

(19)



(11)

EP 2 422 948 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:

29.02.2012 Bulletin 2012/09

(51) Int Cl.:

B27N 3/02 (2006.01)

B27J 5/00 (2006.01)

B27K 7/00 (2006.01)

(21) Application number: **10766673.7**

(86) International application number:

PCT/ES2010/000166

(22) Date of filing: **19.04.2010**

(87) International publication number:

WO 2010/122189 (28.10.2010 Gazette 2010/43)

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL
PT RO SE SI SK SM TR**

(72) Inventors:

- **Rodríguez Arnal, Ángel**
30120 - El Palmar (Murcia) (ES)
- **Rodríguez Arnal, Gloria**
30120 - El Palmar (Murcia) (ES)
- **Roldan Gómez, Carlos**
30120 - El Palmar (Murcia) (ES)

(30) Priority: **20.04.2009 ES 200901021**

(71) Applicants:

- **Rodríguez Arnal, Ángel**
30120 - El Palmar (Murcia) (ES)
- **Rodríguez Arnal, Gloria**
30120 - El Palmar (Murcia) (ES)
- **Roldan Gómez, Carlos**
30120 - El Palmar (Murcia) (ES)

(74) Representative: **Jiminez Brinquis, Ruben et al**
Zarol Patentes y Marcas, S.L.L.
Avda. de los Pinos, 9 3^o B-C.P.
30009 Murcia (ES)

(54) **METHOD FOR PRODUCING SURFBOARD BLANKS FROM BLACK CORK**

(57) This invention refers to a method for producing blanks whose main feature is that it makes it possible for them to be made 100% in black cork, achieving the specifications of lightness and resistance without the need for whatsoever chemical adhesive and also achieving other properties that are advantageous in comparison with traditional materials.

This method dispenses with the longitudinal wooden core that currently needs to be attached to the blank and with any type of pollutant material in the manufacturing

process, with evident benefits for the environment and for shapers, who are currently affected by the high toxicity of traditional materials.

The procedure comprises four stages, which consist of grinding the virgin cork to a grain size of between 0.2 and 0.8 mm; the addition of nitrogen in a high-pressure chamber; the subsequent baking of the cork; and its final removal from the mould as a shaped blank.

EP 2 422 948 A1

Description

PURPOSE OF THE INVENTION

[0001] This invention refers to a method for producing surfboard cores, known as 'blanks', made of 100% natural cork without the use of any added synthetic material.

[0002] The main feature of this invention consists of enabling the production of said blanks using a 100% traditional material such as cork, extracted from the bark of the cork tree and used by man for thousands of years. Said material gives the surfboard blank a number of beneficial properties that cannot be obtained with the materials used at the present time (foam, wood or plastic). It is also an alternative void of any environmental impact insofar as the tree is not felled to collect the bark and no kind of adhesive or chemical binder is used to shape it, unlike the materials used at the present time, which include various toxic substances that endanger the health of workers and users and whose manufacturing process involves hazardous environmental contamination.

[0003] One advantage provided by the greater resistance of the cork blank produced by the process is that no wooden core is necessary, as at present with the use of current materials. This greatly simplifies the manufacturing process and reduces manufacturing and assembly times; it also reduces energy requirements significantly.

[0004] This report describes the various components of the process and the treatments required to obtain a surfboard blank with excellent properties for practising said sport, as shown hereinunder.

FIELD OF APPLICATION OF THE INVENTION

[0005] This invention will apply in the surfboard manufacturing industry and similar industries.

BACKGROUND TO THE INVENTION

[0006] The manufacture of a surfboard today begins with the production of the blank in a material known as foam or epoxy, produced in an industry that has the necessary production processes. Said blanks are then sold to workshops and factories, where they are moulded by professionals, called 'shapers', who mould them correctly and then apply various layers of glass fibre as a 'glaze' for the unit, which consists of applying a resin diluted in petrochemical solvents. Finally, it is sanded and polished to give it the end finish.

