



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.04.2011 Bulletin 2011/16

(51) Int Cl.:
B63B 9/00 (2006.01) B63H 5/14 (2006.01)
B21D 19/04 (2006.01)

(21) Application number: **10187057.4**

(22) Date of filing: **08.10.2010**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventor: **De Uil, Arie**
3362 WB, SLIEDRECHT (NL)

(74) Representative: **Uittenbogaart, Gustaaf Adolf**
Indeig B.V.
Bloemendaalseweg 277A,
P.O. Box 3
2050 AA Overveen (NL)

(30) Priority: **14.10.2009 NL 2003642**

(71) Applicant: **Scheepswerf van de Giessen B.V.**
3370 AB Hardinxveld-Giessendam (NL)

(54) **Method for constructing a nozzle and a nozzle**

(57) The invention relates to a method for producing a nozzle with an inner wall for guiding a flow of water through a screw propeller, wherein the inner wall has a profile on the one side and possibly also a second profile on the other side.

According to the invention, the inner wall of the nozzle is formed from a hollow cylindrical body formed by rolling out plates with an approximate thickness of the

inner wall in the radius to the inner wall and by welding the rolled plates to form the hollow cylindrical body and by subsequently spinning the one side of the hollow cylindrical body by means of plastic deformation or spinning to the first and/or the second profile.

The invention also relates to a nozzle, wherein the inner wall is an axisymmetric or rotationally symmetric part with no more than one or several welds in the axial direction.

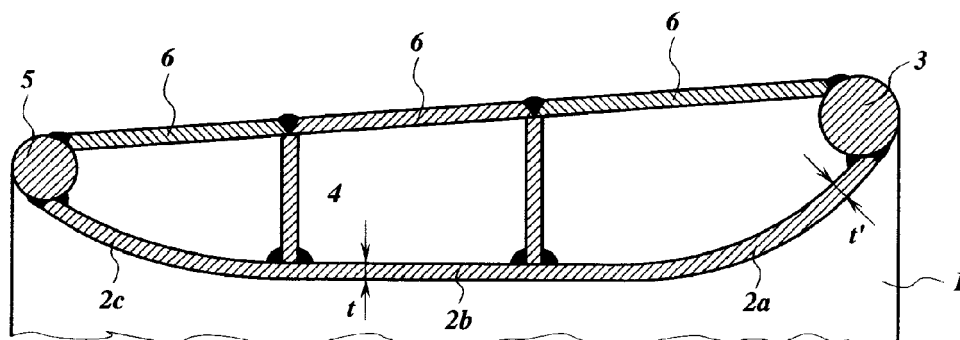


Fig. 1

Description

[0001] The invention relates to a method according to the preamble of claim 1. The method relates to the construction of a nozzle as is described, among others, in EP A 1129006. In the method known in the prior art for constructing this nozzle, the first profile and/or the second profile of the inner wall is built up by welding smaller components formed from a flat plate against or onto supporting ribs and longitudinal partitions, which supporting ribs and longitudinal partitions are attached to the outer side of a narrow hollow cylindrical body. This makes forming the first profile and possibly also a second profile extremely cumbersome due to the large number of welds which run both in the longitudinal direction and the transverse direction of the nozzle so that the desired smooth shape of the inner wall cannot always be achieved.

[0002] In order to overcome this drawback, the method is performed according to claim 1. In this manner, an inner wall with the required shape can be achieved, wherein fewer welds are required for constructing the inner wall and which also results in few grinding operations being required in order to achieve the desired smooth shape.

[0003] According to an embodiment of the invention, the method is performed according to claim 2. In this manner, the inner wall has no concentric welds, which produces a very smooth shape of the inner wall without the need for additional finishing operations and with less welding work being required.

[0004] According to an embodiment of the invention, the method is performed according to claim 3. In this manner, the outer side of the nozzle is easy to construct.

[0005] According to an embodiment of the invention, the method is performed according to claim 4. As a result, the plates on the outer side of the nozzle are easy to attach, thus resulting in a rigid construction.

[0006] According to an embodiment of the invention, the method is performed according to claim 5. As a result, it is possible to form the desired profile in the relatively thick plate material of the inner wall.

[0007] According to an embodiment of the invention, the method is performed according to claim 6. Applying a metal-spinning operation in order to achieve the desired shape prevents the wall thickness of the relatively thick inner wall from being rolled out and the inner wall from becoming too thin when forming the first profile and/or second profile.

[0008] According to an embodiment of the invention, the method is performed according to claim 7. In this way, during the metal-spinning operation, which causes local deformation of the inner ring, the inner ring maintains its circular shape.

