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(71) Applicant: **SJ AB**
105 50 Stockholm (SE)

(72) Inventors:
- **Tolérus, Ulf**
  114 59, STOCKHOLM (SE)
- **Lundhammar, Henry**
  174 62, SUNDBYBERG (SE)

(74) Representative: **Karlsson, Leif Gunnar Börje**
Groth & Co KB
Box 6107
102 32 Stockholm (SE)

(54) Wheel axle cover

(57) Cover for a wheel axle (31), preferably of a rail-mounted vehicle, which cover is arranged as two axle cover parts (11), which are mounted around and surround the wheel axle (31) in the form of a circular-cylindrical pipe, which axle cover parts (11) as mounted form two radial gaps (45) that essentially are running along the wheel axle (31) and extend from one end of the pipe to the other end thereof, wherein each axle cover part (11) is provided with at least two internally placed elongate ridges (19, 191, 192, 193, 194, 602, 603, 604, 605, 606, 607, 608), which are orientated primarily in the circumferential direction so that an air channel (20) is formed between the elongate ridges.

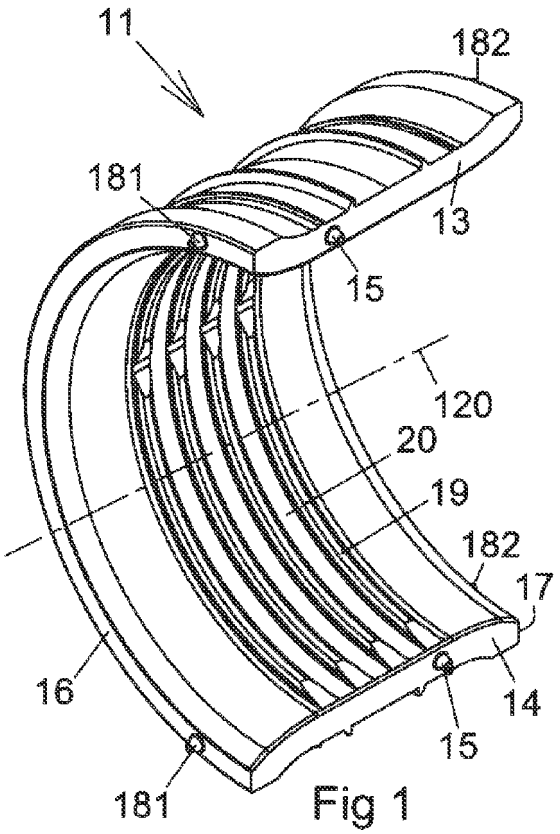

Fig 1

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Description

Technical Field

[0001] The present invention relates to an axle cover, in particular for a wheel axle of a rail-mounted vehicle.

Background of the Invention

[0002] In a rail-mounted vehicle, the wheels are carried in pairs by a wheel axle that connects two wheels with each other. The wheel axle rotates together with the wheels and is manufactured of solid material. During travelling, there is risk of the wheel axle being hit by flying stones, which may cause crack formation in the axle, which in turn may lead to axle fracture. Thus, wheel axles are subjected to impact action by said flying stones. The risk of such flying stones and crack formations increases at higher speeds and constitutes also a great inspection and maintenance problem in high-speed trains.

[0003] The background of the invention is further seen in SE 513494 (equivalent to US 6,568,333), which publication discloses a cover for a wheel axle of a rail-mounted vehicle. The cover consists of a circular-cylindrical pipe. The pipe consists of an inner rubber layer that abuts against the axle and an outer layer, which holds the inner layer in place as well as which can be mounted/dismounted upon inspection and maintenance. The inner layer is provided with a slot to allow the layer to be forced off and on, respectively, the axle upon dismounting/mounting. In other respects, the inner layer shapes itself to the wheel axle and accordingly abuts against the greater part of the surface of the wheel axle. The inner layer is protected from flying stones by an outer layer that is impact resistant and is held in place by a screw joint. In one embodiment according to this patent specification, it is also shown that the inner layer is formed as two halves of a primarily circular-cylindrical pipe, which are formed of rubber and abut directly against the axle surface. In this connection, the cover is formed with two slots between the two halves.

[0004] In the shown embodiments, the covers are fastened on the axle by the screw joint so that the cover cannot slide on the axle when this rotates.

