



- (51) International Patent Classification:  
*E04B 1/86* (2006.01) *E04B 1/90* (2006.01)
- (21) International Application Number:  
PCT/CZ2016/050046
- (22) International Filing Date:  
20 December 2016 (20.12.2016)
- (25) Filing Language: Czech
- (26) Publication Language: English
- (30) Priority Data:  
PUV 2015-31938 22 December 2015 (22.12.2015) CZ
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- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH,

[Continued on next page]

(54) Title: SOUND ABSORBING AND THERMAL INSULATION PANEL

(57) Abstract: A sound absorbing and thermal insulation panel containing at least one acoustic resonance membrane (2) formed by a layer of polymer nanofibers of 20 to 200 nm in diameter which is in the form of a plane layer situated on the surface of a carrier body (1) of the sound absorbing and thermal insulation material over at least one free space formed in the body or which is situated on the surface of the carrier body (1) made of a porous material with an open cell structure. The carrier body (1) with the acoustic resonance membrane (2) is mounted inside the cover (3) of a permeable textile material which tightly encloses them.

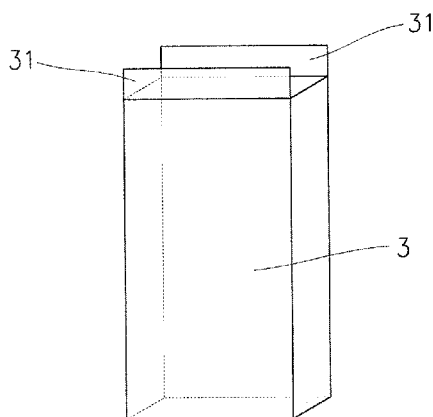
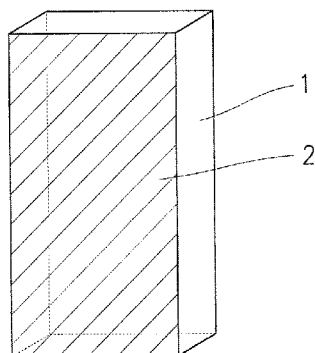


Fig. 1



GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

**Published:**

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

## Sound absorbing and thermal insulation panel

### Technical field

The invention relates to a sound absorbing and thermal insulation panel  
5 containing at least one acoustic resonance membrane formed by a layer of  
polymer nanofibers of 20 to 200 nm in diameter which is situated on the surface  
of a carrier body from sound absorbing and thermal insulation material over at  
least one free space created in this body, or which is situated on the surface of  
the body made of a porous material with an open cell structure.

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### Background art

A sound absorbing means containing at least one acoustic resonance  
membrane formed by a layer of polymer nanofibers which is in the form of a  
plane layer situated on the surface or in the inner space of a frame over at least  
15 one free space which is defined by this frame and is firmly connected to this  
frame is known from CZ 304456. The frame can be solid or flexible. A flexible  
frame can be formed by a polyurethane foam.

Further development led to a solution of a sound absorbing means  
which contains at least one acoustic resonance membrane formed by a layer of  
20 polymer nanofibers of up to 200 nm in diameter, which is situated on the  
surface of a body made of a porous material with an open cell structure having  
porosity higher than 90%. The body with the open cell structure may be formed  
by a board of a foam material or a board of a web of bound polyester fibres with  
at least 50% of fibres perpendicular to the direction of the sound propagation.

25 The disadvantage which prevents the widespread use of the above  
described sound absorbing means is especially their appearance from the view  
side and a danger of damage to the acoustic resonance membrane, which is  
arranged on the view side of the sound absorbing means as well. Another  
disadvantage is the fact that cleaning their view side is difficult and, moreover,  
30 during cleaning there is a danger of damage to the acoustic resonance  
membrane.

The aim of the invention is to remove these shortcomings and to develop a sound absorbing panel which can be cleaned without a danger of damage to the acoustic resonance membrane and whose appearance would match the environment in which it is to be placed and which would develop its aesthetic value.

