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(21) International Application Number: PCT/FI97/00155 (22) International Filing Date: 10 March 1997 (10.03.97) (30) Priority Data: 961133 11 March 1996 (11.03.96) FI (71) Applicant (for all designated States except US): AHLSTRÖM ALCORE OY [FI/FI]; Karhulantie, FIN-48600 Karhula (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): KORHONEN, Pertti [FI/FI]; Tuulikinkatu 1 D 32, FIN-48700 Kymnlinna (FI). (74) Agent: AHLSTROM MACHINERY OY; Patent Dept., P.O. Box 18, FIN-48601 Karhula (FI).		(81) Designated States: CA, EE, JP, KR, LT, LV, NO, PL, RU, SK, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>
(54) Title: CORE AND A METHOD OF MANUFACTURING SUCH (57) Abstract The present invention relates to a method of manufacturing a core, especially a spiral core, from superimposed plies of board produced by winding, gluing, and drying such, whereby the moisture contents of at least some of the board plies entering the winding stage differ from each other in order to provide a stepwise moisture structure within the core wall. This decreases unfavourable stresses which are produced in the drying stage if a core is manufactured from plies having equal moisture contents.		

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CORE AND A METHOD OF MANUFACTURING SUCH

The present invention relates to a method of manufacturing a core, especially a spirally wound core, from superimposed plies of board by winding, glueing, and then drying such.

Webs produced in the paper, plastic and textile industries are usually reeled on cores for rolls. Cores made from board, especially spiral cores, are manufactured by glueing plies of board one on top of the other and by winding them spirally in a special spiral machine. The width, thickness, and number of plies of board needed to form a core vary depending on the dimensions and strength requirements of the core to be manufactured, the ply width being typically 50 to 250 mm, thickness 0.2 to 1.2 mm and the number of plies 3 to 30. The strength of the board ply varies to comply with the strength requirement of the core.

The wall thicknesses of cores will vary within a wide range, being typically 0.50 to 18 mm. The thicker the core wall, the more plies it is composed of. Irrespective of the ply, moisture of the board entering the spiral machine is typically the same, homogeneous, e.g. 8 %, which often corresponds to the demand for moisture of the finished core.

As a great number of thin plies are glued together by spreading glue onto large surfaces thereof to make them into a thick core wall, and as the dry matter content of the glue is generally low, about 20 to 60 %, the moisture of the board clearly increases at the spiral machine, usually up to 11 - 18 %. Therefore, the produced core has to be dried until it is ready to be delivered to the user.

Drying is effected by blowing mildly heated air through a stack of cores. Drying is laborious and time consuming because the core wall to be dried is thick. A moisture gradient is inevitably formed inside the thick material during drying. In other words, the surface has to dry before the inner parts of the wall can begin to dry. Such a moisture gradient may be several percentage units of moisture per a few millimetres. This is shown, by way of example, in the accompanying graph which indicates a typical moisture profile within a core wall. It is typical of a moisture gradient of known cores that it does not readily become level once it has been formed.

When a ply of board is glued, its fibres swell. During drying of the core, the fibres shrink again as their moisture decreases. For drying, the cores are usually stacked tightly in an overlapping arrangement. Because of the mode of stacking, each core dries mainly internally when air is blown thereto. In the tight stacking, the moisture gradient is formed in one direction, i.e., z-direction, so that the moisture decreases from near the outer periphery of the core towards the inner surface the core wall (cf. Fig.).

Hence, as the core wall has differences in its moisture content and as shrinking occurs at different times during drying, and the latter has an opening effect on the core structure, relatively strong internal stresses are developed in the core wall. Stresses also result from differences in angles of board strips of various plies, according to the geometry of a spiral core. In the worst case, these stresses may even cause material defects. In any case, they weaken the strength of the core when it is under strain, the most typical of such strain being so-called chuck loading (i.e., the roll is supported by a core through relatively short chucks).

The internal stresses of the core may be detected by splitting a thin annulus cut off of the core or by testing cores that have been dried and treated in different manners with a special chuck strength testing device.

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It is an object of the present invention to provide a method of decreasing, eliminating or even changing the direction of these stresses, in order to thereby increase the strength and load resistance of a core, especially in case of chuck loading.

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In the method of the present invention, the core is manufactured of superimposed plies of board by winding, glueing and drying them, and it is a characteristic feature of the invention that the moisture contents of at least some of the plies entering the winding stage differ from each other in order to produce a stepwise moisture structure in the core wall.

