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**MENETELMÄ VULKANOINTIMUOTIN MUOTTISEGMENTIN VALMISTAMISEKSI, MUOTTISEGMENTTI JA VULKANOINTIMUOTTI
METHOD FOR PRODUCING A MOULD SEGMENT OF A VULCANIZING MOULD, MOULD SEGMENT, AND VULCANIZING MOULD**

Method for producing a mould segment of a vulcanizing mould, mould segment, and vulcanizing mould

The invention relates to a method for producing a mould segment of a vulcanizing mould for a pneumatic vehicle tyre for forming the profiling of the tread, having a metallic base part with a mould side with ribs which form channels encircling or delimiting profile blocks. The invention furthermore relates to a mould segment of a vulcanizing mould for a pneumatic vehicle tyre for forming the profiling of the tread of the pneumatic vehicle tyre, having a metallic base part and having ribs for forming channels which encircle or delimit profile blocks. Furthermore, the invention relates to a vulcanizing mould consisting of mould segments.

Pneumatic vehicle tyres are vulcanized in heating presses, in which a green tyre is inserted into a vulcanizing mould and vulcanized under the action of pressure and temperature. The tread of the tyre is shaped and heated here by means of a mould segment ring consisting of a plurality of mould segments, the tread profile also being formed since the mould segments are provided with mould elements, such as ribs and lamellae, on their mould sides facing the mould cavity. Traditionally, mould segment rings are manufactured from steel alloys or aluminium alloys by casting methods with subsequent machining or by machining only.

In addition, it is known to produce those parts of mould segments that form the profiling in the tread by means of an additive production method, in particular by SLM (selective laser melting) and to fasten them to a traditionally manufactured further mould segment base part. A mould segment produced in this way is known, for example, from US 2016/039160 A1.

It is also known to produce individual mould elements, for example lamellae, which form sipes in the tread, or ribs, which form channels in the tread, by additive manufacturing methods. DE 10 2012 102 322 A1 discloses a method for producing a vulcanizing mould for pneumatic vehicle tyres, in which the lamellae are produced by means of SLM, while segment base parts are produced by a casting method or a machining method and the lamellae are subsequently introduced. It is also known from EP 2 987 630 A1 to produce at least one mould segment base part together with the negative profile elements by SLM.

A method for producing a mould segment of a vulcanizing mould for tyres from a mould support and a separate profile part, a mould insert, is known from US 2015/0165706 A1. In this case, the mould insert can be produced using an additive method.

5 In the known methods for producing mould segments, in which the complete mould segment is produced by an additive method or which uses a segment part, which is made of steel, for example, and which is connected to a second segment part, which is built up together with the shaping elements, such as ribs or lamellae, by an additive method, large-volume parts are to be built up using the
10 additive method. The production is thus time-consuming and requires large installations. Use is made here of multi-laser systems which work in parallel on a component and have to be precisely matched to one another in order to obtain a component of satisfactory quality. The subsequent milling effort required to provide a satisfactory mould segment is considerable. In addition, large-volume components
15 produced using an additive method tend to warp as a result of internal stresses that occur, which necessitates special manufacturing methods, such as the sintering of a lattice structure inside the component. Of particular advantage in the case of mould segment parts produced by an additive method such as selective laser melting is the possibility of producing mould parts with a complex design, in particular
20 mould parts with a large number of lamellae. Such mould parts are therefore of great interest for vulcanizing moulds for vulcanizing winter tyres and Nordic tyres.

 The problem addressed by the invention is that of providing hybrid mould segments - mould segments with constituent parts not manufactured by additive methods in combination with constituent parts manufactured by additive methods
25 - in a novel and innovative way that do not have the above disadvantages, wherein it is sought to fully maintain the advantages of additive methods.

 According to the invention, the stated problem is solved by means of a method in which a rib skeleton consisting of ribs, the profile of which at least partially corresponds to the arrangement and the profile of ribs forming channels, is
30 milled from the base part,

 inserts with peripheral frame parts are built up by means of an additive method,

the inserts being inserted into the rib skeleton and the frame parts completing the ribs of the rib skeleton to form the ribs forming the channels.

5 The stated problem is furthermore solved by means of a mould segment in which the base part has a milled-out rib skeleton consisting of ribs, the arrangement and the profile of which at least partially corresponds to the arrangement and the profile of ribs forming channels, into which rib skeleton inserts produced by an additive method and having peripheral frame parts are inserted, said frame parts completing the ribs of the rib skeleton to form ribs forming channels.

10 In the case of the invention, those elements or constituent parts of the shaping part of the mould segments that require a particularly precise configuration are therefore produced by an additive method. The inserts are small components that can be printed inexpensively without distortion and internal stresses in small systems, each insert with a laser. The difficulties associated with the use of multi-lasers are therefore eliminated. The base part is in particular a part which is pre-
15 manufactured from a steel alloy or aluminium alloy customary for mould segments and on which the rib skeleton is produced by milling, the milled base part having a high degree of dimensional accuracy, since the rib skeleton can be milled out particularly precisely. The rib skeleton is above all also particularly advantageous because it allows the inserts to be built up with a small additive portion of material, since the rib skeleton already contains some of the ribs provided. Furthermore, the
20 material of the base part can correspond to the material from which the metal powder for building up the inserts is composed, and therefore the constituent parts of the mould segment have the same material expansion. The outlay on printing for producing the inserts is substantially less than for printing large-volume mould segment parts according to the prior art, and therefore less time and less material
25 are required, resulting in significantly lower costs. The invention also provides a modular concept for mould segments of tyre vulcanizing moulds, since the inserts can be exchanged, and no exchange of large constituent parts of the mould segments or even of the mould segments themselves is required if, for example, different rib designs or surface structures within the scope of the development of
30 treads are intended to be tested with vulcanized tyres on vehicles in use.

