(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 181 981 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.02.2002 Bulletin 2002/09

(51) Int Cl.[7]: **B02C 17/22**

(21) Application number: **00117128.9**

(22) Date of filing: **10.08.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

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(54) Modular lining for grinding mill and method to assemble and install it

(57) The present invention describes a lining for grinding mills, consisting of a plurality of lining modules and lifters fixed in a removable way to the mill drum by appropriate fixing means.

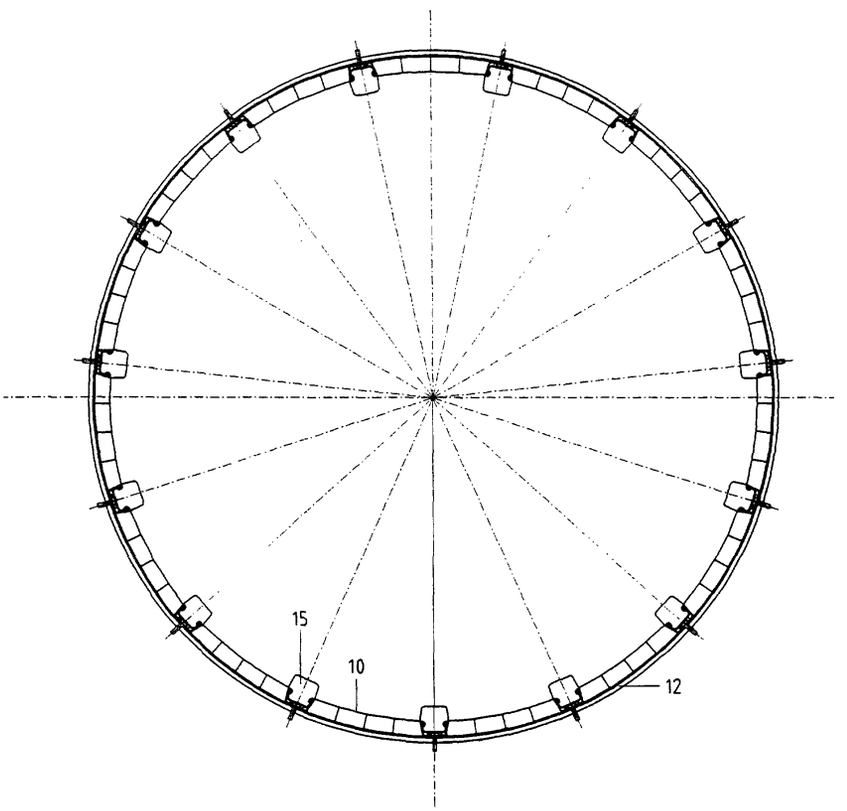

Fig. 1

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Description

Field of the invention

[0001] The present invention relates to a wear and tear resistant lining for grinding mills, and to a method for assembling and installing it.

State of the art

[0002] The already known ceramic linings for grinding mills consist of ceramic tiles which are directly applied to the inner surface of the grinding chamber of the mill, hereinafter called "drum", in order to protect the wall of the drum from the wear and tear, due to the grinding action, to lengthen the life of the mill and to prevent pollution of the ground material.

[0003] These linings further comprise longitudinally extending bars, which are also called "lifters", which improve the grinding action inside the mill and are obviously also subjected to wear and tear or damages.

[0004] Once consumed or damaged, the ceramic lining and/or the lifters have to be removed and replaced by a new lining.

[0005] At present, the replacement of a ceramic lining is a very expensive and time consuming operation, which obliges to stop the mill production for several days. In fact the mill must be completely unloaded, the old lining must be totally removed using pneumatic hammers and the inner drum surface must be blast cleaned before applying the new lining.

[0006] It is therefore evident the need to make available a ceramic lining for grinding mill easier to repair or substitute in case of damage or wear and tear.

Summary of the invention

[0007] The present invention refers to a lining for grinding mills formed by a plurality of modules consisting of a metal support to which are fixed the ceramic tiles, said modules being kept adherent to said internal surface of the mill drum by lifters fixed to the drum by appropriate fixing means.

List of the drawings

[0008]

Figure 1 shows the cross-section of the mill drum with the lining modules and the lifters;
Figure 2 shows the planar projection of the internal surface of the mill drum in a particular embodiment of the invention (see below);
Figure 3 shows in particular the cross section of a lining module;
Figure 4 shows a particular realisation of the fixing of the tiles to the metal support;
Figure 5 show in particular the engagement between lifter and the modules once mounted inside the mill drum
Figure 6 shows a particular embodiment of the means for fixing the lifters.

