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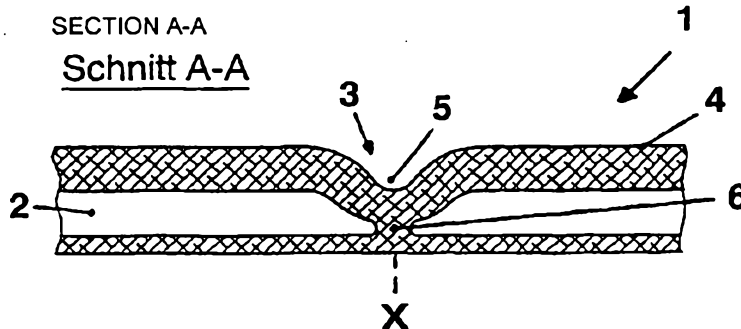
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(54) Title: MAT CONSISTING OF TUBES

(54) Bezeichnung: RÖHRENMATTE



(57) Abstract: The invention relates to a mat (1) consisting of tubes made of an elastomeric material in the form of an extrudate. The inventive mat comprises at least a first and a second front face which are arranged in a vertical or angled manner in relation to the extrusion direction and at least several tubes (2) which extend in parallel in the extrusion direction and between the two front faces. The inventive mat (1) consisting of tubes is characterised in that at least a portion of the tubes (2) is closed at adjustable distances, whereby a closed air column respectively is formed and whereby the tube seal (3), together with the mat consisting of tubes, forms a single-piece elastomer compound. Furthermore, an advantageous method for producing the inventive mat (1) consisting of tubes is provided. According to the inventive method and after the extrusion, the tubes (2) are closed at certain points by means of pressure and a pad roller, whereby beads (5) and closing webs (6) are produced. The pad roller is provided with pins that are distributed over the circumference of the roller. Vulcanisation is carried out subsequently.

(57) Zusammenfassung: Die Erfindung betrifft eine Röhrenmatte (1) aus elastomerem Werkstoff in Form eines Extrudates, umfassend wenigstens eine erste und zweite Stirnseite, die senkrecht oder gewinkelt zur Extrusionsrichtung angeordnet sind; sowie mehrere Röhren (2), die zwischen den beiden Stirnseiten parallel in Extrusionsrichtung verlaufen. Die erfindungsgemäße Röhrenmatte (1) zeichnet sich nun dadurch aus, daß wenigstens ein Teil der Röhren (2) in einstellbaren Abständen geschlossen ist, und zwar unter Ausbildung jeweils einer eingeschlossenen Luftsäule, wobei der Röhrenverschluß (3) einen einstückigen Elastomerverbund mit der Röhrenmatte bildet. Ferner wird ein vorteilhaftes Verfahren zur Herstellung der erfindungsgemäßen Röhrenmatte (1) vorgestellt. Danach werden nach der Extrusion mit Hilfe einer Andrückrolle, die über den Umfang der Rolle verteilt mit Stiften versehen ist, die Röhren (2) punktuell zugedrückt, und zwar unter Ausbildung von Sicken (5) und Verschlußstegen (6). Anschließend wird vulkanisiert.

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— *Vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen.*

Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

TUBE MAT

Description

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The invention relates generally to tube mats of an elastomeric material in the form of an extruded product.

10 Examples of types of tube mats are described in the publications DE-C-33 45 388, DE-C-34 03 234, DE-C-35 24 719 and EP-B-0 569 867.

In currently known tube mats it is possible for dirt and water to penetrate the tube mat on the face sides. This can frequently lead to the tube mat not being able adequately to fulfil its function with regard to its elasticity.

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It is an object of the present invention to provide a tube mat which alleviates the aforementioned problem.

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According to one aspect of the present invention there is provided a tube mat for vibration and sound damping in rail traffic technology, said tube mat being made of elastomer material in the form of an extrudate having a length, which comprises: (a) a first face side and a second face side arranged perpendicular to or at an angle with the length of the extrudate; and (b) a plurality of tubes extending in parallel along the length of the extrudate between the two face sides; wherein a portion of the tubes are closed at adjustable intervals to form in each case an enclosed air column, whereby the tube closure forms a one-piece elastomer composite with the tube mat; wherein said tube mat comprises a web-shaped structure extending along the length of the extrudate; and wherein the first and/or the second face sides are partially or completely open to form a correspondingly open face area and a closed tube system is formed in the center area of the tube mat.

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According to another aspect of the present invention there is provided an elastic

insert for a cross-tie shoe system comprising the tube mat as described above.

According to yet another aspect of the present invention there is provided an elastic substrate for a rail support site adapted to be arranged underneath the foot of a rail which
5 comprises the tube mat as described above.

The closure of the tube may for example extend perpendicularly or at an angle different from 90 degrees to the extrusion direction, preferably at an angle of between 45 and 80 degrees.

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Preferably, the following two variants relating to tube closure are employed.

- The first and the second face sides of the tube mat are closed, thereby forming a completely sealed tube system;
- The first and/or second face sides is/are partially or completely open, thereby forming a corresponding open face zone. However in the region of centres of the tube mat a sealed tube system is present.