The method is particularly advantageous if the inserts are built up additively together with lamellae and/or micro-lamellae. Particularly complex lamellae and micro-lamellae can be printed particularly precisely and with almost any small spacings. The method is therefore particularly advantageous for the production of mould segments for the profiling of winter or Nordic tyres.

Inserts which are preferably built up additively together with inner layers on a building plate, are cut out of the building plate together with the building plate part, on which they are built, such that the building plate parts partly form or form bottom plates of the inserts, are particularly dimensionally stable. The building plate parts are therefore constituent parts of the inserts and, if inner layers are also built up additively, form the inserts together with these bottom plates. The inner layers form the mould surfaces which form the positive surfaces of the tread of the tyre.

In an alternative embodiment, the inserts together with inner layers are built up additively on a building plate, the inserts then being separated from the building plate, such that the inner layers form bottom plates of the inserts. The inner layers, together with the frame parts provided, ensure the stability of the inserts for their handling when being installed in and possibly removed from the base part.

In a further alternative, the inserts, preferably together with inner layers, are built up additively on building plate parts which are adapted to the inserts, in particular are cut to size from a building plate. Dimensionally stable inserts are also obtained in this variant.

According to a preferred refinement, the inner layers can be built up additively with at least one surface structure. The inner layers of inserts can have different structures such that these inner layers consist of differently structured partial regions, and/or inserts can be built up, the inner layers of which have structures that differ from the structures of the inner layers of other inserts.

The mould segment therefore preferably has inserted inserts having bottom plates, each of which consists of an additively built up inner layer or of an additively built up inner layer and a part of the building plate on which the inserts have been built up. The tread of the tyre to be vulcanized obtains the intended curved outer contour by means of the inner layers which have curved outer surfaces which

are the mould surfaces for forming the positive surfaces of the profile elements of the tread.

In a further preferred embodiment, inserts which are subdivided or divided by additional ribs are built up additively. The building up of such inserts is appropriate, for example, when ribs are provided which are intended to form blind grooves in the tread. This embodiment is also advantageous if in particular relatively narrow ribs are provided which form channels, for example, which subdivide profile blocks into smaller profile block elements. Inserts of this type can also be inserts that are used at mould segment boundaries and, for example, additionally have part of a second insert "divided" by the mould segment boundary.

The mould segment is therefore preferably provided with inserts which are additionally subdivided or divided by ribs and optionally provided with micro-lamellae for the formation of correspondingly narrow and shallow sipes in the tread of the tyre to be vulcanized.

In a further preferred embodiment, inserts which have sections of a shoulder decoration or of shoulder decoration ribs are built up additively. This embodiment is considered in particular when relatively complex decorative elements and the like are intended to be realized.

In an alternative embodiment of the method, shoulder decoration ribs with surface decorative elements are milled out on the base part. As is known, shoulder decoration ribs form those regions of the tread of the tyre to be vulcanized which are already outside the ground-contacting part of the tread and follow the shoulder curvature of the tyre. Depending on the design, the shoulder decoration ribs can be created precisely and inexpensively by milling. Inserts which, as mentioned, are built up additively with sections of shoulder decoration ribs may require a greater outlay and higher production costs. The mould segment therefore has either a base part with milled shoulder decoration ribs with decorative elements milled on the surface, or inserts which have sections of a shoulder decoration or shoulder decoration ribs.

At the positioning positions of the inserts on the base part, depressions with flat bottom surfaces are preferably milled out between the ribs of the rib skeleton, the orientation of which depressions on the base part is adapted to the intended

outer contour of the tread of the tyre to be vulcanized, the depressions also being milled to a depth adapted to the thickness of the bottom plates of the inserts.

The mould segment therefore preferably has a correspondingly designed base part which has depressions with flat bottom surfaces between the ribs of the rib skeleton and between the ribs and the shoulder decoration ribs.

In order to ensure the necessary mould ventilation when moulding the tyre to be vulcanized into the vulcanizing mould, in a preferred embodiment, ventilation holes which reach into the bottom surfaces of the depressions are made in the base part, and the building plate is provided with ventilation holes, the positions of which correlate with the positions of the ventilation holes in the base part. Threaded bores can already be created in the building plate if the inserts are to be screwed to the base plate. Thus, the base part of the mould segment has ventilation holes reaching into the bottom surfaces of the depressions, and the bottom plates of the inserts are preferably penetrated by ventilation holes, the positions of which correlate with the positions of the ventilation holes in the base part.

The inner layers of the inserts are therefore preferably also built up leaving holes free, the positions of which correspond to the positions of the ventilation holes in the building plate.