[0005] These previously known axle covers protect the wheel axle against impacts from flying stones but have disadvantages by the fact that the tight connection thereof against the axle surface implies that moisture penetrating between the inner layer and the axle surface is retained and creates rust formation and thereby a risk of an initial indication and a later crack formation.

The Object of the Invention

[0006] The object of the present invention is to provide an improved cover for a wheel axle of a rail-mounted vehicle.

[0007] The object is furthermore to provide an axle cover of a rail-mounted vehicle having good cover properties against impacts from flying stones from outside as well as formed and mounted so that a continuous aeration takes place between the axle cover and the wheel axle.

[0008] The object is also to provide an axle cover that prevents rust and emergence of rust and crack formations on the axle.

[0009] In addition, the object is that such an improved axle cover is easy to mount and dismount.

Summary of the Invention

[0010] By the present invention, as this is set forth in the independent claim, the above-mentioned objects are met wherein the mentioned disadvantages have been eliminated. Suitable embodiments of the invention are defined in the dependent claims.

[0011] The invention concerns a cover for a wheel axle, preferably of a rail-mounted vehicle. The cover is arranged as two axle cover parts, which are mounted around and surround the wheel axle in the form of a circular-cylindrical pipe. The mounted axle cover parts form between themselves two slots that essentially are running along the wheel axle and extend from one end of the pipe to the other end thereof. Each axle cover part is provided with at least two internally placed elongate ridges or protuberances. The elongate ridges are orientated essentially in the circumferential direction so that an air channel is formed between the elongate ridges. With "essentially in the circumferential direction", reference is made to the fact that the ridges have an extension on the inside of the pipe so that one or more ridges together run around the inside of the entire pipe. In this connection, the ridges may be divided or in one piece, and may also be parallel but situated in imaginary planes that are angled in relation to the axis of the pipe.

[0012] It is also conceivable that the ridges are curved in their longitudinal direction so that the ridges, in planar view from the inside of the parts, have a curve-shaped extension instead of a linear one.

[0013] Thus, the inside of the axle cover is formed with ridges that abut against the rustproof axle surface by a relatively small contact surface. The figures show cross-sections through a number of designs of such ridges. Ridges having partly a plane top surface are particularly advantageous for distributing the load when mounting over a larger contact surface and thereby obtaining weaker abutment forces between the ridge and the axle surface.

[0014] In one embodiment, the elongate ridges have in cross-section a plane top surface, which is 30-50 % of the bottom surface of the ridges. The width "b" of the top surface in mm should be $2 \leq b \leq 10$ in applications for rail-mounted vehicles. Too slender a top surface implies too great wear while too wide a top surface implies that moisture is accumulated between the top surface and the envelope surface of the axle.

[0015] The function of the ridges is to prevent moisture and water from becoming standing a longer time between

the axle covers and the axle surface. The channels that are formed between the ridges will work in such a way that possible moisture in the channels is pressed along the channels to either axial cross channels and or directly to the radial gaps so that the moisture is transported away from the axle surface.

[0016] In one embodiment, the elongate ridges are provided with at least one interruption, which interruptions are placed essentially axially right opposite each other so that an essentially axially directed cross channel is formed on the inside of the axle cover. However, the direction of the cross channel may deviate from the axial one by up to 45°. The cross channel contributes to increasing the air transportation in the axial direction and contributes also to drainage should water be accumulated in the channels.

[0017] In one embodiment, the edge surface of one part, which faces the edge surface of the other part when the parts are mounted, is provided with at least one peripheral spacer shoulder, i.e., tangentially projecting, so that two radial gaps are formed between the parts when the same are mounted around the wheel axle. These radial gaps contribute to transport out air radially from the axle covers. Here, "radial" is defined as the principal air flow direction in the gap.

[0018] In one embodiment, each one of the two axle cover parts is formed to surround an equally great part of the wheel axle when they are mounted. Thus, the axle covers are formed of two halves, which together as mounted form an axle-surrounding cover. The halves are fixed on the axle by strip clamps. Also fastening ears integrated in the axle covers and through which a screw runs for the mounting of the covers are feasible.

[0019] Preferably, the axle covers are manufactured from cross-linked polyethylene, so-called PEX, but other materials may be used. The cross-links impart the material with considerably improved properties for the absorption of impact energy and to resist wear. Also the temperature range in practical use is improved in the cross-linking, and is approx. -100 °C to +100 °C. At very high impact energy absorptions in a short time, i.e., at high power generation, the ability of the material to be phase transformed is utilized. In this connection, the material is brought to be transformed from the solid to the liquid state and even to the gas state. This may also take place in one step, so-called sublimation. In these phase transformations, great amounts of energy are required. This means that the hitting particle, a stone or the like, is retarded more strongly than upon deformation only of the PEX material.