### **Principle of the invention**

The aim of the invention is achieved by a sound absorbing and thermal insulation panel, the principle of which consists in that the carrier body with the acoustic resonance membrane is situated inside a cover from a permeable textile material which covers it tightly without any deformations or twisting of the carrier body with the acoustic membrane.

For the purpose of inserting and removing the carrier body with the acoustic membrane in/out of the cover, a closeable opening is formed on the side of the cover.

For reinforcing the cover, it is advantageous if on the sides adjacent to the closeable opening reinforcing means which can be fixed on the carrier body and/or the cover are arranged inside the cover.

At the same time, it is important that the closing element of the opening does not cause deformations of the carrier body with the acoustic membrane, neither does it cause the deformations of the cover. A zip or a Velcro-type fastener appears as the most suitable means for this purpose.

For ensuring suitable sound absorption of the panel it is advantageous if the textile material of the cover is chosen from a group of fabrics, knitted fabrics or non-woven textiles with permeability higher than 20cm/s in pressure gradient of 100 Pa.

According to one of the alternative embodiments, the carrier body is formed by a board from a foam material with the open cell structure and the board can be provided with an embossed pattern on the front view side. It is

necessary to use pure soft silk, soft kinds of satin and damask or other similar soft material as a cover of such a board.

In another alternative embodiment, the carrier body is formed by a board of a web of bound polyester fibres with the open cell structure.

5 In some cases, for a higher sound absorption quality, it is advantageous if the openings are created in the board of the carrier body.

For easy and repeated fixing of the panel to the base, it is advantageous if on the back side of the textile material cover there is one part of the Velcro-type fastener, the other part of which is placed on the base to which the panel is  
10 to be fixed.

Another suitable method of fixing of the sound absorbing panel is its hanging in space, on the wall or in other suitable place. For this purpose, the panel is provided with means for its hanging, for example a lug, tapes, etc.

For the division of spaces in flats, offices or means of transport, it is  
15 advantageous if the carrier body is formed by narrow bands placed individually in the cover and arranged in a vertical curtain. Optionally, the bands can be placed separately in the common cover and arranged in a folding manner.

### **Description of drawings**

20 The invention will be described on the enclosed drawings, where Fig. 1 schematically represents an embodiment of the cover with a closeable opening for inserting the carrier body and Fig. 2 schematically represents an embodiment of the cover in the form of a band in which the carrier body is covered.

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### **Examples of embodiment**

A sound absorbing and thermal insulation panel according to the present invention contains a cover **3** made from a permeable textile material which tightly covers a carrier body **1** with an acoustic resonance membrane **2**, which is  
30 formed by a layer of polymer nanofibers of 20 to 200 nm in diameter and which

is in the form of a plane layer situated on the surface of the carrier body 1 made of a sound absorbing and thermal insulation material over at least one free space created in the carrier body 1. The free spaces in the carrier body 1 are in the advantageous embodiment formed by an open cell structure of a porous material which contains pores passing through the entire thickness of the carrier body 1.

In the basic embodiment, the cover 3 is formed as a hollow rectangular parallelepiped of the sizes corresponding to the sizes of the carrier body 1 with a closeable opening for inserting the carrier body 1 in the cover 3. In the embodiment according to Fig. 1, the cover 3 is in the place of the closeable opening provided with flaps 31, which overlap each other for closing the opening and are provided with connecting means for a repeated closing/opening of the opening, for example, for cleaning or washing the cover 3 when it is necessary to take the carrier body 1 out of the cover 3 and after cleaning or washing insert it in the cover again and close it. According to the requirements regarding the appearance or other requirements, the connecting means are chosen from a Velcro-type fastener, zip, magnets and connections which can be repeatedly attached to one another. In case of using magnets, they are placed in flaps or attached to them so that during closing the magnets will abut on each other with their opposite poles. The flaps 31 can also be connected by sewing or one flap can be created and sewed along the perimeter of the opening, etc. It is also possible to use other known connecting means.