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The following materials may be usefully employed for the tube mat :

- The tube mat comprises a vulcanised rubber compound based on ethylene-propylene-diene-copolymer (EPDC), where the Shore A hardness is between 30 degrees and 50 degrees.
- An alternative material is a vulcanised rubber compound based on natural rubber (NR), where the Shore hardness A is between 30 and 60 degrees.

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Additional mixing ingredients usually in the rubber compounds are for example sulphur or sulphur donors, accelerators, zinc oxide, filling agents and anti-ageing agents.

The tube mat in accordance with the invention is particularly suitable for use in railway technology, specifically within the area of vibration damping and sound insulation for
30 the following areas of application:

- It may serve as elastic matting in the track bed or ballast bed. In this aspect

the tube mat may also be used as a track bed mat or as a sub-ballast mat. If required, the mat can be covered with a protective layer of non-woven fabric or the like.

- The tube mat may function as an elastic padding in cross-tie shoe systems.
- 5 - It may further serve as an elastic padding in rail supporting points, in particular again in the form of a cross tie plate, which is arranged beneath the rail foot.

Furthermore an object of the invention according to another aspect is to provide a method for the tube mat of the type described above which substantially assures a safe tube seal and is economical.

A particularly advantageous method for production of the tube mat in accordance with the invention includes the following process steps:

- 15 - after extrusion, the tubes are closed by being compressed with the aid of a nip roller being equipped with pins distributed over its circumference, thereby forming beads or closing webs, or bridges;
- subsequently, vulcanisation is performed.

Further advantageous process parameters are presented within the description of figures of preferred embodiments.

Figure 1 shows a tube mat with the tubes being sealed or closed following a line at an angle different from 90 degrees to the extrusion direction;

Figure 2 shows details of the tube seal or closure as per cross section A-A (Figure 1);

Figure 3 shows a tube mat with seal or closure of tubes following a line perpendicularly to the extrusion direction;

Figure 4 shows a tube mat as per cross section A-A (Figure 3);

Figure 5 shows a tube mat as per cross section B-B (Figure 3);

5 Figure 6 shows a method of production of a tube mat as per Figure 1.

The following reference numbers are used in conjunction with these figures:

- | | | |
|----|----|--|
| | 1 | tube mat |
| 10 | 2 | tubes |
| | 3 | tube seal or closure |
| | 4 | upper side of the tube mat |
| | 5 | bead |
| | 6 | closing web or bridge |
| 15 | 7 | tube mat |
| | 8 | tubes |
| | 9 | tube seal |
| | 10 | tube seal |
| | 11 | first front face side of the tube mat |
| 20 | 12 | second front face side of the tube mat |
| | 13 | extruder with outlet opening |
| | 14 | carrier or support rollers |
| | 15 | nip roller or pressure applicator roller |
| | 16 | pins |
| 25 | 17 | vulcanisation channel |

Figure 1 shows a tube mat 1 of an elastomeric material, ie. of rubber or rubber-like plastic or material similar to rubber. This tube mat is an extrudate with extrusion direction Y. A length L of up to 100 m can be achieved.

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Tube mat 1 shows several tubes 2 which extend parallel to one another in extrusion

direction Y. The tubes in this arrangement are sealed at adjustable spacings a, each tube forming an enclosed air column. The tube seal 3 here extends in a line X at an angle α of about 55 degrees to extrusion direction Y. This results in several closed tube segments I, II, III and IV.

5 With regard to product cuts, the following two possibilities are available depending on the respective requirements:

- The cut is performed along the line X through the centre of tube seal 3. This results in a front face of the tube mat, which is completely closed.

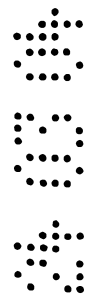
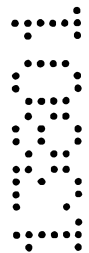
10 - The cut is performed along the line Z perpendicular to extrusion direction Y. This results in a tube segment III which is open within the front face of the tube mat. This is however acceptable if the tube mat has at least one closed tube segment, in particular several closed tube segments series-connected. This applies also if the tube mat 1 is used as a track bed mat or as a sub-ballast mat.

15 Figure 2 shows the tube seal 3, where on the upper side 4 of the tube mat 1 a bead 5 is formed within the sealing region. The tube seal itself is caused by the closing web 6.

In the event the product cut is performed along line X through the centre of closing web 6, this results in a closed front face of tube mat 1.

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Figure 3 shows a tube mat 7 with tubes 8. During the manufacture of this tube mat as an initially continuous web, several tube seals 9, 10 are formed which hereby contrast with the embodiment example as per Figure 1 extend in a line X perpendicularly to extrusion direction Y. The tubes 8 in this arrangement are sealed at an adjustable spacing 25 b, thereby forming a closed tube segment V.



In this embodiment example the product cut is performed along line X, resulting in the formation of a first front face 11 and a second front face 12, each of which is completely sealed. In this arrangement there is only one single closed tube segment V.

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Such a tube mat is for instance used as an elastic padding in cross tie show systems.