[0009] The invention also comprises a nozzle according to the preamble of claim 8. Such a nozzle is known from EP A 1129006. As previously described, the profile of the inner wall of the known nozzle is built up from segments that are joined by welding. In this manner, the

shape of the inner wall is not always smooth, which is disadvantageous to the flow of water through the nozzle. The assembly of the segments to form an inner wall also requires many hours of work.

[0010] In order to avoid these drawbacks, the nozzle is according to claim 8. As a result, the nozzle is easier to assemble and requires less finishing work on the inner surface of said nozzle.

[0011] According to an embodiment of the invention, the nozzle is according to claim 9. In this manner, the inner wall is easier to form as there are no concentric welds or butt welds, which makes said inner wall smoother.

[0012] According to an embodiment of the invention, the nozzle is according to claim 10. As a result, the plates on the outer circumference of the nozzle can be narrower, which makes them easier to produce and/or to attach.

[0013] According to an embodiment of the invention, the nozzle is according to claim 11. As a result, the length of the plates around the outer circumference can be smaller and these are thus easier to produce and/or to attach.

[0014] The invention is explained below with reference to several exemplary embodiments by means of a drawing.

[0015] In the drawing:

Figure 1 shows a cross-section of a nozzle according to the invention,

Figure 2 shows a top view of a device for forming an inner wall of the nozzle according to figure 1,

Figure 3 shows details of the cross-section of the nozzle during the various forming steps of the inner wall on the device of figure 2,

Figure 4 shows a view in perspective of a first step in the assembly of the nozzle of figure 1,

Figure 5 shows a view in perspective of a second step in the assembly of the nozzle of figure 1,

Figure 6 shows a view in perspective of a third step in the assembly of the nozzle of figure 1,

Figure 7 shows a view in perspective of the assembled nozzle of figure 1.

[0016] Figure 1 shows a nozzle 1 with an inner wall 2_{abc} that is formed from a hollow cylindrical body 2, one outer end of which is formed to provide a first profile 2_a and wherein the second outer end is formed to provide a second profile 2_c. Between the first profile 2_a and the second profile 2_c there is a cylindrical part 2_b that corresponds to the original unformed hollow cylindrical body 2. This cylindrical part 2_b of the nozzle 1 encircles a screw propeller (not shown) that rotates within the nozzle 1 with minimal clearance. The nozzle 1 has a wall thickness *t*, which wall thickness *t* at the point of the cylindrical part 2_b corresponds to the wall thickness of the unformed hollow cylindrical body 2. When the hollow cylindrical body 2 is formed to provide the first profile 2_a or the second profile 2_c, the wall thickness *t'* at the larger diameter

will become smaller as the diameter increases. In order to maintain sufficient strength of the inner wall 2_{abc} across the entire width, the wall thickness t' is at least 80% of the wall thickness t and preferably at least 90% of wall thickness t .

[0017] In another embodiment of the cylindrical part 2, the cylindrical part 2_b is formed with a greater wall thickness and/or possibly also from a different material. In such an embodiment, there are one or two concentric welds or butt welds in the hollow cylindrical body 2 and the first profile 2_a and/or the second profile 2_c is formed from plates of a different wall thickness and/or from a different material than the plates from which the cylindrical part 2_b is formed.

[0018] The front side of the nozzle 1 has a nose profile 3 that is shown here as a solid rod, but can also be constructed as a tube or as any other convenient profile. The rear side of the nozzle 1 has a rear profile 5 that can have the same construction but, for example, with dimensions other than those of the nose profile 3. On the outer side of the inner wall 2_{abc} two support partitions 4 are applied in order to support the exterior plates 6. The edges of the exterior plates 6 are attached against or to the nose profile 3, the rear profile 5 or against the edge of another exterior plate 6 by means of a weld. In the latter case, the edges of the exterior plates 6 lie on a support partition 4 and are welded thereto. It will be evident that the number of support partitions 4 and thus also the number of concentric welds between the exterior plates 6 depends on the width of the nozzle 1 and that this width is, among other things, dependent on the diameter of the thruster 1. The nozzle 1 can also be constructed without a nose profile 3 or rear profile 5, and also without support partitions 4. In that case the exterior plate or exterior plates 6 is/are welded directly to the inner wall 2_{abc} .