The milling work on the base part is simplified if, according to a preferred embodiment, this is carried out in such a way that the depressions in the base part are milled with rounded corner regions. The inserts to be built up according to the additive method can then be built up additively in a particularly precise manner with correspondingly rounded outer corner regions and also with sharp-edged inner corners. Accordingly, the preferred design of the base part is also provided with depressions with rounded corner regions, the inserts having correspondingly rounded outer corner regions and, if desired, sharp-edged inner corners.

It is particularly advantageous if the base part of the mould segment consists of a steel alloy or of an aluminium alloy since such materials can be milled particularly well.

The invention also relates to a vulcanizing mould for pneumatic vehicle tyres, which contains a segment ring with mould segments according to one or more of Claims 14 to 25.

Further features, advantages and details of the invention will now be described in more detail with reference to the partially schematic drawing, which illustrates exemplary embodiments. In the drawing:

Fig. 1 shows a view of a mould segment part of a tyre vulcanizing mould
 5 consisting of a base part together with inserted inserts,

Fig. 2 shows a view of the associated base part,

Fig. 3 shows a view of the associated inserts,

Fig. 4 shows a schematic view of a building plate with built-up inserts,

Fig. 5 shows a schematic view of inserts cut out of the building plate,

10 Fig. 6 shows a schematic view of an individual insert, and

Fig. 7 shows a view of a detail of an insert inserted into a base part.

In the description below, "radial direction" is understood as meaning the direction of a perpendicular to the mould surface forming the tread outer surface. "Axial direction" is understood as meaning a direction parallel to the axis of rota-
 15 tion of the tyre to be vulcanized.

Fig. 1 shows a view of a mould segment part 1 of a mould segment of a segment ring of a tyre vulcanizing mould, wherein in particular the inner side - the side facing the mould cavity - can be seen. A conventional segment ring is composed, for example, of seven to fourteen mould segments, each of which has a
 20 mould segment spine opposite the inner side, by means of which the mould segments are arranged in a manner known per se on a segment shoe of the tyre vulcanizing mould. On its inner side, the mould segment part 1 has mould elements which, according to the profiling provided in the tread of the tyre to be vulcanized, are profile negative elements, ribs 3 and lamellae 4 in the embodiment shown.

25 The rear sides of the mould segment parts 1 are, for example, simple cylindrical surfaces, and therefore the mould segment parts 1 are attached to the segment shoe of the vulcanizing mould by means of appropriately designed adapters. Use is made in particular of adapters which are screwed onto the rear sides of the mould segment parts 1 or are connected to the mould segment parts 1 via tongue and
 30 groove or dovetail connections or other positive or materially bonded connections. In an alternative embodiment, the mould segment parts 1 themselves are already designed as an interface to the container of the vulcanizing mould.

The lamellae 7 form sipes in the tread of the tyre to be vulcanized with a width (on the tread periphery in a new tyre) of the order of magnitude of 0.4 mm to 1.0 mm, the ribs 3 form channels in the tread of the tyre to be vulcanized, the width of which (on the tread periphery in a new tyre) is greater than 1.0 mm and in particular up to 6.0 mm. In addition, it is possible to provide lamellae which are what are referred to as micro-lamellae, which usually form narrow and shallow sipes with a width and depth of about 0.2 mm to 0.3 mm in the tread. In the embodiment shown in Fig. 1, the ribs 3 and lamellae 4 form a typical winter tyre profile in the tread of the tyre to be vulcanized. In the example, a large number of V-shaped ribs 3 running parallel to one another and across the width of the inner side of each mould segment part 1 are also provided, and there are also further ribs 3 running obliquely to the circumferential direction of the mould segment 1 and subdividing the V-shaped ribs 3. On the shoulder side, there is an additional division by means of ribs 3 which are present centrally between and parallel to the sections of the V-shaped ribs 3 running on the shoulder side. Shoulder decoration ribs 2 form the lateral edges of the mould segment part 1. In all of the surface elements encircling the ribs 3 and the shoulder decoration ribs 2 there is in each case a number of lamellae 4 in wave form. Flat structures in the form of decorative elements 5 for forming shoulder decorations of the tyre are located on the upper side of the shoulder decoration ribs 2 - the side of the mould segment part 1 facing the mould cavity. Owing to the V-shaped ribs 3 between the shoulder decoration ribs 2, the profile negative which is formed is divided into pitches running in a V-shaped manner relative to one another - negative sections that are repeated in the same way in the circumferential direction in each half of the mould segment part.

As shown in Fig. 2 and Fig. 3, the mould segment part 1 is composed of a base part 6 made of a metallic material, in particular of a steel alloy or an aluminium alloy, and also of a multiplicity of inserts 7 inserted into the base part 6. The inserts 7, the production of which will be described in more detail further below, each have a bottom plate 7a (Fig. 6) which has a flat underside and an inner side formed in accordance with the outer surface of the blocks to be formed in the tread of the tyre to be vulcanized. The bottom plates 7a have a thickness d , which is slightly larger at the periphery than in the centre. The inner sides of the bottom

plates 7a therefore form the mould surfaces for forming the outer surfaces of the tread that come into contact with the underlying surface.