Inside the cover 3, not represented reinforcing means, which prevent the carrier body 1 from bending, can be inserted on at least two opposite sides of the cover. The reinforcing means can be fixed on the carrier body 1 or they can be fixed on the cover 3 or they can be, after inserting the carrier body 1 in the cover 3, inserted between the cover 3 and the carrier body 1 before closing the opening.

In the embodiment represented in Fig. 2, the cover 3 is formed by a band of a permeable textile material which is placed on the front surface of the carrier body 1 provided with an acoustic resonance membrane 2 and wrapped around two side walls of the carrier body 1 and both sides of the bands are on the back side of the carrier body 1 connected to one another by means of connecting

means. During the wrapping, the reinforcement means can be placed between the side walls of the carrier body 1 and the cover 3. On the remaining two opposite sides, flaps 31, which close the cover 3 around the carrier body 1, are formed on the band of the cover 3. The flaps 31 are, as well as in the previous  
5 embodiment, provided with connecting means.

The textile material of the cover 3 is chosen from a group of fabrics, knitted fabrics or non-woven textiles having permeability higher than 20 cm/s in pressure gradient of 100 Pa.

On the front side of the cover 3, a work of art or decoration can be  
10 created, for example a tapestry or art protis. Then it is important to pay attention to the highest possible permeability of this work of art or decoration so that the sound absorption quality of the panel is not lowered too much.

In a preferred embodiment, the carrier body 1 is formed by a board of a foam material with an open cell structure. For achieving special view effects, the  
15 carrier body 1 can be provided with an embossed pattern on the front view side, on which the acoustic resonance membrane is situated. In this embodiment, the cover 3 is made of a soft silk or satin.

In another embodiment, the carrier body 1 is formed by a board of a web of bound polyester fibres with an open cell structure.

20 In both embodiments of the carrier body 1, openings can be formed in the board of the carrier body 1 and covered with an acoustic resonance membrane 2 formed by a layer of polymer nanofibers or a board of other than the above described material can be used, in which openings covered by an acoustic resonance membrane 2 are created.

25 The sound absorbing and thermal insulation panel is most frequently designed to be placed on the peripheral walls of a room. For this purpose, it is advantageous if on the back side of the cover 3 of the textile material one part of the Velcro-type fastener is placed and the other part of the Velcro-type fastener is fixed on the wall or another base on which the panel is to be placed.  
30 The Velcro-type fastener makes it relatively easy to remove the panel from the wall and to install it repeatedly, for example after cleaning or washing.

In some cases it is necessary to insert the sound absorbing and thermal insulation panels in the peripheral defined space, for example between the stuccos of the interior. For this purpose, the carrier body 1 is peripherally shaped accordingly and the cover 3 is individually adjusted to this shape.

- 5           Another option is the division of space using the sound absorbing and thermal insulation panels according to the technical solution presented. For this purpose, the panels are equipped with means for the arrangement in space, for example stands, legs or other means for standing on the floor when the panel can be placed in any suitable frame or means for hanging which can be formed  
10 by ceiling consoles, rails with corresponding sliders or tapes or other suitable means.

- For arrangement in space, the carrier bodies 1 can be formed by bands placed individually in a cover 3 and arranged in a vertical curtain. The width of the bands can vary and is dependent on the space in which the panels are to be  
15 used.

          Similarly, the carrier bodies 1 formed by bands placed separately in a common cover 3 which is between the carrier bodies 1 stitched through, pressed or otherwise joined and the individual parts are arranged in the folding manner.

- 20           In another not represented embodiment the carrier body is formed by a wide band of web of bound polyester fibres or another suitable material with an open cell structure placed in a cover 3 which is in the places of the required bends creating the folding stitched through, pressed, attached or arranged otherwise so that these bendings are made possible.

- 25           The sound absorbing and thermal insulation panels provide an easy arrangement of any interior, in case of the hotel or office spaces it is not necessary to stop the operation or block using the rooms because of installation or subsequent cleaning.