[0019] Figure 2 shows a metal-spinning machine 7 with a column 8 for supporting a revolving table 9 with a horizontal first axis of rotation 11. The metal-spinning machine has a longitudinal guide 27 along which a longitudinal carriage 23 can be moved in a direction parallel to the first axis of rotation 11. A cross-slide 25 can be moved along the longitudinal carriage 23 in a direction at right angles to the first axis of rotation 11. A swivelling arm 24 is attached to the cross-slide 25 and can be rotated about an axis 26. A stationary roller support 19 and a movable roller support 20 are attached to the swivelling arm 24, wherein a clamping cylinder 22 can move the movable roller support 20 along a clamping guide 21 towards the stationary roller support 19. The stationary roller support 19 supports an inner roller 15 that can rotate about a second axis of rotation 16. The movable roller support 20 supports an outer roller 17 that can rotate about a third axis of rotation 18. The second axis of rotation 16 and the third axis of rotation 18 are parallel. By moving the movable roller support 20 towards the stationary roller support 19, the rollers 15 and 19 form a clamp that can clasp a hollow cylindrical body 2 to be formed by metal-spinning.

[0020] Three or more clamping segments 14 are attached around a coupling piece 12. The clamping segments 14 can be moved in relation to the coupling piece 12 by clamping means 13, thus forming a clamping bush.

5 The clamping means 13 can clamp the clamping bush within an inner surface of the hollow cylindrical body 2. The coupling piece 12 is mounted on a support bush 10 so that the hollow cylindrical body 2 can rotate about the first axis of rotation 11. Possibly a quick-release coupling is provided between the coupling piece 12 and the support bush 10 so that the hollow cylindrical body 2 can be easily remounted and be formed at both ends. It is also possible for the clamping bush to be used on a welding manipulator (not shown) for the further assembly of the nozzle 1.

10 **[0021]** Figure 2 shows the start of the forming operation of the hollow cylindrical body 2. Movements of the longitudinal carriage 23 along the longitudinal guide 27 and of the cross-slide 25 along the longitudinal carriage 23 allow the inner roller 15 to be positioned on the inner side of the hollow cylindrical body 2. Subsequently, the clamping cylinder 22 forces the outermost roller 17 against the outer surface of the hollow cylindrical body 2. In order to form the hollow cylindrical body to the first profile 2_a or the second profile 2_c , the rollers 15, 17 are moved towards the rim, whilst the hollow cylindrical body 2 rotates about a first axis of rotation 11, so that the inner roller 15 and the outer roller 17 form a helical path along the hollow cylindrical body 2. At the same time, the clamping inner roller 15 and outer roller 17 rotate about the second axis of rotation 16 and the third axis of rotation 18, and the second axis of rotation 16 and the third axis of rotation 18 rotate about the axis 26. See figures 3a and 3b for the various stages of this operation. Figure 3c shows the forming of the second rim of the hollow cylindrical body 2 after the coupling piece 12 is positioned with the other side on the support bush 10.

25 **[0022]** Preferably the inner roller 15 and the outer roller 17 are clamped against and moved along the hollow cylindrical body 2 in such a way that the desired first profile 2_a or the second profile 2_c are formed in one go. If necessary, the operation can be repeated a number of consecutive times, whereby account is taken of the fact that the plate thickness t' becomes thinner by rolling the rollers 15, 17 over the material of the hollow cylindrical body 2 and possibly also increases the total width of the hollow cylindrical body 2.

30 **[0023]** Figure 4 shows the beginning of the assembly of the inner ring 2_{abc} with the various components to form the nozzle 1. Figures 5 and 6 show the successive stages during the assembly and figure 7 shows the nozzle 1 when this is ready to be mounted to a ship. Figures 4, 5 and 6 show a schematic view of the clamping segments 14 as can be applied when assembling the nozzle 1, by mounting this together with the clamping segments 14 to a welding manipulator (not shown). A first transition 28 indicates the transition of the first profile 2_a to the cylindrical part 2_b of the inner wall 2_{abc} , a second transi-

tion 29 indicates the transition of the second profile 2_c with the cylindrical part 2_b .

[0024] As shown in figure 4, the longitudinal partitions are first placed on the outer circumference of the inner wall 2_{abc} . Longitudinal partitions 30 of a connecting chamber and a central partition 31 of the connecting chamber are positioned parallel to the upper side of the inner wall 2_{abc} and a lower longitudinal partition 35 is placed on the underside. The connecting chamber connects the upper side of the nozzle 1 to the underside of the ship. After the longitudinal partitions 30, 25 and the central partition 31 are placed in position, the nose profile 3 and the rear profile 5 are then mounted by sliding these through the recesses 34 in the longitudinal partitions, after which the partitions 20, 31, 35 and profiles 3, 5 are welded. As shown in figure 5, the supporting partitions 4 are then positioned and welded and, as shown in figure 6, the lateral partitions 32 and dividing partitions 33 of the connecting chamber are then placed in position and welded. Figure 7 shows nozzle 1 after the exterior plates 6 have been mounted and welded.

[0025] The nozzle 1 is connected to the ship by means of a connecting chamber. It will be evident that this can be implemented in various different ways.