[0020] In one embodiment, the parts are provided with end surfaces that, when the parts are mounted, are axially situated in a plane perpendicular to the rotation axis of the wheel axle, which end surfaces are provided with at least two axial spacer shoulders so that an axial distance is formed between the cover and the nearest adjacent surface in the axial direction.

[0021] In one embodiment, the axle cover halves are provided with both axially and tangentially projecting spacer shoulders for facilitating mounting as well as for providing axial and radial air gaps between the parts.

[0022] Furthermore, the orientation of the elongate ridges in relation to the longitudinal axis of the pipe may be varied depending on the effect of air passing through that is aimed at.

[0023] In one embodiment, one of the elongate ridges is orientated so that it is situated in a first imaginary plane, which is orientated at an angle the acute angle of which is in the interval of 45°-90° to the rotation axis of the wheel axle, and the direction of the other elongate ridge coincides with a second imaginary plane, which is orientated at an angle the acute angle of which is in the interval of 45°-90° to the rotation axis of the wheel axle. Thus, one of the ridges may have a first angle while the other ridge may have an angle deviating from the same.

[0024] In a specified embodiment, the directions of the two elongate ridges in relation to the rotation axis of the axle are the same, i.e., the elongate ridges are parallel to each other. In these embodiments, the ridges are still parallel to each other but exhibit jointly a helicoidal extension on the inside of the axle cover halves. Said channels are formed in a corresponding way. Also this embodiment is provided with said axially directed cross channels. By this design of the ridges, an increased air passing through in the channels can be attained. Depending on the inclination and the direction of the helicoidal ridges, the air speed and direction of flow can be determined to a certain extent. In a shown embodiment, the elongate ridges form an angle of approx. 83° with the rotation axis of the wheel axle.

[0025] In an additional specified embodiment, the directions of the two elongate ridges coincide with imaginary planes, which are orientated 90° to the rotation axis of the wheel axle. Thus, the ridges are parallel and running in imaginary perpendicular planes to the rotation axis. In other words, the ridges are parallel to each other and extend parallel to the inner circumference of the circular-cylindrical axle surface so that peripheral air channels are formed between two adjacent ridges.

[0026] In one embodiment, the ridges of each cover half have at least one interruption so that an essentially axially directed cross channel is formed between two adjacent peripheral channels. This interruption implies that air and also moisture can be transported axially in the axle cover.

[0027] By such designs of the axle covers with the internally arranged ridges thereof, a form of centrifugal fan is provided, which sucks in air axially from the ends of the axle covers and presses out air radially through the radial gaps between the two axle cover parts when the axles with the axle covers rotate. In other embodiments, air may also be pressed out in the gap between two axle covers. Thus, an advantageous aeration of the axle cover according to the present invention is achieved.

[0028] By vibrations during operation, a certain friction may arise between the axle surface and the ridges of the

axle covers and therefore the axles are coated with a two-component epoxy lacquer in order to better resist the possible wear of the axle covers against the axle.

[0029] The outside of the axle cover is smooth with the exception of elevations in the form of long, circumferentially enclosing ridges that have been created to fix strip clamps in the axial direction, i.e., laterally on the covers. In shorter axle covers, it is suitable with one strip clamp while longer covers are attached by two or more strip clamps. The outsides of the two parts of the cover are accordingly provided with elevations between which said strip clamps are arranged to be guided when the cover is mounted on the wheel axle.

Brief Description of the Drawings

[0030] Now, the invention will be described in more detail, reference being made in connection with the accompanying drawing figures. The drawing figures show only explanatory sketches intended to facilitate the understanding of the invention.

Figure 1	shows a perspective view of a first embodiment of a part of an axle cover according to the invention.
Figure 2	shows a planar view of the inside of the embodiment according to Figure 1.
Figure 3a	shows a side view of the embodiment according to Figure 1.
Figure 3b	shows an enlargement of the area in the circle in Figure 3a.
Figure 4	shows a planar view of the outside according to Figure 1.
Figure 5	shows a section through an interior ridge according to the invention.
Figure 6	shows a planar view of the inside of an alternative embodiment according to Figure 2.
Figure 7	shows a part view of an alternative embodiment according to Figure 6.