[0007] In the surfboard blank manufacturing industry, the material known as 'foam' refers to certain classes of chemically treated polyurethane or polystyrene foam, which appeared after the Second World War with the new materials that were introduced during the war to replace wooden boards. This cheap alternative was developed by Hobie Alter and Gordon "Grubby" Clark and gave rise to a new era in surfing, making the sport affordable for a large number of people. At the same time, the high

contamination produced by the products used in the manufacture of foam turned surfing into one of the most polluting industries of modern times, to the point where, in 2005, the main foam factory that produced and distributed 90% of the product across the world (dark Foam) was forced to close as a result of pressure from North America environmental legislation. However, said pressure has not been turned into efforts made by manufacturers to find a cleaner process, but rather the foam industry has simply moved to developing countries that have less restrictive legislation and cheaper labour costs.

[0008] The shapers use breathing apparatuses to protect themselves from the dust and gases released by the foam, which include volatile organic compounds such as 2,4 toluene diisocyanate (2,4 TDI). According to the International Agency for Research on Cancer (IARC), this compound is a human carcinogen and has various effects on the human body, such as the irritation of the mucous membrane, fatigue and breathing difficulties. This represents an evident risk for workers' health that would be best eliminated at source with a raw shaping material that does not produce hazardous particles for human beings or the environment.

[0009] In addition, foam is an extremely fragile and deformable material, and requires a longitudinal piece of wood to make the unit rigid. This piece of wood is called the 'core' and its use increases the complexity of the manufacturing process.

[0010] As a result of the above, it would be desirable for there to be a procedure that uses a material with the advantages of foam (low density, elasticity and low price) but without the aforementioned disadvantages. The procedure described in this report not only achieves this, but also has other advantages as a result of the excellent properties of cork.

[0011] Cork comes from the bark of the cork tree (*Quercus suber*), a tree that is native to the Western Mediterranean. It is also what is known as a climax tree, in other words, one that adapts to its environment. In 1664, Robert Hook discovered the cell and cellular structure of its organisms by observing a piece of bark. In 1665, he designed a microscope and examined cork, describing it as a tissue made up of small cells. Its chemical composition and anatomical structure make it a unique natural material which, despite the continuous progress made in science and technique and the constant efforts made in this direction, has never been imitated to the full.

[0012] Black cork is a material obtained from virgin cork grain which, after baking in an autoclave, segregates its own resin, called 'suberin', which binds the grains together and forms an agglomerate of excellent isolation properties, which is the main use given to it today. On the market, black cork can be found in applications such as heat and vibration isolation for buildings, sealing and for isolating thermal equipment and also spacecraft. Each of these applications requires a different manufacturing process according to the physical properties required of the product.

[0013] The traditional treatment for producing black cork starts with grinding the virgin cork to a grain size of between 2 and 10 mm in a hammer or star-type mill. The grains are then baked at a temperature of 400°C. The baking process makes the material expand, roast and acquire its characteristic colour. It also makes the cork segregate a resin (called 'suberin') that binds all the grains together naturally. Carrying out the baking process in moulds obtains the different shapes of the boards. The cell structure of the cork is maintained after the baking process and only the size of the cells varies. This achieves the excellent properties of the material.

[0014] The authors of this report are not aware of the existence of any method for processing black cork that achieves a product with the physical properties required for use as a surfboard blank, which is confirmed by the absence of uses given to black cork that require certain mechanical properties beyond resistance to compression, since, according to the traditional method for processing this type of cork, the high number of grains and low-level cohesion between them leads to low resistance to traction and twisting.

[0015] This process describes the parameters and processing method required to obtain a surfboard blank made of black cork with excellent properties for practising said sport, as show hereinunder. Said process also solves the aforementioned problems, since it is an environment-friendly alternative in comparison with previous methods used to obtain blanks. It is very accessible and no changes are required in the surfboard shaping workshops, since cork blanks can be worked with the same tools as those used for traditional foam blanks.

EXPLANATION OF THE INVENTION

[0016] The method for reducing surfboard blanks from cork starts with the grinding of the cork. As a raw material, it is possible to use very different qualities of cork, including the possibility of using waste remains from other processes, as long as the remains have not been contaminated by other materials, such as wood or plastic.