[0026] In the embodiment shown, the inner wall 2_{abc} has a cylindrical part 2_b . Such a cylindrical part 2_b enables a good cooperative operation between the screw propeller and the nozzle 1. This cylindrical part 2_b can also be very short or not be present at all.

Claims

1. Method for producing a nozzle (1) with an inner wall (2_{abc}) for guiding a flow of water through a screw propeller, wherein the inner wall has a first profile (2_a) on the one side and on the other side possibly also a second profile (2_c), **characterized in that** the inner wall of the nozzle is formed from a hollow cylindrical body (2) by rolling out plates with an approximate thickness (t) of the inner wall to the radius of the inner wall and by welding the plates to form the hollow cylindrical body and by subsequently spinning the one side of the hollow cylindrical body by means of plastic deformation or spinning to form the first profile and, if required also the other side of the hollow cylindrical body by means of plastic deformation or spinning to produce the second profile.
2. Method according to claim 1, wherein said plates have approximately the same width as the inner wall (2_{abc}).
3. Method according to claim 1 or 2, wherein after forming the inner wall (2_{abc}) one or more concentric supporting ribs (4), a nose profile (3) and/or a rear profile (5) are welded to the outer side of the inner wall of the nozzle (1), after which the outer side of the nozzle is formed by welding curved plates (6) around the outer side of the inner wall of the nozzle to or against the inner wall, the concentric supporting rib(s), the nose profile and/or the rear profile.
4. Method according to claim 3, wherein one or more longitudinal partitions (30, 31, 35) are welded to the inner wall (2_{abc}) for mounting the curved plates (6) and the ends of the curved plates are welded to or against the longitudinal partitions.
5. Method according to one of the preceding claims, wherein the hollow cylindrical body (2) is formed by spinning by clamping said hollow cylindrical body to a revolving table (9,10), wherein a rim of the hollow cylindrical body is accessible, after which a clamp with two rollers (15, 17) clasps the wall of the hollow cylindrical body and the hollow cylindrical body is formed to a desired profile (2_a , 2_c) by rotating said hollow cylindrical body around a first axis of rotation (11), wherein the clamp with two rollers is moved simultaneously towards the accessible rim so that the rollers follow a helical path over the hollow cylindrical body and wherein possibly the clamp with the rollers rotates around a second axis of rotation (26) that is at right angles to the first axis of rotation.
6. Method according to claim 5, wherein the first profile (2_a) and/or the second profile (2_c) is formed in a single or a few metal-spinning operations(s).
7. Method according to one of the preceding claims, wherein a clamping bush (12,13) is placed within the hollow cylindrical body (2) during the metal-spinning operation, said clamping bush also being placed in position on the revolving table (9, 10) for one or for both metal-spinning operations.
8. Nozzle for guiding a flow of water through a screw propeller, comprising an inner wall (2_{abc}) with a first profile (2_a) on the one side of the screw propeller and possibly also a second profile (2_c) on the other side of the screw propeller and possibly a cylindrical wall section (2_b) at the position of the screw propeller, **characterized in that** the inner wall forms an axisymmetric or rotationally symmetric part with a central axis with no more than one or several welds in the direction of the central axis.
9. Nozzle according to claim 8, wherein the inner wall (2_{abc}) has an approximately constant wall thickness (t).
10. Nozzle according to claim 8 or 9, wherein one or several concentric supporting ribs (4) are welded to the inner wall (2_{abc}) on the exterior side, onto which the sides of curved plates (6) of the outer wall are welded with a concentric welding seam.

11. Nozzle according to claim 8, 9 or 10, wherein one or more longitudinal partitions (30, 31, 35) are welded onto the inner wall (2_{abc}), onto which and/or against which the ends of the curved plates (6) are welded.