Detailed description of the invention

[0009] The present invention allows to overcome the above said problems thanks to an easily removable ceramic lining wherein the ceramic lining is constituted of modules as above described.

[0010] The ceramic lining according to the invention overcomes the drawbacks of the already known ceramic mill linings, providing an effective ceramic mill lining which can be easily substituted, totally or partially, when necessary.

[0011] Moreover the invention refers to a module of ceramic lining as above described and to a method to replace a ceramic mill lining with a minimum loss of time.

[0012] According to the invention a module 10 consists of a metal support 11 and ceramic tiles 13 which are applied to and completely cover one surface of the metal support 11 leaving the two lateral free margins 14 (see Fig. 3).

[0013] The metal support 11 is normally a metal plate, preferably shaped in order to match the inner surface of the mill drum 12.

[0014] The lifters 15 consist of bars of ceramic, gum, resin or other suitable material capable to fit in the space formed by the free margins 14 of two adjacent modules and protruding above the tiles of said adjacent modules; they are provided with suitable fixing means in order to be fixed to the mill drum in an easily removable manner. In view of their mutual disposition the fixing of the lifter to the mill drum automatically implies that also the module will be kept fixed to the internal surface of the mill drum.

[0015] According to a particular embodiment of the invention the lifter can preferably be oriented to form, on the inner surface of the mill drum, an appropriate angle with the axis of the drum, i.e. forming a coil portion (see Figure 2). When the above said embodiment is applied, the lifters, besides improving the grinding action as above said, also "classify" the grinding elements possibly used for grinding (as for example the balls used in ball mills) distributing them along the longitudinal axis of the drum in relation with their dimensions and weight. Figure 2 shows also the opening 29 allowing entry to the mill drum for the necessary reparations.

[0016] In a preferred embodiment of the invention the tiles 13 are fixed to the metal support 11 by a film of glue. Alternatively, the inner surface of the metal support 11 is provided of "T" shaped emerging section 16 to which the tiles 13 can be anchored by accordingly shaped cavities 17 which can also, if preferred, be filled with glue (see Fig. 4).

[0017] The described embodiment allows, once one or more tiles are to be substituted, to replace them with-

out the need of disassembling the whole lining from the mill drum. In fact it will be sufficient to remove the lifters corresponding to the modules containing the damaged tiles and these will be easily removed and substituted.

[0018] Lifter fixing means according to a particular embodiment of the invention consist of a generally "U" shaped metal structure 18 (see Figure 6). The "U" structure 18 is provided with a first portion 19 able to hold the lifter bar and with a second portion 20 able to be fixed to the mill drum.

[0019] In a preferred embodiment of the invention said "U" shaped first portion 19 consists of a metal convex section into which the ceramic body of the lifter bar can be blocked possibly by the aid of suitable glue and/or resin.

[0020] In this embodiment, the anchoring between the ceramic body and the metal structure of the lifter is preferably ensured by lateral cavities 21 present in the ceramic body which can house the wall of the first portion 19 and are possibly filled by a suitable glue and/or resin. Advantageously, dangerous sharp angles and corresponding high local stresses in the ceramic body of the lifter are avoided by an appropriate shaping (for example rounded) of the cavities 21.

[0021] In a further preferred embodiment, said second portion 20 of the metal structure of the lifter consists of a "U" shaped metal section fixed to the external surface of the first portion 19 on the sides 22 and forming with the bottom of the latter a free gap 23.

[0022] Inside this gap 23 can be housed the head of bolts 24 passing through corresponding rail 25 present in the bottom surface of the second portion 20 and then through the space left in between the two metal support of two adjacent modules and through further holes 26 present in the mill drum 12. The lifter is finally fixed to the drum with nuts 27. Moreover the bottom of the first portion 19 is welded to the bottom of the second portion 20 at the points 28

[0023] According to the method of the invention, a first lifter 15 is fixed to the mill drum 12 and subsequently a first longitudinal row of modules 10 is placed all along the length of the lifter, so that its side free margin 14 is comprised between the inner surface of the drum and the bottom surface of the lifter metal structure 18.