[0017] Grinding is one of the most common processes in the cork industry, although black cork is usually only ground as from 2 mm. To make the surfboard blank, the grains must be ground to a size of between 0.2 and 0.8 mm, depending on the density and the properties required for the use required of the material, in other words, the type of surfing for which the blank is to be used.

[0018] Cork is characterised by the fact that it is made up of polyhedral cells with empty interiors (approximately 80% of their volume is gas, mainly nitrogen), closely bound to each other to make up the corky tissue. However, this tissue has a discontinuous structure owing to the presence of lenticels (pores) that cross the entire thickness of the body of the cork radially. The lenticels are permeable to gases and liquids and make it possible to control gaseous exchanges between the living tissues of the trunk and the outside environment during the tree's

life.

[0019] After the appropriate size of cork grain has been obtained, the material is placed inside a high-pressure chamber, where nitrogen is added until sufficient pressure is reached for said gas to penetrate through the lenticels. After sufficient time has passed for the nitrogen to penetrate evenly in all the cork cells, the unit is placed in the autoclave for the baking process.

[0020] It is important to note that the transfer from the high-pressure chamber with nitrogen to the autoclave in which the baking process is to take place must be made with no loss of the pressure that is being applied to the cork; otherwise, part of the gas in the cells would be lost. Accordingly, the high-pressure chamber must be placed inside the autoclave and opened when the baking pressure is guaranteed to be the same as the pressure inside the chamber.

[0021] The purpose of grinding the cork to such fine grain is for the resin known as 'suberin' to be released naturally through the lenticels during the baking process, and for it to be distributed and make the existing cork particles coagulate evenly and fully. This produces the agglomerate with a good finish thanks to the evenness of the final surface. These are excellent physical properties for producing surfboard blanks, as well as for the later finish of the board and for practising the sport itself.

[0022] The creation of overpressure in the cork cells means that higher temperatures can be used in the baking process to increase the quantity of suberin that is to act as a binder for the cork grains, as well as to make the material lighter by increasing the content of lighter-than-air gases and increase the volume of each cell.

[0023] As part of a process with other advantages, the high-pressure chamber could have two functions: besides the initial addition of nitrogen to the cork grains, it could act as a mould after it has been placed in the autoclave. Depending on the technical specifications of each board, different mould shapes and grain sizes will have to be used. Similarly, the nitrogen addition time and the proportions of gas used will be particular to each type of board.

[0024] The baking process in the autoclave makes the cork expand, removes any microorganisms and produces its well-known texture and black colour. In this procedure, the moulds must be placed in an autoclave that reaches the required temperature of between 420 and 450°C for 20/30 minutes. The heat applied to the cork causes it to segregate its own resin and bind together to form a compact block which, depending on the mould that is used, will be made directly available for distribution or be transferred to the next shaping process, in which the block is machined using a numerical control machine or any other procedure appropriate for said function. Thanks to the high pressures in the autoclave, a sufficiently high quantity of suberin can be obtained to completely block many of the lenticels, preventing the gas inside the cells from escaping and providing a stable end material with properties of lightness and resistance that

make it particularly appropriate for producing surfboard blanks.

[0025] As a further advantage, it will be possible to use a high-pressure chamber with one or more moving walls in order to vary the interior volume of the chamber and obtain different types of blanks with the same moulding device.

[0026] After the baking temperature required for the appropriate segregation of the suberin in the cork cells has been reached, the material must be left to cool, together with a gradual reduction of the pressure inside the autoclave. This allows the material to adapt gradually to the atmospheric conditions so that the internal tension created in the material by the effects of pressure and temperature can be absorbed.

[0027] One very important advantage of this method consists of the permanence of a small number of lenticels not blocked by the suberin during the segregation process. Said lenticels act as micro-suckers thanks to the elastic properties of the cork and make it possible for the final glazing of the board with natural resins that could not be used in traditional methods owing to low-level cohesion with the blank material. This method allows for the use of low-resistance gum-resins thanks to the permanent suction of the blank itself on the outer layer, which fixes it and provides it with initial compression. This will logically provide extra resistance from the twisting and traction to which the blank will be subjected during use.

[0028] Owing to its composition and structure, cork is an ideal material for the manufacture of blanks and its properties include the following:

Lightness: due to the fact that 80% of its volume is air. This lightness is essential for modern surfboards. It is one of the lightest materials in existence, which affords it high-level floatability.