The design of the base part 6 will now be explained in more detail with reference to Fig. 2. The base part 6 is a milled part with milled shoulder decoration ribs 2 with milled decorative elements 5 on the lateral edges and a milled rib skeleton 8. The rib skeleton 8 consists of ribs 8', the arrangement and the profile of which corresponds to the arrangement and the profile of the ribs 6, although the ribs 8' are narrower than the ribs 6, and flank sections of the ribs 6 are missing on both rib flanks 8'a. As will be described later, these flank sections are supplemented by frame parts 7b of the inserts 7. According to a preferred embodiment, the rib flanks 8'a are, as shown in Fig. 2, flat surfaces which are oriented in the radial direction. In principle, the rib flanks 8'a are milled in such a way that a flush insertion of the inserts 7 mentioned from above is possible; the rib flanks 8'a can therefore be slightly inclined relative to the radial direction, for example.

The level of the tips of the ribs 8' corresponds to that of the ribs 3. However, the ribs 8' have a greater height than the ribs 3, since the ribs 8' of the rib skeleton 8, on the shoulder side together with the shoulder decoration ribs 2, enclose deeper milled-out depressions with flat bottom surfaces 9. The depth of the depressions is adapted to the greatest thickness d of the bottom plates 7a of the inserts 7 in such a way that, when the inserts 7 are inserted, the inner sides of the inserts 7 forming the mould surface are located at the intended mould surface level.

The orientation of the bottom surfaces 9 is adapted to the desired rounding or contour of the outer side of the tread of the tyre to be vulcanized, preferably by each bottom surface 9 being aligned at right angles to a straight line oriented in the radial direction, with respect to the outer contour mentioned, through the geometric centre point thereof. The bottom surfaces 9, which are oriented virtually in the axial direction, are therefore located in the central region of the base part 6.

The decorative elements 5 on the shoulder decoration ribs 2 have, for example and as shown in Fig. 1 and Fig. 2, flat and narrow elevations which continue the ribs 8' of the rib skeleton 8.

For ventilation, the base part 6 is pierced between the bottom surfaces 9 and its rear side, with either in each case a larger number of holes 11a being created

per bottom surface 9 (Fig. 2) or only one or two holes 11a being created for ventilation, and a type of channel network of flat depressions, connected to the hole 11a or the holes 11a, being milled on the respective bottom surface 9. The holes 11a are arranged in such a way that their positions do not coincide with the positions
 5 of the lamellae 4 in the inserts 7.

The inserts 7 are built up in a larger number on a building plate 10 by an additive method, in particular by selective laser melting. The building plate 10 is a flat plate, and, in a preferred embodiment, the thickness of the plate also determines the required depth of the mentioned depressions in the base part 6. The building
 10 plate 10 is first also provided with holes 11b (Fig. 4 and Fig. 5) corresponding to the arrangement of the holes 11a in the base part 6. Depressions in the form of channel networks, which correspond to the milled channel networks that may be provided on the bottom surfaces 9, may be formed, but this is not absolutely necessary, since the milled channel networks on the bottom surfaces 9 usually already
 15 ensure good ventilation.

The building plate 10 is aligned and positioned accordingly in a 3D printer, and the holes 11b created are filled with metal powder or the like flush with the upper side of the building plate 10. The individual inserts 7 are then built up layer by layer in their intended designs, together with the provided lamellae, any micro-
 20 lamellae, other surface structures, optionally letters, treadwear indicators, etc. Ventilation holes are left free at the positions of the holes 11b in the building plate 10. A thin inner layer 12 (Fig. 4) is preferably built up on the upper side of the building plate in a curved manner corresponding to the intended curvature of the mould surface. The inserts 7 are also built up with peripheral frame parts 7b (Fig. 6),
 25 which are designed in such a way that, when the inserts 7 are inserted at their intended positions on the base part 6, the ribs 8' of the rib skeleton 8 are supplemented to form complete ribs 3. In the case of inserts 7 that are to be positioned on the shoulder side, frame parts 7b are formed only on those three sides that border ribs 8'. Depending on the actual design of the tread profile with ribs, associated inserts
 30 that shape the profiling can also only have frame parts on two sides and/or be designed in such a way that they form larger profile blocks, more than one profile block or other block-like structures in the tread.

In a preferred embodiment, the built-up inserts 7 together with the building plate part, on which they are directly built up, are cut out of the building plate 10, for example by means of a laser beam, water jet or mechanically. The mating surfaces are reworked if necessary. At this point, ventilation valves, if provided, can be inserted in the holes 11b penetrating the building plate 10 and the inner layer 12. The bottom plates 7a of such inserts 7 consist of the building plate part and the inner layer 12. In an alternative embodiment, the inserts 7 are separated along the upper side of the building plate 19, for example are cut off, such that the bottom plates 7a are formed by the inner layers 12. The milling depth of the depressions in the base part 6 depends on the intended design.

The positioning and insertion of the inserts 7 at their positions on the base part 6 subsequently takes place. The inserts 7 are fixedly connected to the base part 6, preferably by shrinking, by the base part 6 being heated before insertion. The inserts 7 can also be connected to the base part 6 by screwing or welding. In an embodiment with building plate parts as constituent parts of the bottom plates 7b of the inserts 7, screw holes with internal threads can be created in the building plate and the base part, such that inserts 7 can be easily exchanged.

Milling out the depressions in the base part 6 with sharp-edged corners is expensive. The corner regions of the depressions are therefore preferably milled in a rounded manner. The corner regions between the frame parts 7b on the inserts 7 are built up in rounded form on the outer side, corresponding to the rounded corner regions of the depressions, during the additive building-up method, and the inner corners between the frame parts 7b are built up with sharp edges, as shown in Fig. 7.