5

10

15

20

25

30

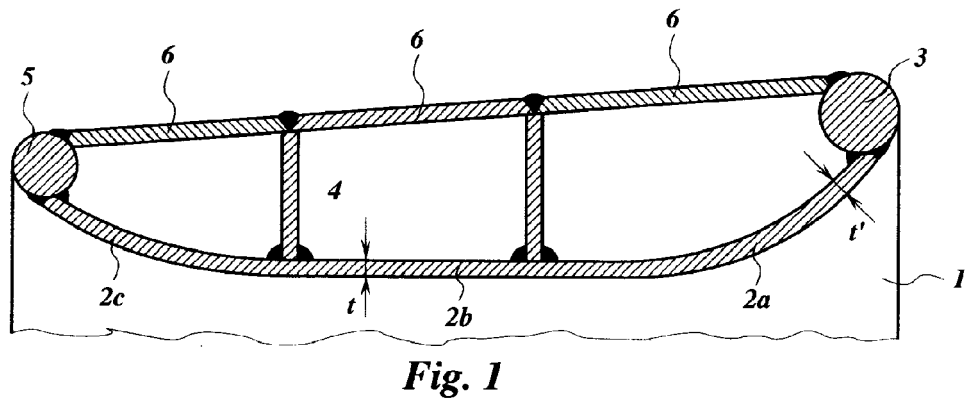
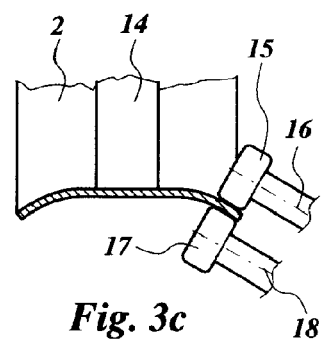
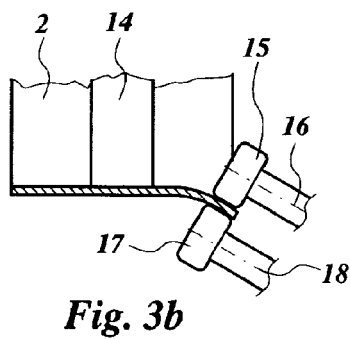
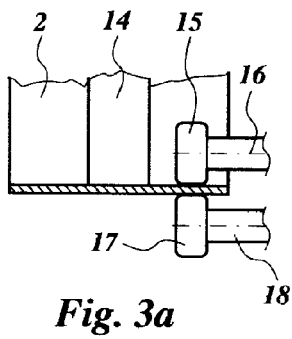
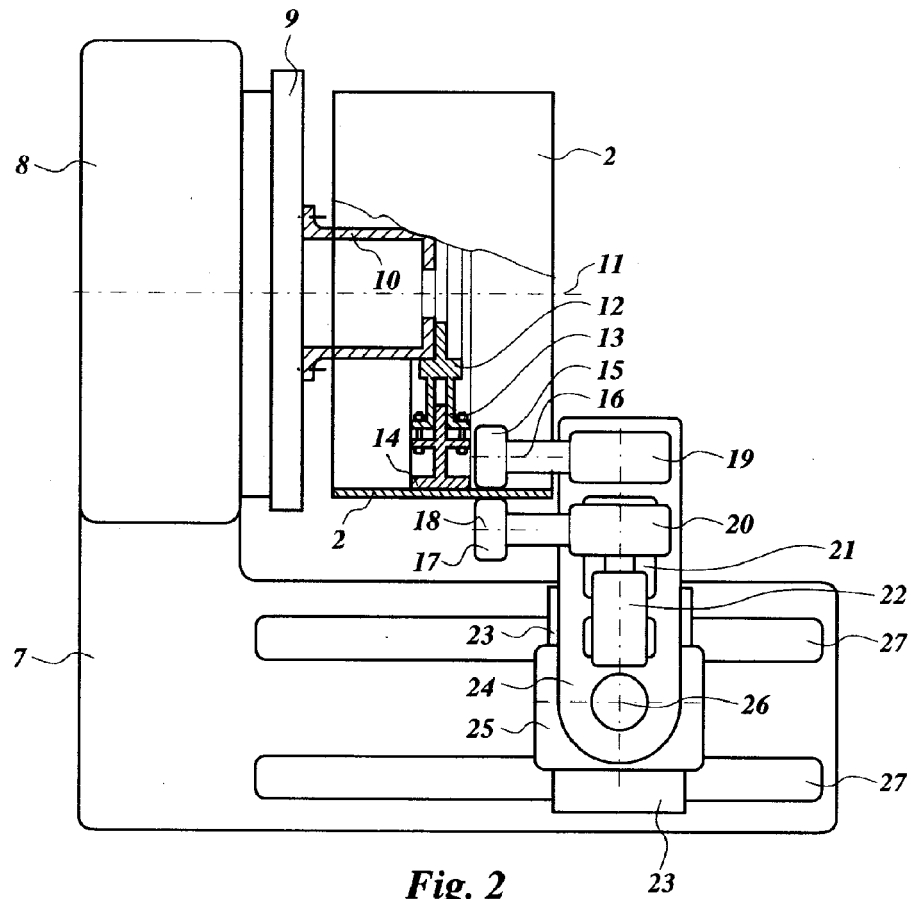
35