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As mentioned hereinabove, prior art board cores have been manufactured so that the plies of board used to compose the core wall have equal moisture contents. During drying of the core, the moisture gradient is so formed that the plies nearest to the inner wall (or walls) dry first, thereby developing unfavourable stresses.

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When the original moisture contents of the different board plies are arranged according to the invention, for example, already during board manufacture or when slitting the board strips having different widths and intended for different plies, so that the moistures comply with the moisture gradient which is inevitably developed in the board plies during core drying, stresses described hereinabove are minimized. The stepwise moisture structure according to the invention can be produced when the shape of the moisture gradient is first received by either thermodynamical calculation or definition by

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tests. Required differences in moisture content (stepwise moisture structure) may be produced at a spiral machine, by changing and/or adjusting the method of glueing various board plies (e.g., one-side or two-side glueing), or
5 by changing and/or adjusting the type of glue. Thus, at least one type of glue is used for glueing various board plies. Required differences in moisture content may be produced at the spiral machine also by changing properties, especially the dry matter content, of the type of
10 glue used for glueing various board plies.

In prior art methods, all plies within the core wall have typically had the same moisture content of, e.g., 8 %. The original moisture content of the internal plies of
15 the core manufactured by the method according to the invention is e.g. 6 %, increasing towards the outer surface of the core first to 7 %, then to 8.5 % and finally, on the outer surface to about 10 %. Glueing increases the moisture content because of the water contained in the
20 glue, which water is removed in drying. However, the originally provided stepwise moisture structure relationship according to the invention is maintained in every stage, whereby developing of harmful stresses in drying is avoided. The moisture values given hereinabove are
25 exemplary, and other types of stepwise moisture structures are feasible according to each case, for example, according to the desired final moisture content of a finished core. Furthermore and for example, the outermost ply may be left drier in order to expedite the drying
30 process itself, or drier plies may be arranged on both surfaces of the core wall in accordance with the moisture gradient anticipated on the basis of the mode of drying.

The chuck load resistance of the core manufactured by the
35 method according to the invention is even 50 % higher in comparison with cores manufactured according to prior art when under unfavourable stress. This is indicated by the

table below, presenting the chuck load resistance values of cores manufactured according to prior art and correspondingly, according to the present invention.

5			
		Chuck load resistance kN/100 mm (1)	
10	Core	Comparison value (2)	Stepwise moisture
15	Printing paper core	0.70	0.95
	Rotogravure paper core	1.80	2.30
	Rotogravure paper core	2.40	3.20

20 (1) defined with Ahlstrom Core Tester (EP patent 309123),
test core length 100 mm, power acceleration to maximum
180 s

(2) long term statistic average of said core grade

25 The method of the invention also allows use thereof by
manufacturing a pretensioned core in such a way that a
tension status opposite to the direction of tensions
developing under chuck loading is produced in the core,
thereby increasing the core strength. This is accom-
30 plished, e.g., by letting the core moisture increase
after drying.

The invention is not limited to the exemplary embodiments
described hereinabove, but various modifications and
35 applications are possible within the inventive scope
defined by the accompanying claims.

Claims:

1. A method of manufacturing a core, especially a spirally wound core, from superimposed plies of board produced by winding, glueing, and drying such, **characterized** in that the moisture contents of at least some of the plies of board entering the winding stage differ from each other to provide a stepwise moisture structure within the wall forming the core.
2. A method as recited in claim 1, **characterized** in that the moisture contents of the plies, i.e., the stepwise moisture structure, have been chosen in accordance with the moisture profile being formed in the core wall during core drying.
3. A method as recited in claim 2, **characterized** in that the core moisture is allowed to increase after drying of the core for providing a tension effect stretching the core structure.
4. A method as recited in any of the preceding claims, **characterized** in that various moisture contents of the plies of board are produced by the board machine during board manufacture and/or subsequent slitting of board strips which are of different widths and are intended for different plies.
5. A method as recited in any of the preceding claims, **characterized** in that required differences in moisture content are produced at a spiral machine, by changing and/or adjusting the method of glueing various board plies, e.g. one-side or two-side glueing.
6. A method as recited in any of the preceding claims, **characterized** in that required differences in moisture

content are produced at a spiral machine, by using at least one type of glue for glueing various board plies.

- 5 7. A method as recited in any of the preceding claims, **characterized** in that required differences in moisture content are produced at a spiral machine, by changing properties of the type of glue used for glueing various board plies.
- 10 8. A method as recited in any of the preceding claims, **characterized** in that required differences in moisture content are produced at a spiral machine, by changing the dry matter content of the type of glue used for glueing various board plies.
- 15 9. A core, especially a spiral core, comprising superimposed plies of board, **characterized** in that the core is composed of plies of board, at least some of said plies of board having been provided intentionally with moisture
- 20 contents differing from each other.