- Elasticity: its elasticity is surprising. It produces a more efficient and safe distribution of the force of the wave along the structure of the board and can be adapted to any type of surfing and surfer.

- High friction factor: the cork surface is covered with micro-suckers that produce high-level adherence and help prevent slipping. This greatly helps the correct fusion between the blank and the resin by which it is to be covered.

- High impermeability: the diffusion of liquids and gases through the cork is very cumbersome and extremely slow. Unlike foam blanks, cork blanks do not absorb water or deteriorate when they come into contact with it.

- Aeroelasticity and shock absorption: The area affected by deformation from impact extends and is distributed around the nearby areas and the cork blank is capable of absorbing and minimizing the

turbulence of any wave and resisting impacts and shocks.

- Poisson's ratio of 0: when the cork volume is reduced in any one direction, there is no perpendicular deformation whatsoever, which dramatically reduces the stress on the material when it is forced under extreme conditions.

- Ease-of-use: by modifying the water content of the cork, it becomes more elastic for processing. As mentioned previously, a cork blank can be worked in exactly the same way and using the same tools as a foam blank.

- Low water content: the equilibrium moisture content of the cork with the atmosphere is usually 6%, which prevents the proliferation of microorganisms and makes it extremely durable. Besides being clean and natural, surfboards with cork blanks have an unlimited service life, unlike current foam blanks.

- Non-toxic: cork has no component that is toxic for human beings or the environment. Its structure in the form of round cells means that, in spray form, it is not harmful for the respiratory tract and is easily eliminated by the human body.

- Biodegradable: if turned into waste, it is 100% biodegradable.

[0029] This invention also brings into line a sport like surfing, which is traditionally linked to very positive environmental values, with the supply industry for the sport, which is paradoxically a highly polluting industry. The use of cork as a raw material represents energy spending of around 500 times lower than foam and it does not generate any pollutant waste whatsoever.

[0030] Given the wide variety of types of surfing in existence (surfing, windsurfing, bodyboarding, kitesurfing, etc.), surfboards must have very specific physical properties. In order to adapt to these requirements, which can also vary according to the part of the surfboard in question, it is possible to use different-sized grains in the production of one single blank to obtain the physical qualities required in each area of the blank. For example, the process can use larger grains in the blank interior and fine grains for the outer coating, making the process cheaper.

[0031] It must be pointed out that although, as mentioned previously, the use of a longitudinal wooden core is not necessary to make the blank sufficiently resistant, this process allows for said stage in the same way as it is included today, in other words, cutting the blank longitudinally and gluing the core in place with adhesives or resins. The insertion of the wooden core makes the blank highly resistant so that the board can be used under extreme conditions.

[0032] The aforementioned manufacturing process is

therefore an innovative system that provides a product of specifications unknown to date for said purpose, which, together with its practical use, afford it sufficient grounds for obtaining the privilege of exclusiveness that is being applied for here.

PREFERRED EMBODIMENT OF THE INVENTION

[0033] This invention is illustrated by the following example, given exclusively by way of illustration and not in attempt to limit its scope in whatsoever way:

Beginning with the purchase of natural cork that has not been treated in any way and which can be acquired directly in boards or as excess from other manufacturing processes, a cork blank is manufactured for a surf longboard of a length of 2.8 m. This type of board is designed for small waves and, consequently, high resistance to impact is not necessary; however, in view of the length of the board, it must have good resistance to twisting and traction. Consequently, a grain size of 0.4 mm is used to allow the distribution of the suberin that is segregated in such a way as to enable a certain amount of flexibility between the bonded grains.

[0034] The stages involved in the process are as follows:

1. Grinding. The initial material is placed in a star-type mill capable of grinding it to a grain size of 0.4 mm. The cork dust is then turned into the mould.

2. Addition of nitrogen. The cork grains are placed in a high-pressure chamber in which nitrogen gas is introduced until a pressure of around 3.5 kg/cm² square centimetres is reached for 1 hour. The chamber will then act as a mould and, consequently, will have the required shape. Previously, its interior surface will have been given an anti-adherent coating to prevent the suberin from adhering to the walls and bottom, which would make it difficult to remove the mould.