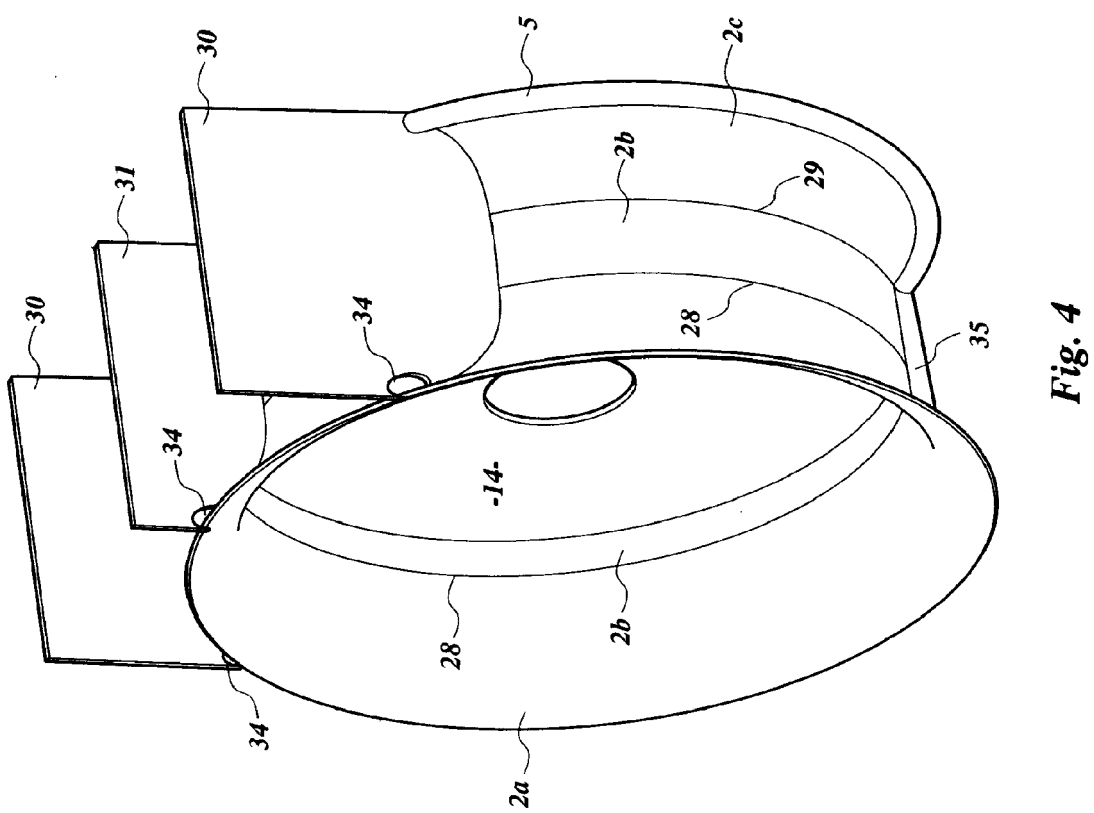
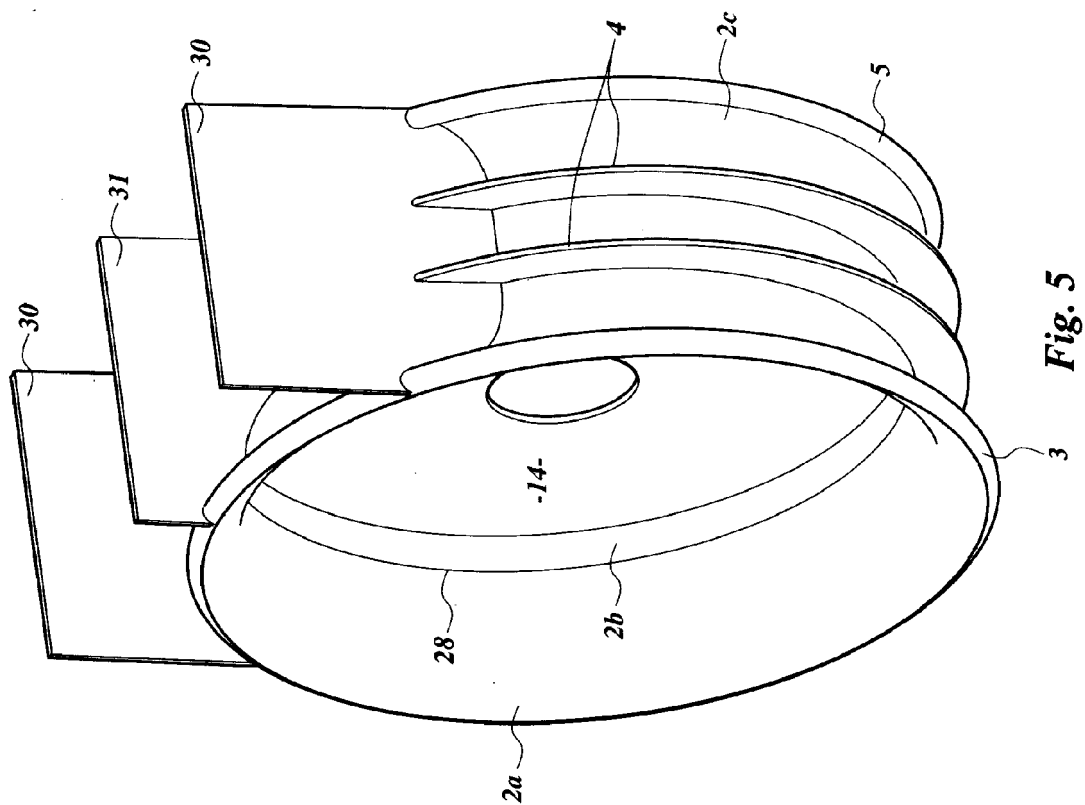
40