[0024] Thereafter it is sufficient to tighten the fixing bolts 24 of the lifter by suitable nuts 27 operated on the outside of the mill drum.

[0025] The same operations are repeated until the whole internal surface of the drum is covered by modules.

[0026] Preferably the lifter and the tiles disposed along the free margin 14 are mutually so shaped in order to allow an easy positioning of the lifter by sliding in the channel formed by the free spaces 14.

Claims

1. Lining for grinding mills consisting of a plurality of lining modules and lifters fixed in a removable way to the mill drum by appropriate fixing means.

2. Lining for grinding mills according to Claim 1 wherein the modules (10) consist of a metal support (11) to which are fixed ceramic tiles (13), in such a way that they cover one surface of said metal support (11) leaving two lateral free margins (14), and the lifters (15) are bars of ceramic, gum, resin or other suitable material provided with appropriate fixing means.

3. Lining for grinding mills according to Claim 2 wherein the metal support (11) is a metal plate and the ceramic tiles (13) are fixed to it by a film of glue.

4. Lining for grinding mills according to Claim 3 wherein the metal support (11) is provided of a "T" shaped emerging section (16) able to anchor the tiles (13) through accordingly shaped cavities (17), possibly filled with glue.

5. Lining for grinding mills according to Claim 2 wherein the fixing means of the lifters (15) are a "U" shaped metal structure (18) provided with a first portion (19) able to hold the lifter bar and a second portion 20 able to be fixed to the mill drum.

6. Lining for grinding mills according to Claim 5 wherein the first portion (19) consists of a metal convex section in to which the ceramic body of the lifter bar can be blocked possibly by the aid of suitable glue and/or resin.

7. Lining for grinding mills according to Claim 6 wherein the ceramic body of the lifter present lateral rounded cavity (21) capable of housing the wall of the first portion (19), possibly filled with suitable glue and/or resin.

8. Lining for grinding mills according to Claim 5 wherein the second portion (20) consists of a "U" shaped metal section fixed to the external surface of the first portion (19) on the sides (22) and forms with the bottom of the latter a free gap (23).

9. Lining for grinding mills according to Claim 8 wherein in the gap (23) are housed the head of a bolts (24) passing through a corresponding rail (25), present in the bottom surface of the second portion (20), and then through the space left in between the two metal support of two adjacent modules and finally through a further hole (26) present in the mill drum (12).

10. Lining for grinding mills according to claims 1 - 9 wherein the lifter is oriented to form, on the inner surface of the mill drum, an appropriate angle with the axis of the drum, i.e. forming a coil portion.

11. Lining for grinding mills according to Claims 1 - 10 wherein the grinding mill is a ball mill.

12. Method for installing a lining for grinding mills according to Claim 1 wherein a first lifter (15) is fixed to the mill drum (12) and subsequently a first longitudinal row of modules (10) is placed all along the length of the lifter, so that its side free margin (14) is comprised between the inner surface of the drum and the bottom surface of the lifter metal structure (18), thereafter the fixing bolts (24) of the lifter are tightened by suitable nuts (26) operated on the outside of the mill drum and the operations are repeated until the whole internal surface of the drum is covered by modules.

13. Module of lining for grinding mills 10 consisting of a metal support (11) to which are fixed ceramic tiles (13), in such a way that they cover one surface of said metal support (11) leaving two lateral free margins (14).

14. Lifters for grinding mills lining (15) consisting of bars of ceramic, gum, resin or other suitable material provided with appropriate fixing means.