**Industrial applicability**

The sound absorbing and thermal insulation panels can be used for facing walls and ceilings of rooms. Furthermore, they can create divisions in rooms, for example in open space offices, means of transport, for example in  
5 planes, buses and trains. Other applications can be used in upholstery, where with the help of panels, in particular of a web, it is possible to adapt bedheads, doors, partitions, etc., and further adjust them by stitching through or buttons.

Another option is covering blank parts of plastic windows, where the panel is placed on the untransparent part of the window.

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## PATENT CLAIMS

1. A sound absorbing and thermal insulation panel containing at least  
5 one acoustic resonance membrane (2) formed by a layer of polymer nanofibers  
of 20 to 200 nm in diameter which is in the form of a plane layer situated on the  
surface of a carrier body (1) of a sound absorbing and thermal insulation  
material over at least one free space created in this body or which is situated on  
10 the surface of the carrier body (1) made of a porous material with an open cell  
structure, **characterized by that** the carrier body (1) with the acoustic  
resonance membrane (2) is placed inside the cover (3) of a permeable textile  
material which tightly covers them.

2. The sound absorbing and thermal insulation panel according to claim  
1, **characterized by that** in the cover (3) on one sidewall a closeable opening is  
15 created for inserting the carrier body (1) with the acoustic membrane (2).

3. The sound absorbing and thermal insulation panel according to claim  
2, **characterized by that** the cover (3) is in the place of the closeable opening  
provided with flaps (31) on which connecting means are mounted.

4. The sound absorbing and thermal insulation panel according to claim  
20 1, **characterized by that** the cover (3) is formed by a band of a permeable  
textile material placed on the front surface of the carrier body provided with an  
acoustic resonance membrane (2) and wrapped around two sidewalls of the  
carrier body (1) and both sides of the band are connected to one another on the  
back side of the carrier body (1) with connecting means.

25 5. The sound absorbing and thermal insulation panel according to claim  
4, **characterized by that** the band is provided with flaps (31) on which  
connecting means for closing the carrier body in the cover are mounted.

6. The sound absorbing and thermal insulation panel according to one of  
the previous claims, **characterized by that** on at least two opposite side walls  
30 reinforcing means are arranged inside the cover (3).

7. The sound absorbing and thermal insulation panel according to claim 6, **characterized by that** the reinforcing means are fixed on the carrier body (1) and/or on the cover (3).

5 8. The sound absorbing and thermal insulation panel according to one of the previous claims **characterized by that** the connecting means are chosen from a group of a Velcro-type fastener, zip, magnets, repeatedly attachable connections.

10 9. The sound absorbing and thermal insulation panel according to one of the previous claims **characterized by that** the textile material of the cover (3) is chosen from a group of fabrics, knitted fabrics or non-woven textiles with permeability higher than 20cm/s in the pressure gradient of 100 Pa.

10. The sound absorbing and thermal insulation panel according to one of the previous claims **characterized by that** the carrier body (1) is formed by a board of a foam material with an open cell structure.

15 11. The sound absorbing and thermal insulation panel according to claim 10, **characterized by that** the carrier body (1) is on the front view side, on which the acoustic resonance membrane (2) is mounted, provided with an embossed pattern and the cover (3) is made of a soft silk or satin.

20 12. The sound absorbing and thermal insulation panel according to one of claims 1 to 9, **characterized by that** the carrier body (1) is formed by a board of a web of bound polyester fibres with an open cell structure.

13. The sound absorbing and thermal insulation panel according to one of the previous claims, **characterized by that** in the board of the carrier body (1) openings are formed.

25 14. The sound absorbing and thermal insulation panel according to one of the previous claims, **characterized by that** on the back side of the cover (3) of the textile material is mounted one part of the Velcro-type fastener for fixing the panel to the other part of the Velcro-type fastener fixed on the base.

30 15. The sound absorbing and thermal insulation panel according to one of claims 1 to 13, **characterized by that** it is provided with the means for arrangement in space.

16. The sound absorbing and thermal insulation panel according to claim 15, **characterized by that** it is provided with means for hanging.