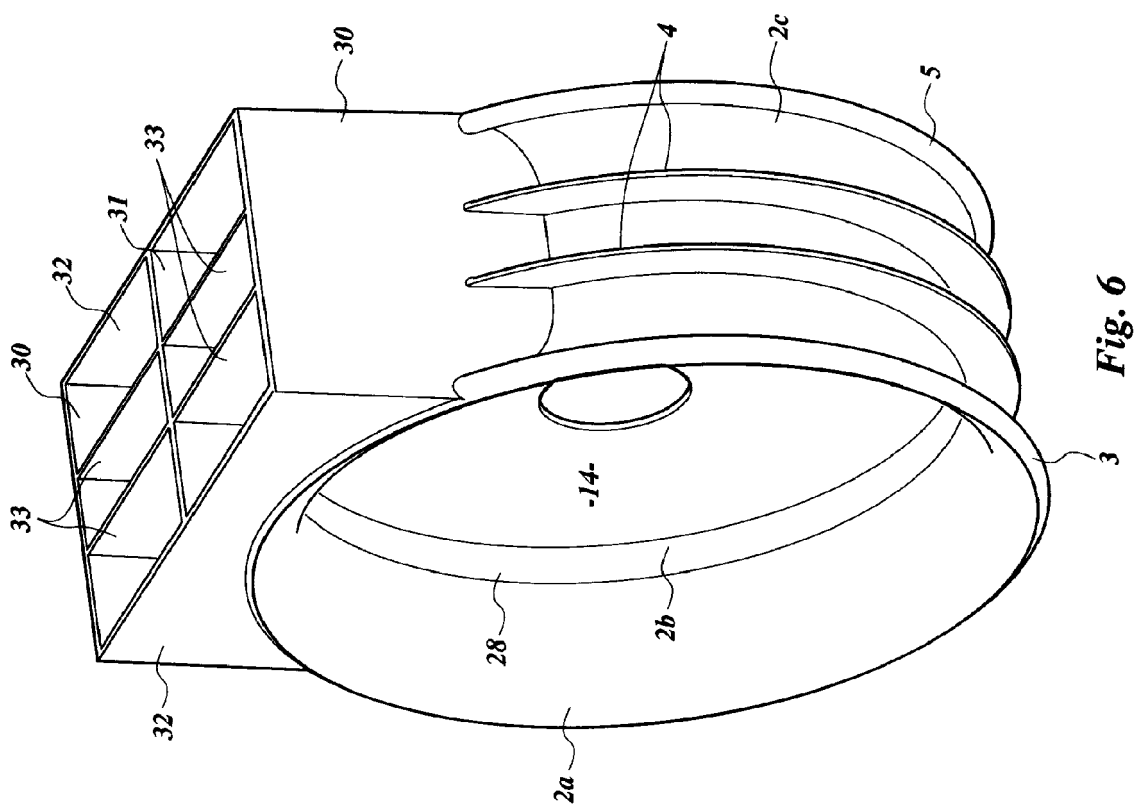
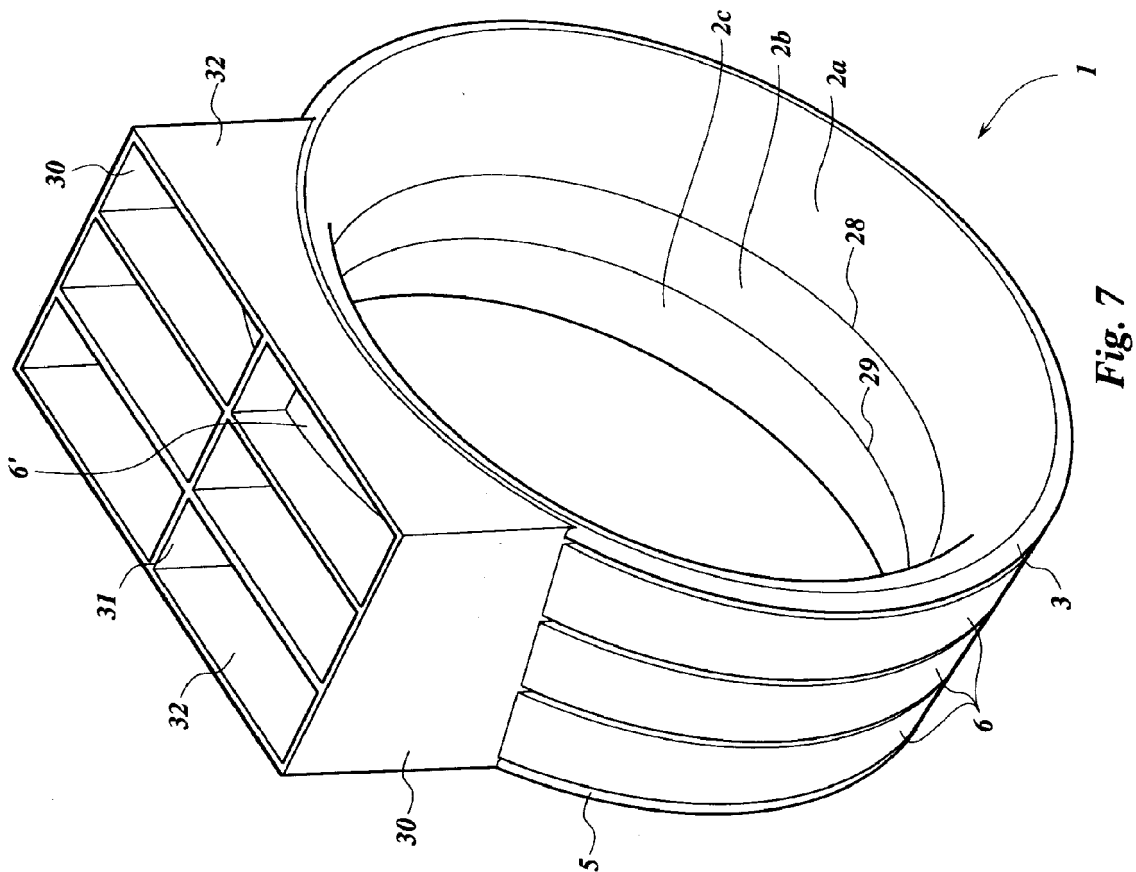
45