In particular, the mould segment division takes place in such a way that complete inserts can be used. Alternatively, there is a "division" of inserts in the data for the additive building-up method, such that inserts are additively built up in two parts.

Furthermore, inserts 7 themselves can additionally have ribs which, for example, subdivide these inserts 7 or divide them into insert elements. The rib skeleton 8 can have ribs which are interrupted in their profile and which supplement frame parts of the inserts.

The additive building up of the inserts takes place fully automatically with software control, as does the milling work on the base parts 6.

List of reference signs

	1.....	Mould segment
	2.....	Shoulder decoration rib
	3.....	Rib
5	4.....	Lamella
	5.....	Decorative elements
	6.....	Base part
	7.....	Insert
	7a.....	Bottom plate
10	7b.....	Frame part
	8.....	Rib skeleton
	8'	Rib
	8'a	Rib flank
	9.....	Bottom surface
15	10.....	Building plate
	11a, 11b	Hole
	12.....	Inner layer
	d.....	Thickness

PATENTTIVAATIMUKSET

1. Menetelmä ajoneuvon paineilmarenkaan vulkanointimuotin muottisegmentin valmistamiseksi, joka muottisegmentti on tarkoitettu kulutuspinnan profiloinnin muotoiluun ja jossa on metallinen perusosa (6),
 5 jonka muottipuolella on ulokkeita (3), jotka muotoilevat profiilielementtejä kiertävät tai rajaavat urat,
 tunnettu siitä,

10 että perusosasta (6) jyrsitään ulokerunko (8), joka koostuu ulokkeista (8'), joiden järjestys ja muoto vastaa ainakin osittain urat muotoilevien ulokkeiden (3) järjestystä ja muotoa, additiivisella menetelmällä rakennetaan inserttejä (7), joissa on reunoilla sijaitsevia
 15 kehysosia (7b), jolloin insertit (7) asetetaan ulokerunkoon (8) ja kehysosat (7b) täydentävät ulokerunгон (8) ulokkeet (8') urat muotoileviksi ulokkeiksi (3).

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2. Patenttivaatimuksen 1 mukainen menetelmä, tunnettu siitä, että insertit (7), mukaan lukien lamellit (4) ja/tai mikrolamellit, rakennetaan additiivisesti.
 25

3. Patenttivaatimuksen 1 tai 2 mukainen menetelmä, tunnettu siitä, että insertit (7), mieluiten mukaan lukien sisäkerrokset (12), rakennetaan additiivisesti rakennuslevylle (10), leikataan irti rakennuslevystä (10) yhdessä sen rakennuslevyn osan kanssa, jolle ne on rakennettu, niin että rakennuslevyn osat muodostavat osin tai kokonaan inserttien (7) pohjalevyt (7a).
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4. Yhden tai useamman patenttivaatimuksista 1-3 mukainen menetelmä, tunnettu siitä, että insertit (7), mukaan lukien sisäkerrokset (12), rakennetaan additiivisesti rakennuslevylle (10), jolloin insertit
 35

(7) tämän jälkeen erotetaan rakennuslevystä (10), niin että sisäkerrokset (12) muodostavat inserttien (7) pohjalevyt (7a).

5 3 mukainen menetelmä, tunnettu siitä, että insertit (7), mieluiten mukaan lukien sisäkerrokset (12), rakennetaan additiivisesti insertteihin (7) mukauteuille rakennuslevyn osille, erityisesti rakennuslevystä (10) mittojen mukaan leikatuille osille.

10 6. Yhden tai useamman patenttivaatimuksista 1-5 mukainen menetelmä, tunnettu siitä, että inserttien (7) sisäkerrokset (12), joissa on vähintään yksi pintatason rakenne, rakennetaan additiivisesti.

15 7. Yhden tai useamman patenttivaatimuksista 1-6 mukainen menetelmä, tunnettu siitä, että rakennetaan additiivisesti inserttejä (7), jotka on jaettu tai jäsennetty lisäulokkeilla.

20 8. Yhden tai useamman patenttivaatimuksista 1-7 mukainen menetelmä, tunnettu siitä, että rakennetaan additiivisesti inserttejä (7), joissa on osia olkakoristeesta tai olkakoristeulokkeista (2).

25 9. Yhden tai useamman patenttivaatimuksista 1-8 mukainen menetelmä, tunnettu siitä, että perusosaan (6) jyrситään olkakoristeulokkeita (2), joissa on pintatason koriste-elementtejä (5).

30 10. Yhden tai useamman patenttivaatimuksista 1-9 mukainen menetelmä, tunnettu siitä, että ulokerungon (8) ulokkeiden (8') väliin jyrситään syvennyksiä, joissa on tasaiset pohjapinnat (9) ja joiden suuntaus perusosassa (6) on mukautettu vulkanoitavan renkaan kulutuspinnan aiottuun ulkoiseen ääriviivaan, jolloin syvennykset jyrситään syvyyteen, joka on mukautettu inserttien (7) pohjalevyjen (7a) paksuuteen.

35 11. Yhden tai useamman patenttivaatimuksista 1-10 mukainen menetelmä, tunnettu siitä, että perusosaan (6) tehdään ilmanpoistoreikiä (11a), jotka ulottuvat syvennysten pohjapintoihin (9).