17. The sound absorbing and thermal insulation panel according to claim 16, **characterized by that** the carrier body (1) is formed by narrow bands  
5 mounted individually in the cover (3) and arranged in a vertical curtain.

18. The sound absorbing and thermal insulation panel according to claim 15 or 16, **characterized by that** the carrier body (1) is formed by narrow bands mounted separately in a common cover (3) which is stitched through or pressed between the carrier bodies (1) and the individual parts are arranged in a folding  
10 manner.

19. The sound absorbing and thermal insulation panel according to claim 15 or 16, **characterized by that** the carrier body (1) is formed by a wide band of a web of bound polyester fibres with an open cell structure placed in a cover which is stitched through in the places of the required bends creating the  
15 folding.

20. The sound absorbing and thermal insulation panel according to claim 1, **characterized by that** the carrier body (1) is peripherally shaped.

21. The sound absorbing and thermal insulation panel according to one of claims 1 to 14, **characterized by that** on the front side of the cover (3) a  
20 work of art or a decoration is created.

22. The sound absorbing and thermal insulation panel according to claim 21, **characterized by that** the work of art is a tapestry or art protis.

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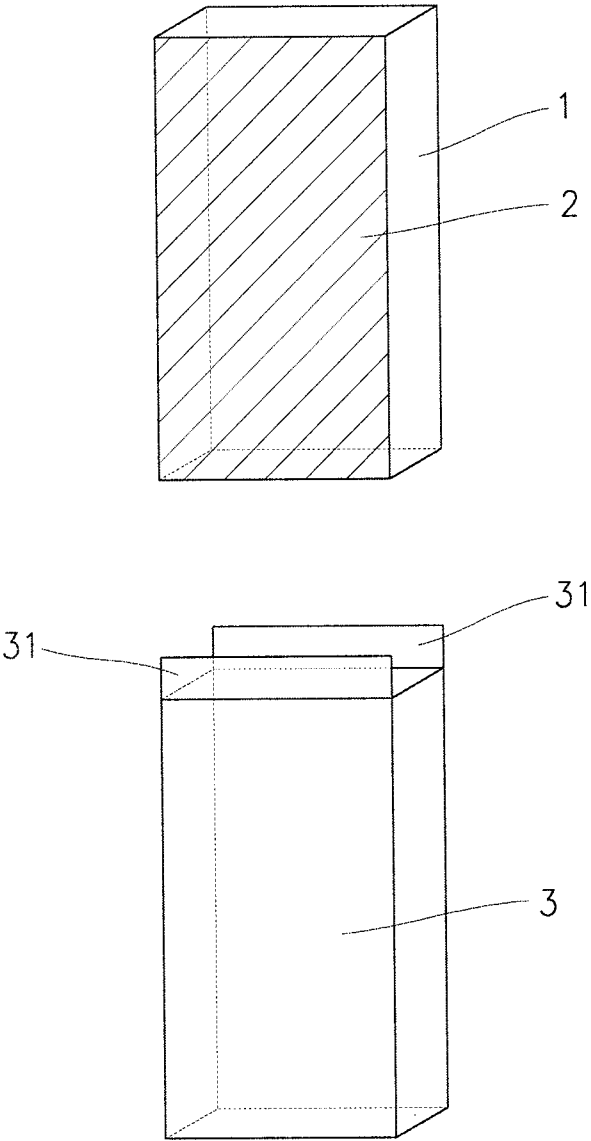


