by the wax dispensing rollers (3) on the two lateral sides of the wax dispenser (2) respectively while the cardboard (10) is moved from the front end (11) of the cardboard conveying mechanism (1) to the back end (12) of the cardboard conveying mechanism (1). 20 25
11. The coating method of claim 10, **characterized in that** the cardboard (10) is heat-insulating cardboard, that the heat-insulating cardboard comprises a cardboard body and a heat-insulating material adhesively bonded to each other, and that an outer surface of the cardboard body as well as two lateral edges and a forward edge of the heat-insulating cardboard is to be coated with wax. 30 35
12. The coating method of claim 11, **characterized in that** the cardboard body has a thickness of 0.3 mm~9 mm. 40
13. The coating method of claim 11, **characterized in that** the heat-insulating material has a thickness of 1 mm~6 mm. 45 50 55

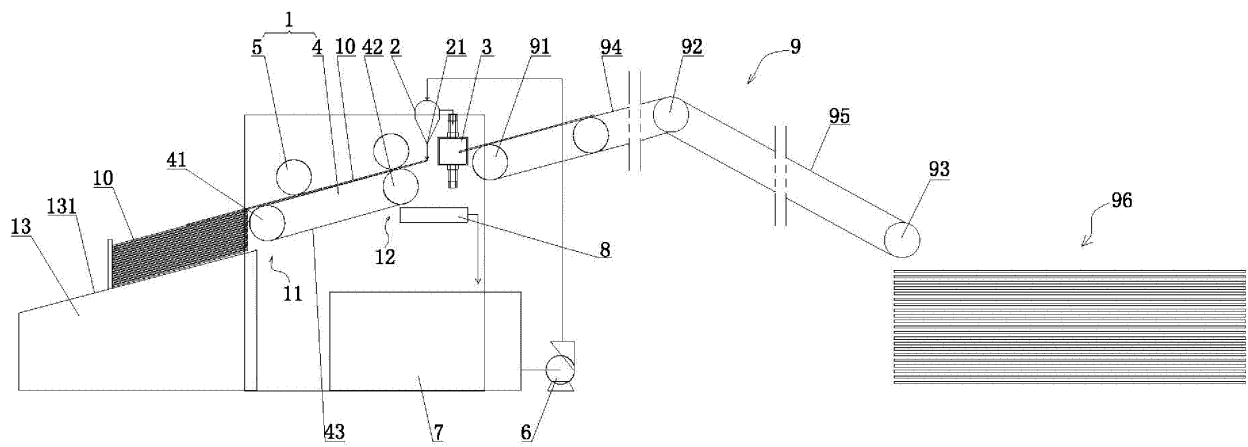


FIG. 1

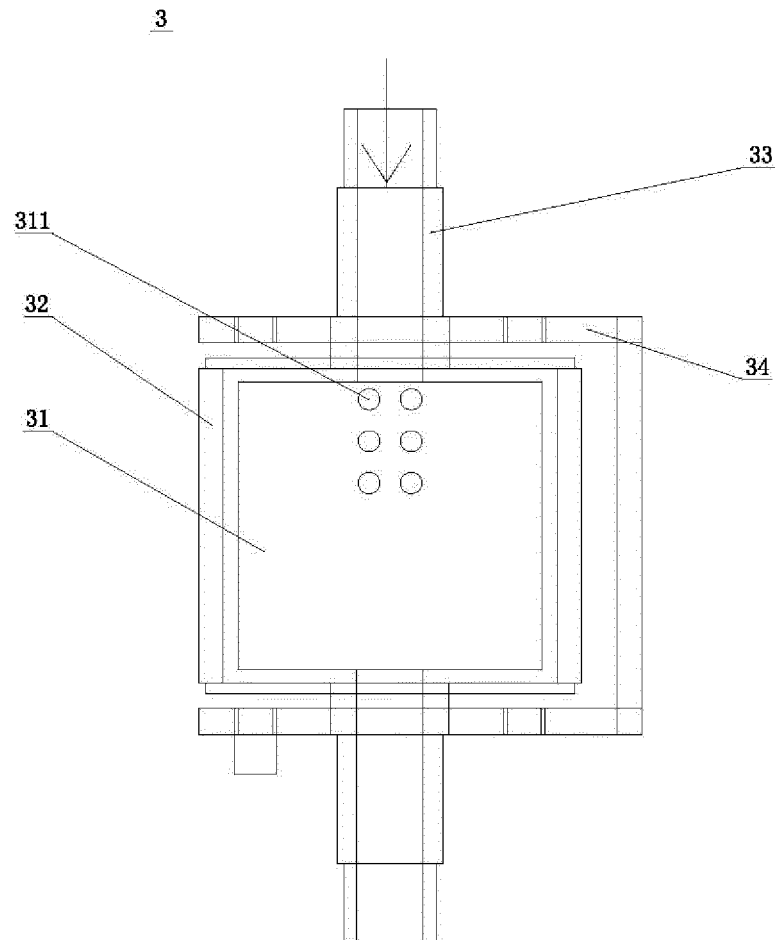


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2015/091837

A. CLASSIFICATION OF SUBJECT MATTER

D21H 23/56 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D21H 23/-; D21H 27/-; D21H 25/-; D21H 19/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI, CNPAT, WPI, EPODOC: coated, smear, board, waterproof, oil-proof, edge?, side?, wax, coat+, water, oil, paper, sheet, package

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3307516 A (CONTINENTAL OIL CO.), 07 March 1967 (07.03.1967), description, column 1, line 10 to column 5, line 59, and figure 1	1-13
A	JPH 0782697 A (SUGIYAMA, K.), 28 March 1995 (28.03.1995), the whole document	1-13
A	CN 101503869 A (WEI MON INDUSTRY CO., LTD. et al.), 12 August 2009 (12.08.2009), the whole document	1-13
A	JPH 11323786 A (TOKUSHU SEISHI K.K.), 26 November 1999 (26.11.1999), the whole document	1-13
A	CN 202416066 U (HARBIN PENGCHENG PLASTIC COLOR PRINTING CO., LTD.), 05 September 2012 (05.09.2012), the whole document	1-13
A	CN 102191723 A (SHENZHEN ARTRON COLOR PRINTING CO., LTD. et al.), 21 September 2011 (21.09.2011), the whole document	1-13
A	CN 104694039 A (SHANGHAI GENIUS ADVANCED MATERIAL (GROUP) CO., LTD.), 10 June 2015 (10.06.2015), the whole document	1-13

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

22 June 2016 (22.06.2016)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/091837

5	C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
10	A	JP 2003089999 A (NIPPON SEISHI K.K.), 28 March 2003 (28.03.2003), the whole	1-13
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Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2015/091837

5	Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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