15. Lifters according to Claim 14 wherein said fixing means are as claimed in Claims 5 - 9.

16. Grinding mill provided with a lining according to Claims 1 - 10.

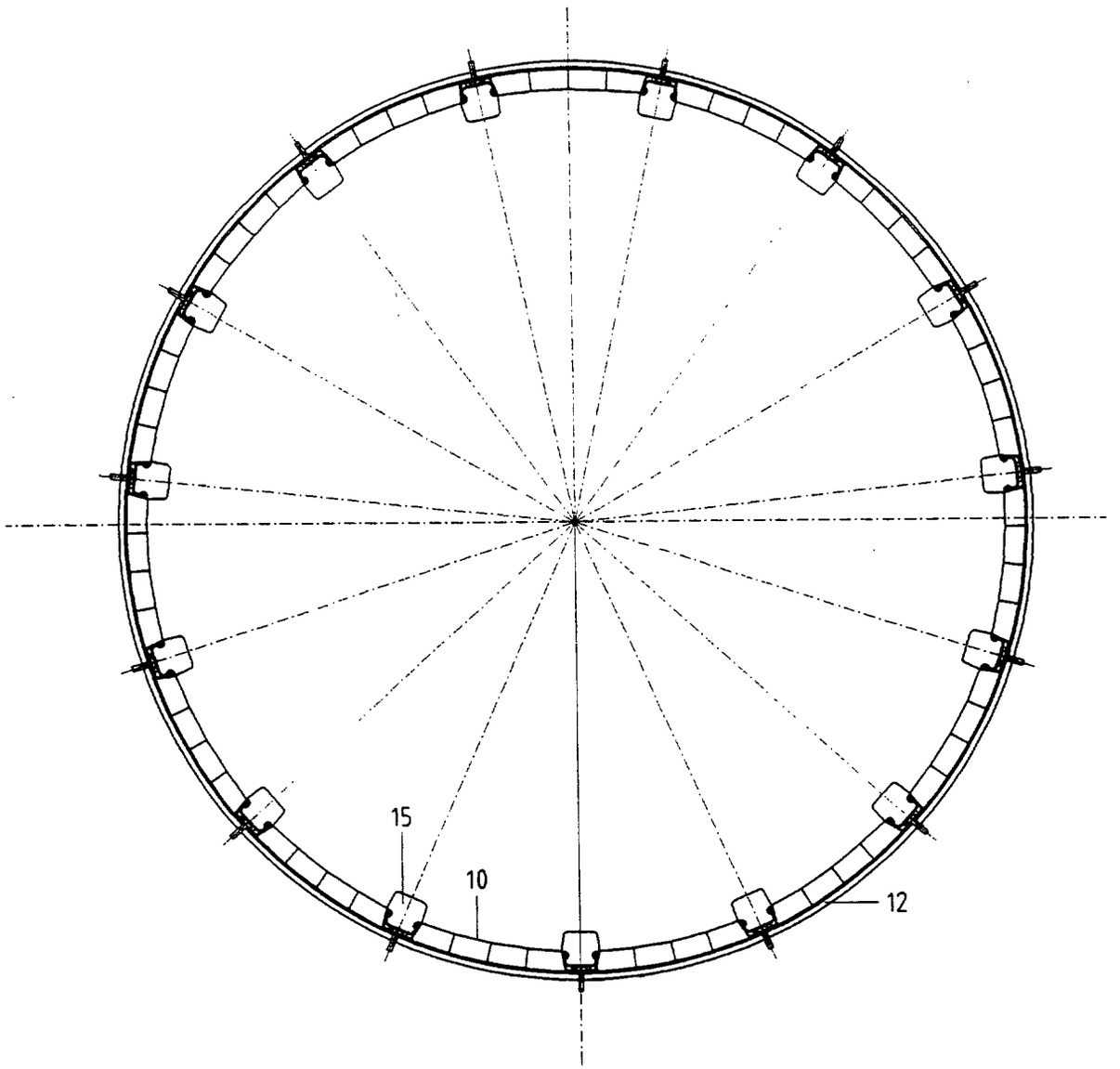

Fig. 1

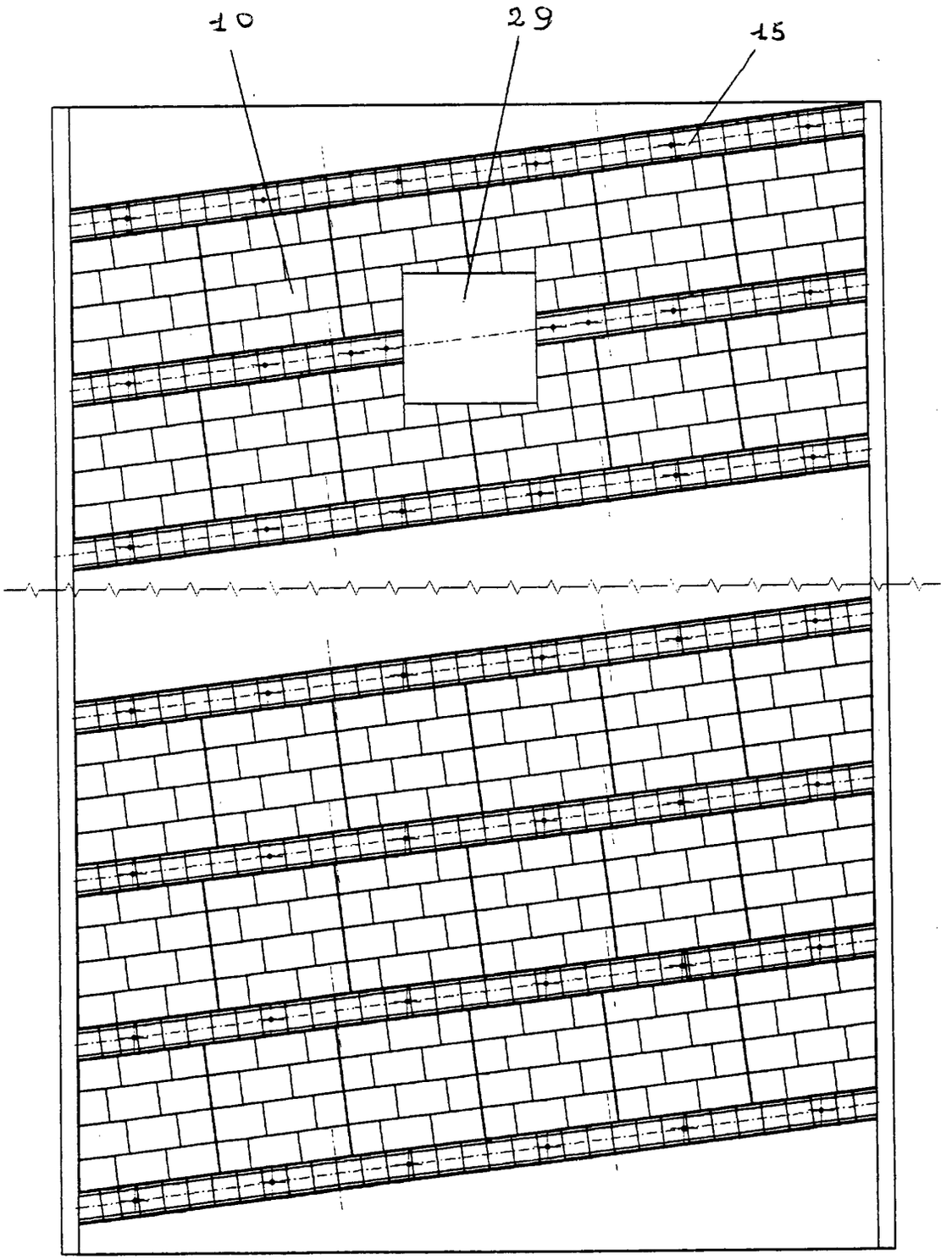

Fig. 2

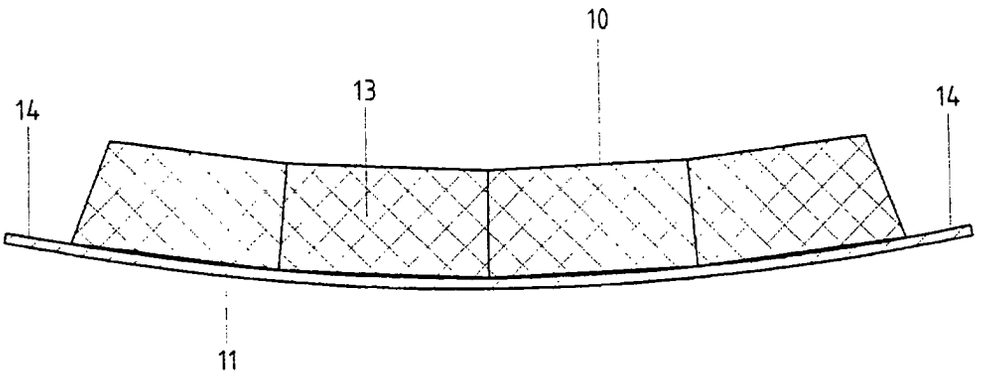

Fig. 3

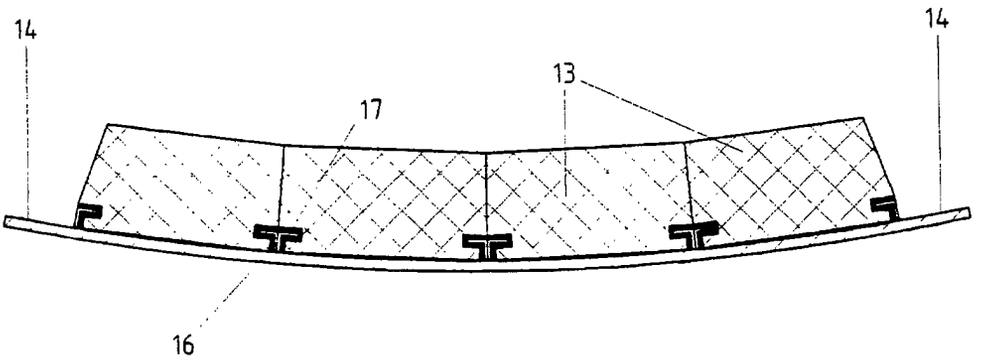

Fig. 4

Fig. 5

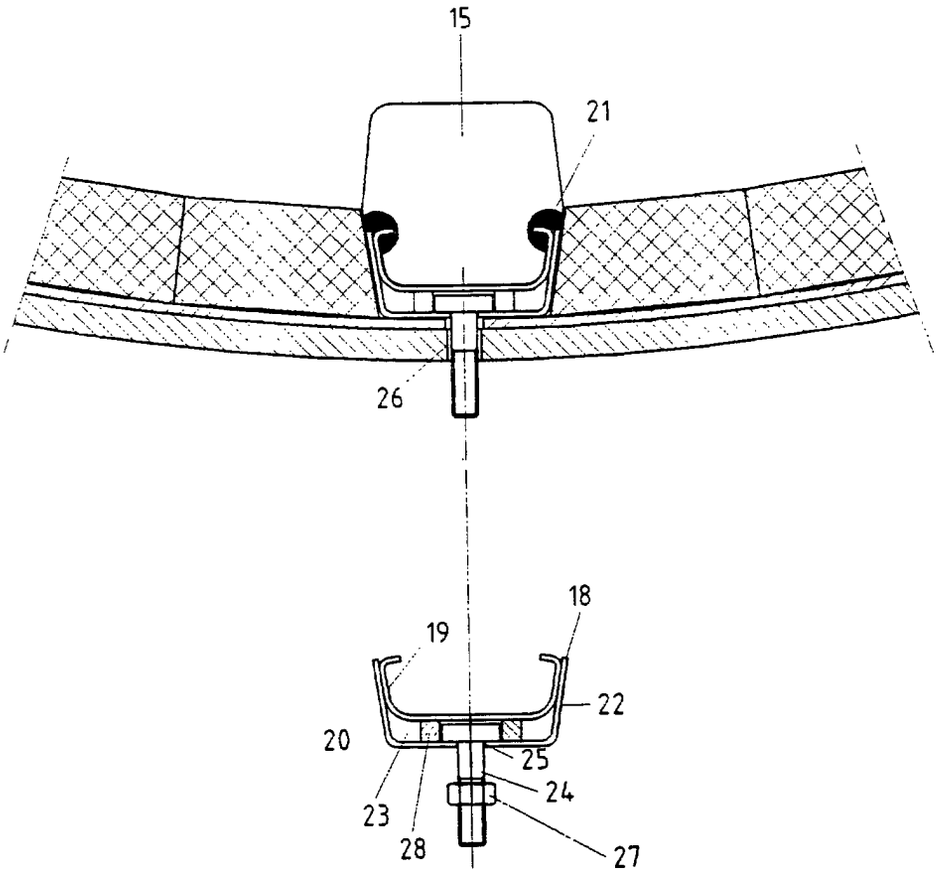

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 11 7128

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 3 462 090 A (LANDES BENJAMIN DANIEL ET AL) 19 August 1969 (1969-08-19) * column 3, line 32 - column 4, line 64; figures 2,3 *	1,11,14, 16	B02C17/22
Y		2,10,12, 13	
A		3-9,15	
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Y	US 4 289 279 A (BRANDT BERTIL) 15 September 1981 (1981-09-15) * column 4, line 58 - line 62; figure 5 *	10	
A	FR 2 131 454 A (CONTINENTAL GUMMI WERKE AG) 10 November 1972 (1972-11-10) * figure 1 *	5,6,8,9, 12,15	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B02C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 January 2001	Verdonck, J

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X : particularly relevant if taken alone
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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
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82