Fig. 1

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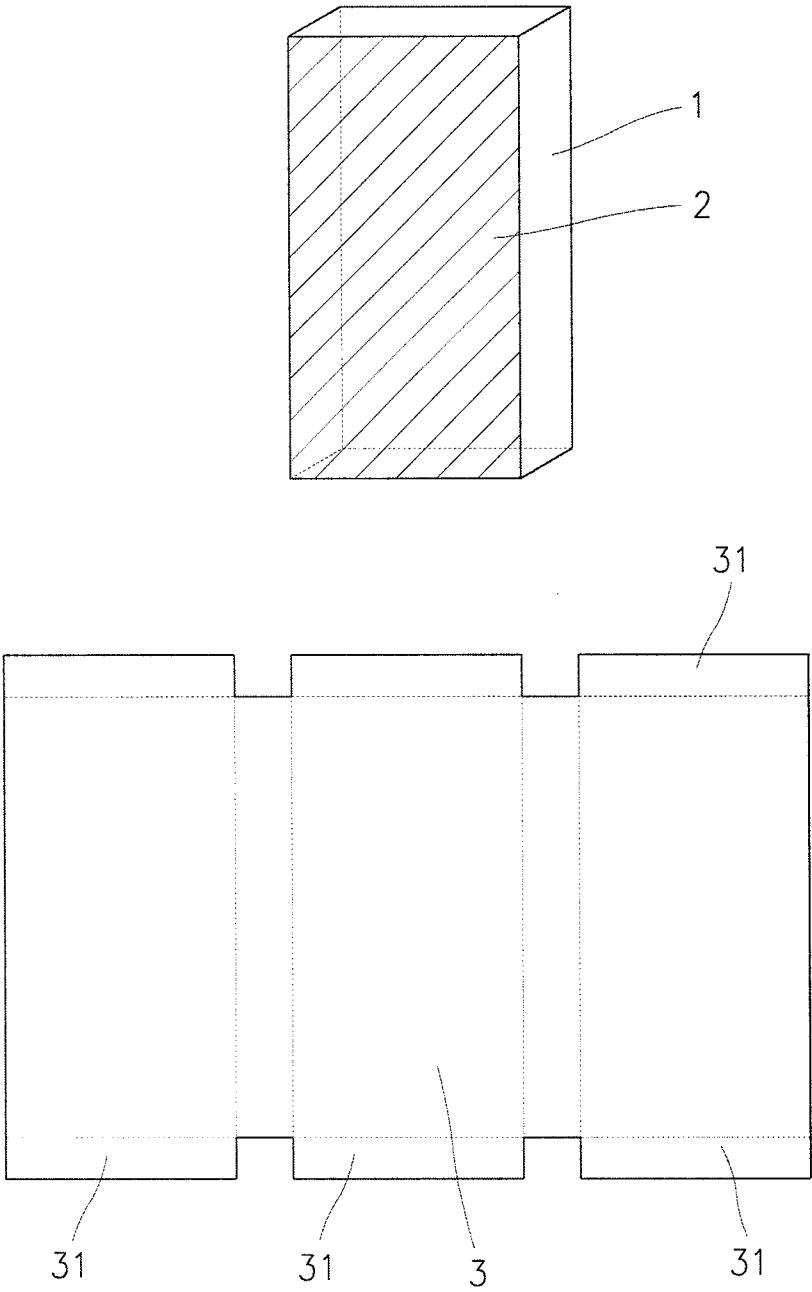


Fig. 2

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/CZ2016/050046

A. CLASSIFICATION OF SUBJECT MATTER  
INV. E04B1/86 E04B1/90  
ADD.

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)  
E04B

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)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2014/111067 A2 (TECHNICKA UNIVERZITA V LIBERCI [CZ]) 24 July 2014 (2014-07-24) cited in the application page 11, line 18 - page 12, line 2; figure 7b	1-22
Y	DE 37 21 972 C1 (BRAUN WERNER) 29 September 1988 (1988-09-29) column 1, line 58 - column 2, line 8 column 3, line 36 - column 4, line 63; figures	1-22



Further documents are listed in the continuation of Box C.



See patent family annex.

## \* Special categories of cited documents :

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

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Date of the actual completion of the international search

7 April 2017

Date of mailing of the international search report

18/04/2017

Name and mailing address of the ISA/

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/CZ2016/050046

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014111067 A2	24-07-2014	CZ 304656 B6	20-08-2014
		EP 2875507 A2	27-05-2015
		WO 2014111067 A2	24-07-2014
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DE 3721972 C1	29-09-1988	NONE	
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