Fig. 4 shows the cross section (A-A) of the tube mat 7 as per Fig. 3, where the tubes 8 seen in cross section are substantially of a semicircular shape, that is in alternating structural arrangement. It is however also possible to use tubes with a different cross sectional shape (e.g. circular).

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Fig. 5 shows a longitudinal section (B-B) of the tube mat 7 as per Fig. 3, wherein a closed tube 8 is formed. With regard to the tube seal 9, 10 the same applies as described with regard to tube seal 3 as per Fig. 2.

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Fig. 6 describes the manufacturing process of a tube mat 1 as per Fig. 1.

The tube mat 1 in the form of a continuous web exits from the extruder 13 in extrusion direction Y. The tube mat is subsequently guided on a sliding system, in particular in the form of carrier rollers 14. A nip roller 15, which is provided with pins 16 distributed over the circumference of the roller, now closes the tubes by spot compression (i.e. exclusively within the sealing region), thereby forming beads 5 and closing webs 6 (Fig. 2). The tube seal 3 (Fig. 1, 2) extends therein in a line X at an angle different from 90 degrees.

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Subsequently, tube mat 1 enters a vulcanisation channel 17. The vulcanisation is executed in a pressureless manner within the UHF channel in a salt bath or hot air system.

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Pins 17 are advantageously exchangeable. Pins of a diameter of about 20 mm for instance have proven successful in track bed mats or sub-ballast mats.

In accordance with a further arrangement layout of nip roller 15 and pins 16,
5 alternatively a tube seal 3 can be achieved which extend along a line X perpendicularly to extrusion direction Y.

The reference to any prior art in this specification is not, and should not be taken
as, an acknowledgment or any form of suggestion that the prior art forms part of the
10 common general knowledge in Australia.

Throughout this specification and the claims which follow, unless the context
requires otherwise, the word "comprise", and variations such as "comprises" or
"comprising" , will be understood to imply the inclusion of a stated integer or step or group
15 of integers or steps but not the exclusion of any other integer or step or group of integers or steps.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS :

1. A tube mat for vibration and sound damping in rail traffic technology, said tube mat being made of elastomer material in the form of an extrudate having a length, which comprises:

(a) a first face side and a second face side arranged perpendicular to or at an angle with the length of the extrudate; and

(b) a plurality of tubes extending in parallel along the length of the extrudate between the two face sides;

wherein a portion of the tubes are closed at adjustable intervals to form in each case an enclosed air column, whereby the tube closure forms a one-piece elastomer composite with the tube mat;

wherein said tube mat comprises a web-shaped structure extending along the length of the extrudate; and

wherein the first and/or the second face sides are partially or completely open to form a correspondingly open face area and a closed tube system is formed in the center area of the tube mat.

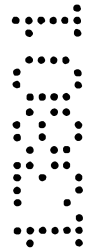
2. The tube mat according to claim 1, wherein the first and the second face sides are closed to form a completely closed tube system.

3. The tube mat according to claim 1, wherein the tube closure extends at an angle α unequal to 90° in relation to the length of the extrudate.

4. The tube mat according to claim 3, wherein the tube closure extends at an angle of from 45° to 80° in relation to the length of the extrudate.

5. The tube mat according to claim 1, wherein the mat consists of a vulcanised rubber mixture based on ethylene-propylene-diene copolymer (EPDC).

6. The tube mat according to claim 5, wherein the hardness in Shore A amounts to 30°



to 50°

7. The tube mat according to claim 1, wherein the mat consists of a vulcanised rubber mixture based on natural rubber (NR).

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8. The tube mat according to claim 7, wherein the hardness in Shore A amounts to 30° to 60°.

9. The tube mat according to claim 1, wherein the tube closure extends perpendicular
10 to the length of the extrudate.

10. The tube mat according to claim 9, wherein the mat is covered with a protective layer.

15 11. The tube mat according to claim 10 wherein the protective layer is a fleece.

12. An elastic insert for a cross-tie shoe system comprising the tube mat according to claim 1.

20 13. An elastic substrate for a rail support site adapted to be arranged underneath the foot of a rail which comprises the tube mat according to claim 1.

14. A method for production of a tube mat according to one of claims 1 to 13 characterised by the following process steps:

- 25
- after extrusion, the tubes are closed by being compressed with the aid of a nip roller being equipped with pins distributed over its circumference, thereby forming beads and closing webs;
 - subsequently, vulcanisation is performed.

30 15. A method according to claim 14, characterised in that exchangeable pins are used.

16. A method according to claims 14 o 15, characterised in that the vulcanisation is executed in a pressureless manner within the UHF channel in a salt bath or hot air system.

17. A method according to one of claims 14 to 16, characterised in that said tube mat is
5 manufactured in substantial lengths, where closed tube segments (I, II, III, IV, V) are formed in combination with a subsequent product cut depending on the purpose of application.

18. A tube mat substantially as hereinbefore described with reference to the
10 accompanying drawings.

19. A method for production of a tube mat substantially as hereinbefore described with reference to the accompanying drawings.

15 Dated this 18th day of March, 2004

PHOENIX AG

By Its Patent Attorneys

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