3. Baking process. The mould-chamber is placed inside an autoclave and heated to 450°C for 20/30 minutes. When the pressure equivalent to the pressure in the mould-chamber is reached, it is opened. During this time, the cork segregates its own resin, bonding together and foaming a compact body in the shape of the mould. The cell structure has also expanded and has become more elastic and the resin has blocked most of the lenticels through which the gas in the cells could escape.

4. Removal. After the baking process has ended, the mould is taken out of the autoclave and left to cool naturally to ambient temperature. The black cork

blank is then removed from the mould.

[0035] When the cork blank has been obtained, it is ready for distribution to the workshops for the final stage of production. As mentioned earlier, no longitudinal wooden core is necessary to make the blank rigid since the material is rigid enough on its own. Similarly, there is no need for cutting the blank into two for them to be joined together with the interior core, which greatly simplifies the manufacturing process.

[0036] For boards with different specifications, besides the grain size, it will be necessary to use block moulds that will then be machined with a numerical control machine to obtain the desired shape. In this case, the process involves an additional stage.

[0037] Having described the nature of this invention sufficiently, together with the way in which it is to be embodied, no further explanation is considered necessary for any expert in the matter to understand its scope and the advantages it offers and it is hereby recorded that, as an essential part of it, it may be embodied in other ways that differ from the details given by way of example above and that will also obtain the protection that is being sought as long as the fundamental principle is not altered, changed or modified.

Claims

1. METHOD FOR PRODUCING CORK SURFBOARD BLANKS, **characterised by** the fact that it comprises the following stages:

- Grinding to a grain size of between 0.2 and 0.8 mm.
- Addition of nitrogen in a chamber capable of withstanding temperatures of up to 450°C and high pressures, where said chamber will also act as a mould for the blank.
- Insertion of the mould in an autoclave and equalising of pressures.
- Opening of the mould inside the autoclave.
- Baking process in the autoclave at temperatures of between 420 and 450°C for 20 to 30 minutes.
- Removal from the mould after it has cooled.
- Machining of the piece obtained as necessary.

2. METHOD FOR PRODUCING CORK SURFBOARD BLANKS, according to claim 1, **characterised by** the fact that it comprises the following stage before the machining of the piece that is obtained:

- Longitudinal cutting of the blank and gluing of a wooden core.

3. METHOD FOR PRODUCING CORK SURFBOARD

BLANKS, according to claim 1, **characterised by** the fact that the chamber in which the nitrogen is added, which is then used as a mould, has one or more moving walls:

5

4. METHOD FOR PRODUCING CORK SURFBOARD BLANKS, according to claims 1 to 3, **characterised by** the fact that cork ground to different grain sizes is used and placed in different areas of the mould:

10

15

20

25

30

35

40

45

50

55

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ ES 2010/000166

A. CLASSIFICATION OF SUBJECT MATTER

see extra sheet

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)

B27N, B27J, B27K

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)

INVENES, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3055057 A (FLOTRON PAUL E) 25.09.1962, the whole document.	1-4
A	GB 231315 A (ENRIQUE VINCKE) 02.04.1925, the whole document.	1-4

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:	"I" 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
"A" document defining the general state of the art which is not considered to be of particular relevance.	
"E" earlier document 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)	"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
"O" document referring to an oral disclosure use, exhibition, or other means	"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 documents, such combination being obvious to a person skilled in the art
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search

10.August.2010 (10.08.2010)

Date of mailing of the international search report

(13/08/2010)

Name and mailing address of the ISA/
O.E.P.M.

Paseo de la Castellana, 75 28071 Madrid, España.
Facsimile No. 34 91 3495304

Authorized officer

A. Pérez Igualador

Telephone No. +34 91 349 84 89

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/ ES 2010/000166

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
US 3055057 A	25.09.1962	NONE	-----
GB 231315 A	02.04.1925	NONE	-----

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES 2010/000166

CLASSIFICATION OF SUBJECT MATTER

B27N 3/02 (2006.01)

B27J 5/00 (2006.01)

B27K 7/00 (2006.01)