12. Yhden tai useamman patenttivaatimuksista 1-11 mukainen menetelmä, tunnettu siitä, että rakennuslevy (10) on varustettu ilmanpoistorei'illä (11b) ja tarpeen mukaan kierrerei'llä, joiden sijainnit korreloivat perusosan (6) ilmanpoistoreikien (11a) sijaintien kanssa.

13. Yhden tai useamman patenttivaatimuksista 1-12 mukainen menetelmä, tunnettu siitä, että inserttien (7) sisäkerrokset (12) rakennetaan jättäen auki reikiä, joiden sijainti vastaa rakennuslevyn (10) ilmanpoistoreikien (11b) sijaintia.

14. Yhden tai useamman patenttivaatimuksista 1-13 mukainen menetelmä, tunnettu siitä, että perusosan (6) syvennykset jyrситään kulma-alueiltaan pyöristetyiksi, jolloin insertit (7) rakennetaan siten, että niissä on vastaavasti pyöristetyt ulkokulma-alueet ja tarpeen mukaan teräväreunaiset sisäkulmat.

15. Ajoneuvon paineilmarenkaan vulkanointimuotin muottisegmentti, joka on tarkoitettu ajoneuvon paineilmarenkaan kulutuspinnan profiloinnin muotoiluun, jossa on metallinen perusosa (6) ja jossa on ulokkeita (3) profiilielementtejä kiertävien ja/tai rajaavien urien muotoilemiseksi, tunnettu siitä, että perusosassa (6) on jyrситty ulokerunko (8), joka koostuu ulokkeista (8'), joiden järjestys ja muoto vastaa ainakin osittain urat muotoilevien ulokkeiden (6) järjestystä ja muotoa, ja johon asetetaan additiivisella menetelmällä valmistettuja inserttejä (7), joissa on reunoilla sijaitsevia kehysosia (7b), jotka täydentävät ulokerunгон (8) ulokkeet (8') urat muotoileviksi ulokkeiksi (3).

16. Patenttivaatimuksen 15 mukainen muottisegmentti, tunnettu siitä, että siinä on inserttejä (7), jotka on lisäksi jaettu tai jäsennetty ulokkeilla.

17. Patenttivaatimuksen 15 tai 16 mukainen muottisegmentti, tunnettu siitä, että inserteissä (7) on pohjalevyt (7a), joista kukin koostuu

additiivisesti rakennetusta sisäkerroksesta (12) taikka additiivisesti rakennetusta sisäkerroksesta (12) ja osasta sitä rakennuslevyä, jolle insertit (7) on rakennettu.

5 18. Yhden tai useamman patenttivaatimuksista 15-17 mukainen muottisegmentti, tunnettu siitä, että siinä on inserttejä (7), jotka on varustettu lamelleilla ja/tai mikrolamelleilla.

10 19. Yhden tai useamman patenttivaatimuksista 15-18 mukainen muottisegmentti, tunnettu siitä, että sisäkerroksilla (12) on kaarevat ulkopinnat, jotka ovat muottipintoja profiilielementtien positiivisten pintojen muodostamiseksi.

15 20. Yhden tai useamman patenttivaatimuksista 15-19 mukainen muottisegmentti, tunnettu siitä, että siinä on inserttejä (7), joissa on osia olkakoristeesta tai olkakoristeulokkeista (2).

20 21. Patenttivaatimuksen 15 mukainen muottisegmentti, tunnettu siitä, että perusosassa (6) on jyrситtyjä olkakoristeulokkeita (2), joissa on pintatasoon jyrситtyjä koriste-elementtejä (5).

25 22. Yhden tai useamman patenttivaatimuksista 15-21 mukainen muottisegmentti, tunnettu siitä, että perusosan (6) ulokerungossa (8) on sen ulokkeiden (8') välissä sekä tarpeen mukaan sen ulokkeiden (8') ja olkakoristeulokkeiden (2) välissä syvennyksiä, joissa on tasaiset pohjapinnat (9) ja joiden suuntaus perusosassa (6) on mukautettu vulkanoitavan renkaan kulutus-

30 pinnan aiottuun ulkoiseen ääriviivaan, jolloin syvennysten syvyys on mukautettu inserttien (7) pohjalevyjen (7a) paksuuteen.

 23. Yhden tai useamman patenttivaatimuksista 15-22 mukainen muottisegmentti, tunnettu siitä, että perusosassa (6) on ilmanpoistoreikiä (11a), jotka

35 ulottuvat syvennysten pohjapintoihin (9).

 24. Yhden tai useamman patenttivaatimuksista 15-23 mukainen muottisegmentti, tunnettu siitä,

että inserttien (7) pohjalevyt (7a) on läpäisty ilmanpoistorei'illä (11b), joiden sijainnit korreloivat perusosan (6) ilmanpoistoreikien (11a) sijaintien kanssa.

25. Yhden tai useamman patenttivaatimuksista
5 15-24 mukainen muottisegmentti, tunnettu siitä, että perusosan (6) syvennyksillä on pyöristetyt kulma-alueet, jolloin inserteillä (7) on vastaavasti pyöristetyt ulkokulma-alueet ja tarpeen mukaan teräväreunaiset sisäkulmat.