Description of the Invention

[0031] Figure 1 shows a first axle cover part 11 in the form of a half wheel axle cover. The axle cover part is formed essentially as a half circular cylinder divided along an axial plane in which the rotation axis 120 of a wheel axle is lying. The axle cover part comprises a first edge surface 13 and a second edge surface 14. On each edge surface, a peripheral spacer shoulder 15 is arranged, which spacer shoulders abut against the first and second edge surface of a corresponding second axle cover part when two axle cover parts are assembled into a wheel axle cover. Further, the axle cover part is provided with first and second end surfaces 16, 17, which are provided with two spacer shoulders 181, 182 each. Further, the axle cover part is internally provided with elongate ridges 19, between which ridges an air channel 20 extends.

[0032] Figure 2 shows in a planar view the inside of the axle cover part 11 including the inner surface 201 thereof and the ridges 191, 192, 193, 194 placed there, which are four in number in the embodiment illustrated. The ridges extend from the first edge surface 13 to the second edge surface 14. Each ridge is provided with an interruption A1, A2, A3, A4. The interruptions are placed right opposite each other in the axial direction so that an axially directed cross channel 21 is formed. The ridges are furthermore provided with a chamfer 22 at each end and at the interruptions. In the embodiment shown in the figure, the ridges 191, 192, 193, 194 are parallel to each other and placed in an imaginary plane each orientated perpendicular to the rotation axis, i.e., the rotation axis forms a normal to the plane. The figure also shows the two spacer shoulders 181 of the first end surface 16 and the two spacer shoulders 182 of the second end surface 17. In addition, the spacer shoulders 15 of the first edge surface 13 and second edge surface 14 are shown.

[0033] Figure 3a shows a side view of the semicircular axle cover part 11 including the axially directed spacer shoulders 181 and the peripherally directed spacer shoulders 15. One of the ridges 194 situated axially outermost is placed on the inside of the axle cover part, the interruption A4 thereof being situated at the length of half the ridge. In order to further illustrate the channel 21 formed by the interruptions, one half of the wheel axle 31 has been drawn in, which wheel axle and axle cover part rotate together around the rotation axis 120.

[0034] Figure 3b shows an enlargement of the encircled area in Figure 3a. The wheel axle 31 abuts against the ridge 194, which is provided with the interruption that forms the channel 21 through which air and water can be transported axially away from the axle cover parts. As previously has been indicated, the ridges are preferably coated with a two-component epoxy lacquer to decrease wear between the axle 21 and the ridge 194.

[0035] Figure 4 shows the outside of a mounted cover 41 for a wheel axle 31, which comprises the first axle cover part 11 and a second axle cover part 12 formed in a corresponding way. The two axle cover parts 11, 12 are held together around the wheel axle 31 by strip clamps 42, which are contracted by a first screw member 43 and a second screw member 44. Between the two axle cover parts 11, 12, when the parts are mounted, there are formed two radial gaps 45 situated diametrically to each other on each side of the wheel axle 31. The function of these gaps is to allow radially outwardly directed air flow of the air sucked in axially between the inner surface 201 of the covers, Figure 2, and the outer surface 46 of the wheel axle.

[0036] Figure 5 shows a section through an interior ridge 19, which is provided with a plane bottom surface 51 and a plane top surface 52. The width TB of the top surface 52 is 30 %-50 %, preferably approx. 38 %, of the width BY of the bottom surface 51. Preferably, the width TB of the top surface is 2 mm $\leq$ TB$\leq$ 10 mm. The height H of the ridge is 30 %-50 % of the width BY of the bottom

surface 51, preferably approx. 41 %. This embodiment of the ridge is the same irrespective of the extension of the ridge in relation to the rotation axis of the wheel axle.