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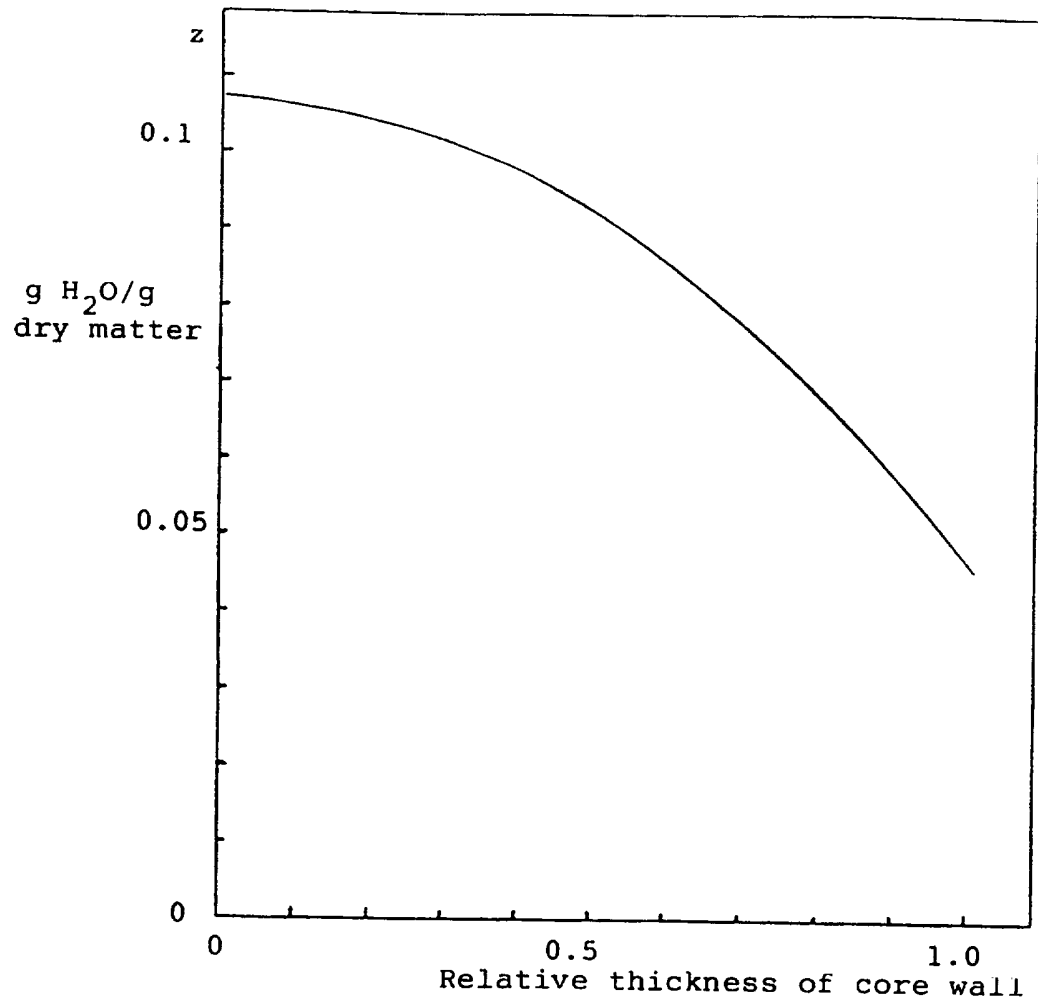


FIG.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00155

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B31C 3/00, B65H 75/02

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)

IPC6: B31C, B65H

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

SE,DK,FI,NO classes as above

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

WPI, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0699518 A2 (FUJI PHOTO FILM CO., LTD), 6 March 1996 (06.03.96), figures 1,2, abstract --	1-9
A	Patent Abstracts of Japan,, abstract of JP,A, 3-217839 (FUJI PHOTO FILM KK), 25 Sept 1991 (25.09.91) --	1-9
A	EP 0534162 A1 (KONICA CORPORATION), 31 March 1993 (31.03.93), claim 2, abstract -- -----	1-9

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

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0699518 A2	06/03/96	JP 8057991 A	05/03/96
EP 0534162 A1	31/03/93	DE 69208790 D,T	08/08/96
		JP 5197085 A	06/08/93
		US 5324554 A	28/06/94