50

55









EUROPEAN SEARCH REPORT

Application Number
EP 10 18 7057

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 739 831 A1 (TECIMAR [FR]) 18 April 1997 (1997-04-18) * figure 3 *	1-4,7-11	INV. B63B9/00 B63H5/14 B21D19/04
X	NL 1 004 558 C2 (SCHEEPSWERF VAN DE GIESSEN B V [NL]) 19 May 1998 (1998-05-19) * figures 2,3 *	1-4,7-11	
X,D	EP 1 129 006 B1 (SCHEEPSWERF VAN DE GIESSEN B V [NL]) 12 January 2005 (2005-01-12) * figure 2 *	1-4,7-11	
A	GB 1 070 743 A (BURNES CORLETT & PARTNERS LTD) 1 June 1967 (1967-06-01) * figure 1 *	1,8	
A	DE 37 18 954 A1 (GARTMANN UWE [DE]) 22 December 1988 (1988-12-22) * abstract; figure 1 *	1,8	
A	GB 1 202 144 A (SAXTON BRISTOWE BUCKLAND) 12 August 1970 (1970-08-12) * figures 1,2 *	1,5	
A	US 5 531 370 A (ROHRBERG RODERICK G [US]) 2 July 1996 (1996-07-02) * figures 2a-4 *	1,5	TECHNICAL FIELDS SEARCHED (IPC)
			B63B B63H B21D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		16 February 2011	van Rooij, Michael
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			

6 EPO FORM 1503 03.82 (P04C01)

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

EP 10 18 7057

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.

16-02-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2739831	A1	18-04-1997	NONE
NL 1004558	C2	19-05-1998	NONE
EP 1129006	B1	12-01-2005	AT 286825 T 15-01-2005 AU 1082600 A 29-05-2000 DE 69923211 D1 17-02-2005 DE 69923211 T2 29-12-2005 EP 1129006 A1 05-09-2001 ES 2237173 T3 16-07-2005 NL 1010537 C2 10-05-2000 WO 0027697 A1 18-05-2000
GB 1070743	A	01-06-1967	NONE
DE 3718954	A1	22-12-1988	NONE
GB 1202144	A	12-08-1970	NONE
US 5531370	A	02-07-1996	NONE

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 1129006 A [0001] [0009]