[0037] Figure 6 shows in a planar view an alternative embodiment of the axle cover part 11 including the inner surface 201 thereof and the ridges 601, 602, 603, 604, 605, 606, 607, 608 placed there, which in this embodiment are eight in number. Four of the ridges 603, 604, 605, 606 extend from the first edge surface 13 to the other edge surface 14 while the other four ridges 601, 602, 607, 608 extend between one of the edge surfaces 13, 14 out toward the respective end surface 16, 17. As seen in the figure, the ridges form the angle α with a projection of the rotation axis 120. The angle α is in the interval of $90° \leq \alpha \leq 135°$ or in the interval of $90° \leq \alpha \leq 110°$, preferably 97°. According to this embodiment, each ridge is provided with the corresponding interruption An as has been shown in Figure 2, but that have been displaced so that they are placed along a channel line 610, which forms the angle β with a projection of the rotation axis 120. The angle β is in the interval of $0° \leq \beta \leq 45°$, preferably 22°. These angle intervals of α and β also imply that the embodiment according to Figure 2 is applicable if α=90° and β=0°but extended by four more ridges. According to the figure, each interruption An forms a subchannel 61_n, which is orientated perpendicular to the longitudinal direction of the ridges and thereby forms the angle $\gamma = \alpha - 90°$. However, each interruption An may be formed so that the subchannel 61n thereof is directed along the channel line 610. In other respects, this embodiment corresponds to the embodiment shown above and described in Figure 2. In the embodiment according to Figure 6, the angle of the ridges may also be directed in opposite directions, i.e., the angle a is in the interval of $45° \leq \alpha \leq 90°$ or in the interval of $70° \leq \alpha \leq 90°$, preferably 83°. In such an embodiment, the angle β is in the interval of $-45° \leq \beta \leq 0°$.

[0038] Figure 7 shows a design of a subchannel 71_n in an interruption An of a ridge 607, where the subchannel has been orientated $\beta+\gamma$ in relation to its orientation shown in Figure 6. The embodiment according to Figure 6 may also be formed with all subchannels orientated in relation to the direction of the respective ridge as has been shown in Figure 7 and placed so that they coincide with the channel line 610.

[0039] Also embodiments where the straight ridges are not parallel to each other are feasible embodiments within the scope of the invention. In addition, embodiments where the ridges are not entirely straight but have some shape of circular arcs are possible within the scope of the invention. In this latter case, the distances between two adjacent circular arcs may be constant or even taper for each axle cover part.

Claims

1. Cover for a wheel axle (31), preferably of a rail-mounted vehicle, which cover is arranged as two axle cover parts (11), which are mounted around and surround the wheel axle (31) in the form of a circular-cylindrical pipe, which axle cover parts (11), when the same are mounted, form two radial gaps (45) that essentially are running along the wheel axle (31) and extend from one end of the pipe to the other end thereof, **characterized in that** each axle cover part (11) is provided with at least two internally placed elongate ridges (19, 191, 192, 193, 194, 601, 602, 603, 604, 605, 606, 607, 608), which are orientated primarily in the circumferential direction so that an air channel (20) is formed between the elongate ridges.

2. Cover according to claim 1, **characterized in that** the elongate ridges (19, 191, 192, 193, 194, 601, 602, 603, 604, 605, 606, 607, 608) are provided with at least one interruption (A1, A2, A3, A4, An), which interruption is placed in the vicinity of the nearest axially adjacent interruption, so that air and liquid passage can take place between the air channels.

3. Cover according to claim 2, **characterized in that** the interruptions are placed essentially axially right opposite each other so that an essentially axially directed cross channel (21) is formed on the inside of the axle cover.

4. Cover according to any one of claims 1-3, **characterized in that** the edge surface of one of the axle cover parts (11), which faces the edge surface of the other axle cover part (12) when the parts are mounted, is provided with at least one peripheral spacer shoulder (15) for the formation of said two radial gaps (45) between the axle cover parts (11, 12) when the same are mounted around the wheel axle (31).

5. Cover according to any one of claims 1-4, **characterized in that** the axle cover parts (11, 12) are provided with end surfaces (16, 17) that, when the parts are mounted, are axially situated in a plane perpendicular to the rotation axis (120) of the wheel axle (31), each of which end surfaces is provided with at least two axial spacer shoulders (181, 182) so that an axial distance is formed between the cover and the nearest adjacent surface in the axial direction.

6. Cover according to any one of claims 1-5, **characterized in that** one of the elongate ridges (19, 191, 192, 193, 194, 602, 603, 604, 605, 606, 607, 608) is orientated so that it is situated in a first imaginary plane, which is orientated at an angle the acute angle of which is in the interval of 45°-90°to the rotation axis (120) of the wheel axle (31), and that the direction of the other elongate ridge (19, 191, 192, 193, 194, 602, 603, 604, 605, 606, 607, 608) coincides with a second imaginary plane, which is orientated

at an angle the acute angle of which is in the interval of 45°-90° to the rotation axis (120) of the wheel axle (31).