10 26. Yhden tai useamman patenttivaatimuksista 15-25 mukainen muottisegmentti, tunnettu siitä, että perusosa (6) koostuu teräs- tai alumiiniseoksesta.

27. Ajoneuvon paineilmarenkaan vulkanointi-muotti, jossa on segmenttirengas, joka sisältää yhden
15 tai useamman patenttivaatimuksen 15-26 mukaisia muottisegmenttejä.

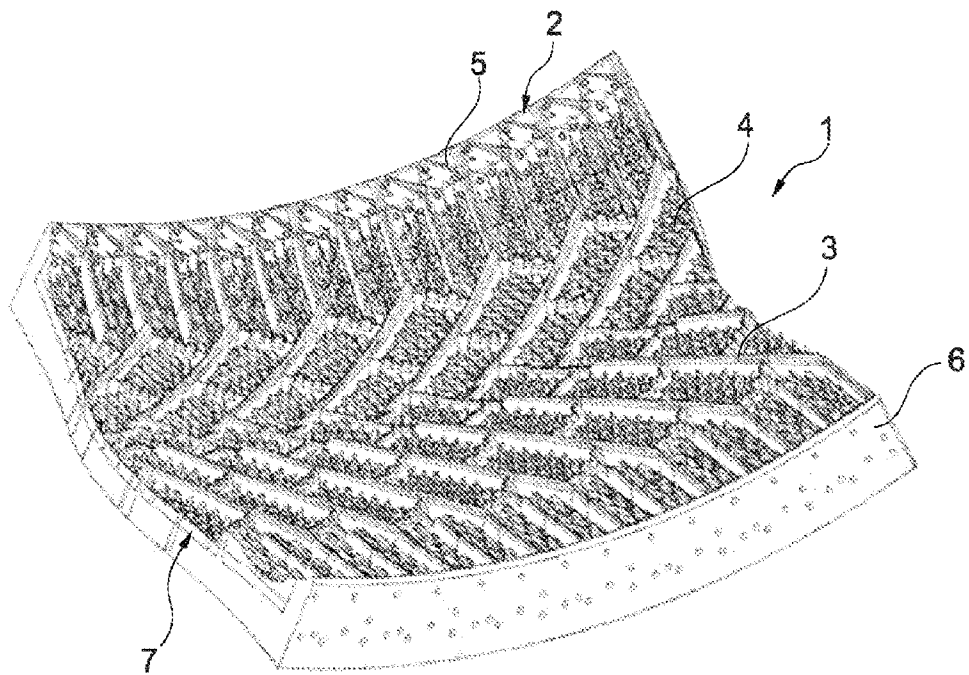


Fig. 1

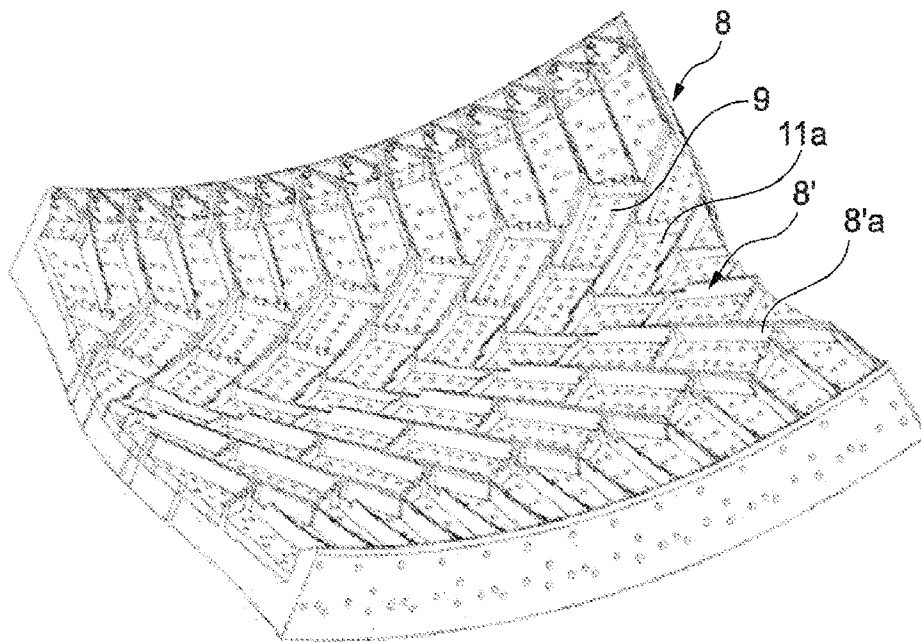


Fig. 2

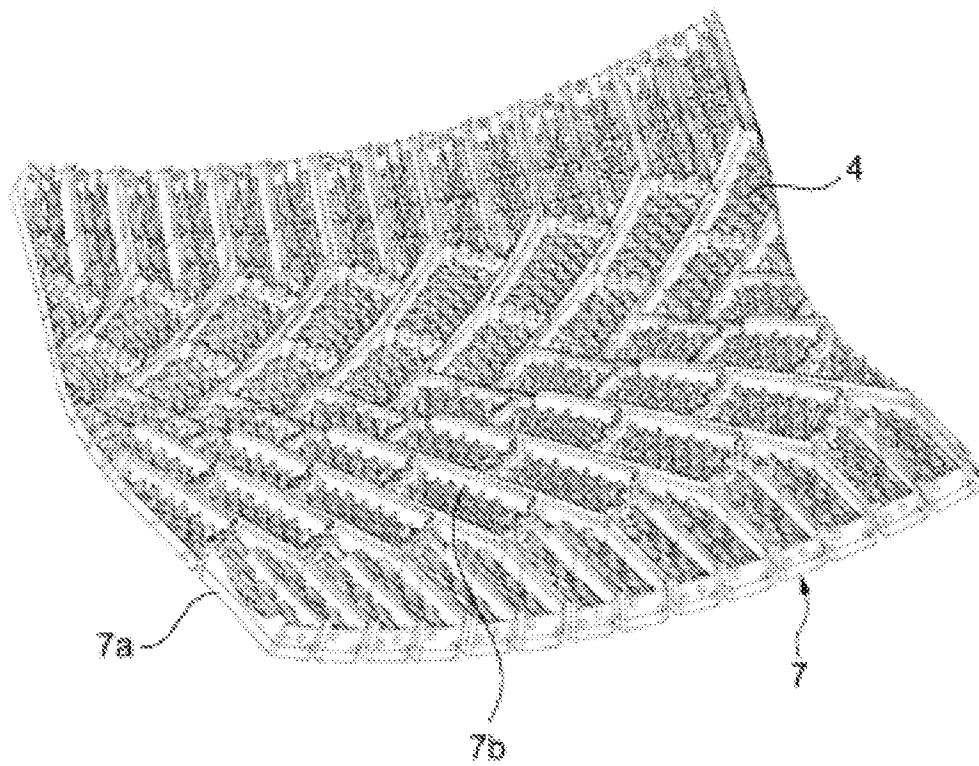


Fig. 3

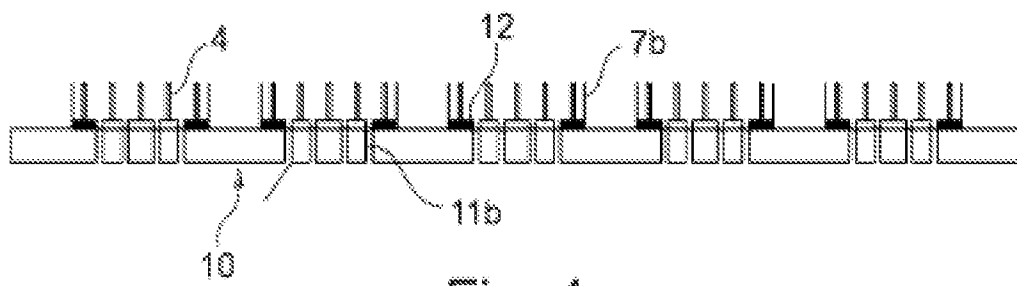


Fig. 4

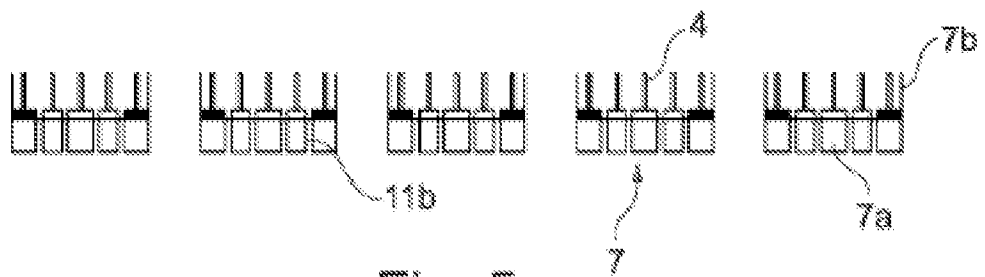


Fig. 5

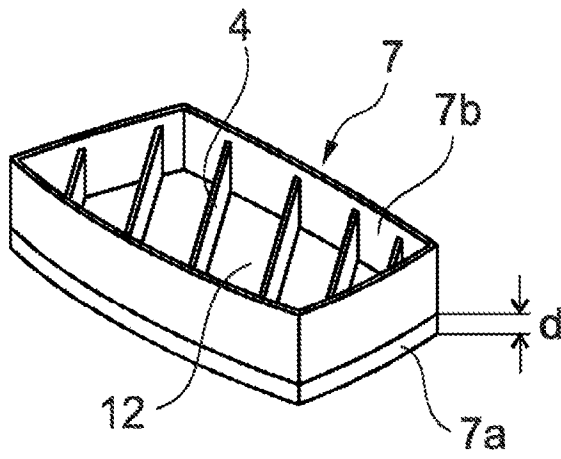


Fig. 6

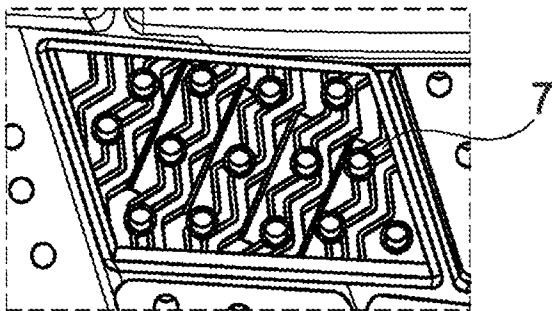


Fig. 7