7. Cover according to claim 6, **characterized in that** the directions of the two elongate ridges (19, 191, 192, 193, 194, 602, 603, 604, 605, 606, 607, 608) in relation to the rotation axis (120) of the axle (31) are the same, i.e., that the elongate ridges are parallel to each other.

8. Cover according to claim 7, **characterized in that** the directions of the two elongate ridges (19, 191, 192, 193, 194, 602, 603, 604, 605, 606, 607, 608) coincide with imaginary planes that are orientated 90° to the rotation axis (120) of the wheel axle (31).

9. Cover according to any one of claims 1-8, **characterized in that** the outsides of the two parts (11, 12) are provided with elevations (23, 24) between which a strip clamp (42) is arranged to be guided when the cover is mounted on the wheel axle (31).

10. Cover according to any one of claims 1-9, **characterized in that** each one of the two axle cover parts (11, 12) are formed to surround an equally great part of the wheel axle (31) when they are mounted.

11. Cover according to any one of claims 1-10, **characterized in that** the elongate ridges (19, 191, 192, 193, 194, 602, 603, 604, 605, 606, 607, 608) in cross-section have a plane top surface (52) having the width (TB).

12. Cover according to claim 11, **characterized in that** the width (TB) of the top surface is 30-50 %, preferably 38 %, of the width (BY) of the bottom surface (51) of the ridges.

13. Cover according to any one of claims 1-12, **characterized in that** the axle cover parts (11, 12) including the ridges (19, 191, 192, 193, 194, 602, 603, 604, 605, 606, 607, 608) thereof are manufactured from cross-linked polyethylene, so-called PEX.

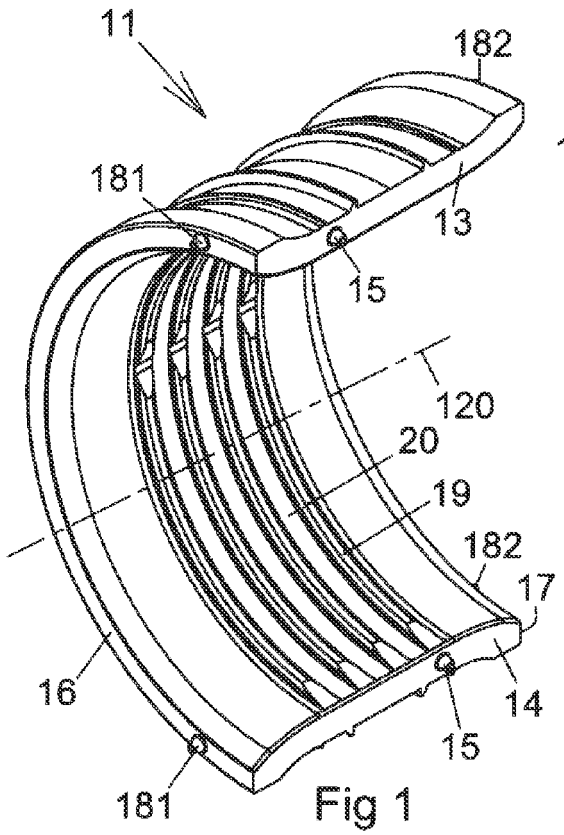

Fig 1

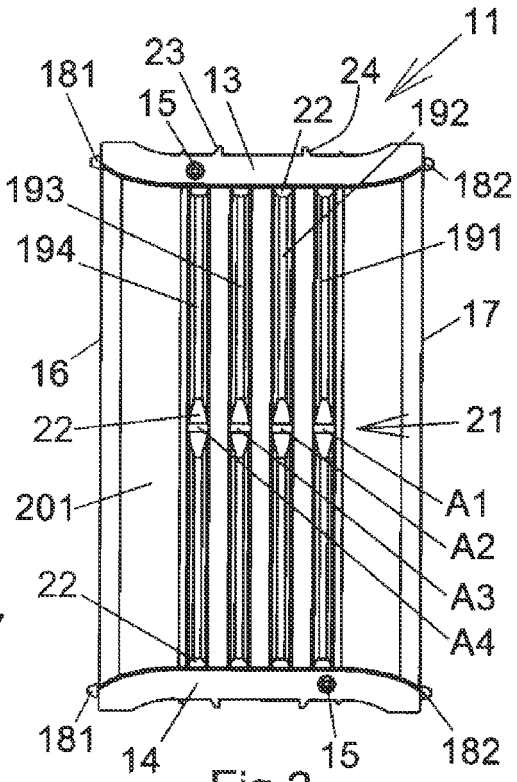

Fig 2

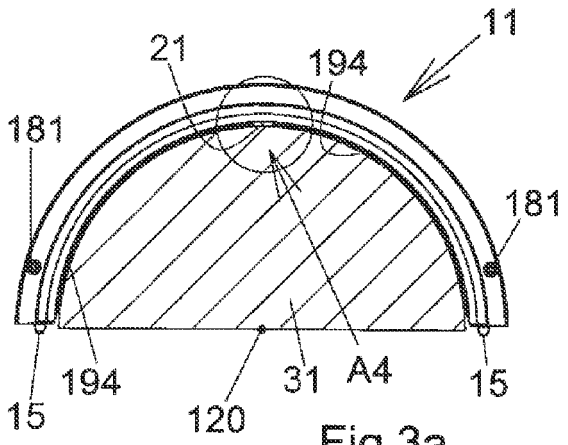

Fig 3a

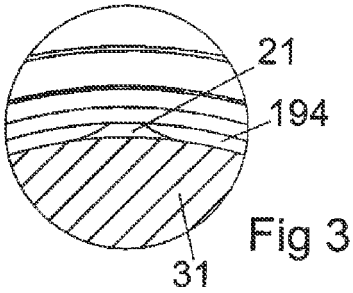

Fig 3b

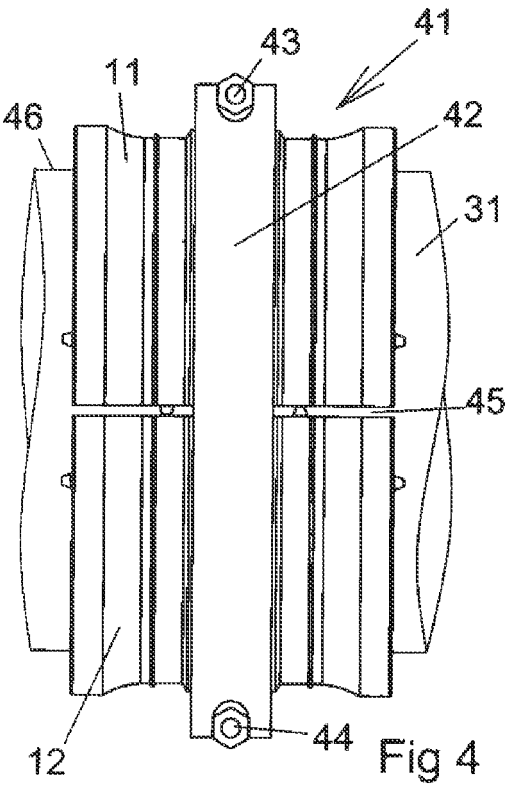

Fig 4

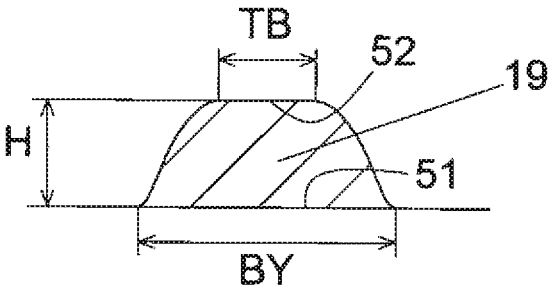

Fig 5

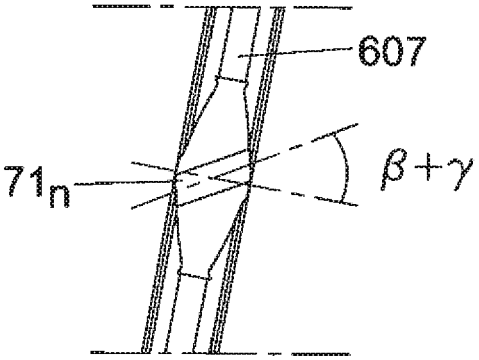

Fig 7

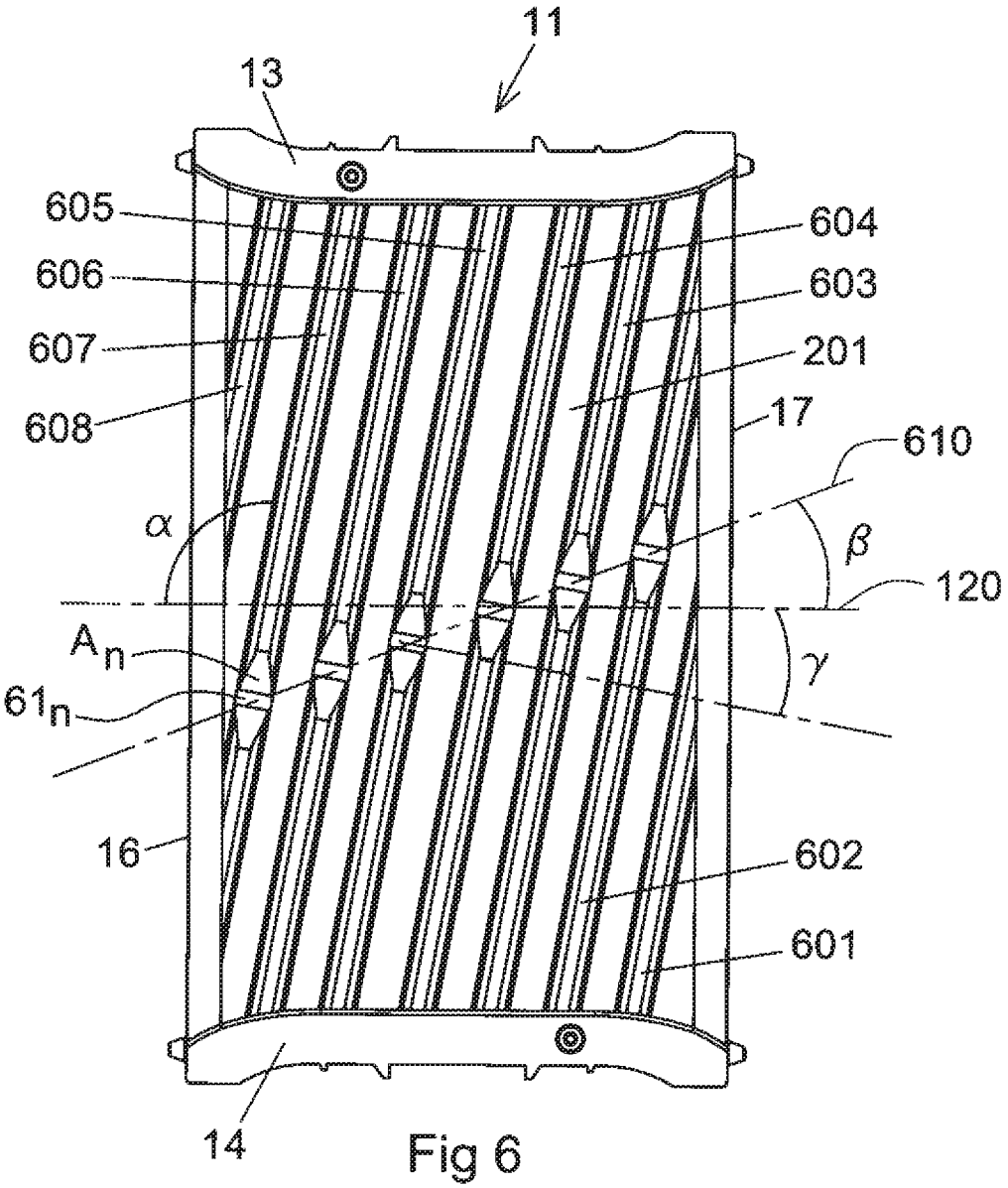

Fig 6

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 0822

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 6 568 333 B1 (KONTIO CAMILLA [SE] ET AL) 27 May 2003 (2003-05-27) * the whole document *	1-13	INV. B21K1/26 B61F5/50
A	DE 381 592 C (G & J JAEGER KOMM GES) 22 September 1923 (1923-09-22) * the whole document *	1-13	
A	FR 629 078 A (M. JAKOB SCHMID-ROOST (CH)) 3 November 1927 (1927-11-03) * figures 1,2 *	1-13	
A	US 2 352 163 A (BUCKWALTER TRACY V) 27 June 1944 (1944-06-27) * figure 7 *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

B21K
B60B
B61F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 May 2011	Awad, Philippe

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 15 0822

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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03-05-2011

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- SE 513494 **[0003]**
- US 6568333 B **[0003]**