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- (54) Title: METHOD OF PRODUCING A LUMBAR SUPPORT AND LUMBAR SUPPORT

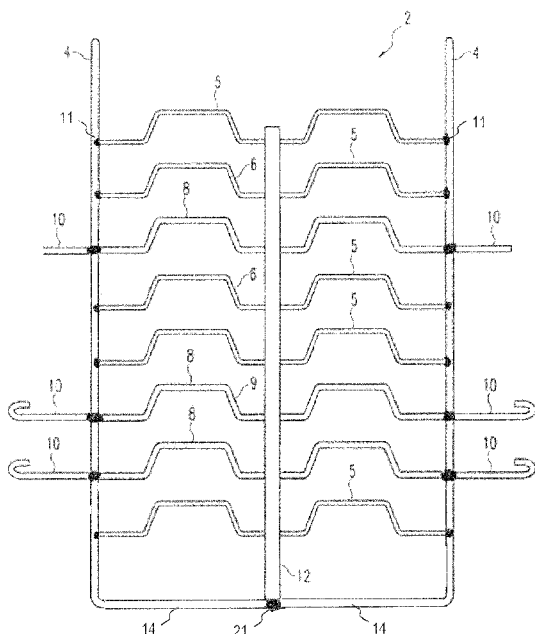


Fig. 2

- (57) Abstract: A lumbar support (2) comprises plural longitudinal mem-
bers (4) which extend along a longitudinal direction and which are offset
from each other in a transverse direction which is transverse to the lon-
gitudinal direction. At least one transverse member (5, 8) is welded to a
longitudinal member (4) at a weld connection (11). The at least one
transverse member (5, 8) is made of a high carbon grade steel.

Method of producing a lumbar support and lumbar support

FIELD OF THE INVENTION

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The invention relates to a support structure for a seat and to a method of producing the same. The invention relates in particular to a lumbar support which has a plurality of longitudinal members and at least one transverse member and to a method of producing such a lumbar support.

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BACKGROUND OF THE INVENTION

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Lumbar supports having a configuration in which one or several transverse members extend from longitudinal wires are well known in the art. For illustration, a lumbar support may comprise a pair of longitudinal wires which extend along a longitudinal direction of a backrest when installed in a seat. A plurality of transverse members may extend between and may be attached to both longitudinal wires. Alternatively or additionally, a wire frame comprising at least two longitudinal wires and a transverse wire may be used for supporting a lumbar support basket made of plastic. Such lumbar supports may provide enhanced comfort to a seat occupant when using a seat for an extended time period. Examples for such lumbar supports are disclosed in EP 1 634 517 A1 or in EP 0 702 522 A1.

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Various techniques can be used to attach transverse members to the longitudinal members of a lumbar support. These techniques include the formation of wire knots, as described in EP 1 634 517 A1, or the attachment using plastic mounts. The plastic mounts may be formed by overmolding the transverse member and longitudinal member of the lumbar support.

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The traditional approaches of producing lumbar supports may have various shortcomings. The formation of wire knots leads to an increase in the amount of wire which is required to produce the lumbar support. Forming overmolded attachments leads to an increase in manufacturing costs and weight of the lumbar support. Plastic mounts may impose limitations on how close to each other transverse wires can be arranged. Plastic mounts may be prone to tear when exposed to loads for longer time periods, which may give rise to undesired noise in continued use of the lumbar support.

BRIEF SUMMARY OF THE INVENTION

There is a continued need in the art for a lumbar support and for a method of producing the same which address the shortcomings of the conventional manufacturing techniques. In particular, there is a continued need in the art for a method of producing a lumbar support which does not require excess amounts of wire for forming wire knots or molding techniques for attaching a transverse member to a longitudinal member of the lumbar support.

A method of producing a lumbar support and a lumbar support as defined by the independent claims are provided. The dependent claims define embodiments.

According to embodiments of the invention, there is provided a method of producing a lumbar support. The lumbar support comprises plural longitudinal members which extend along a longitudinal direction and which are offset from each other in a transverse direction which is transverse to the longitudinal direction. The method comprises welding at least one transverse member to a longitudinal member to form a weld connection, with the transverse member extending from the weld connection along the transverse direction. The at least one transverse member is made of a high carbon grade steel.

By welding one or several transverse member(s) to the longitudinal member(s), the transverse member(s) may be reliably attached to the longitudinal member(s). It is not required to form wire knots, thereby reducing the amount of wire compared to techniques in which transverse wires are attached by wire knots. It is not required to use overmolding techniques, thereby reducing the amount of plastic in the lumbar support and the weight of the lumbar support. The transverse members may be attached to the longitudinal member(s) with a spacing which is smaller than when using plastic mounts. The use of welding techniques mitigates the risk that undesired noise occurs after a plastic mount tears.

By using a transverse member of high carbon grade steel, the transverse member has both the resiliency required for its use in the lumbar support and the weldability required for attachment to the longitudinal members. While welding techniques used for joining components of a seat are generally known, it represents a considerably

challenge to identify a material which combines both weldability and the resiliency required for the specific use in a lumbar support.

The steel from which the transverse member is made may have a carbon content of at least 0.5 % by weight. The steel from which the transverse member is made may have a carbon content of at least 0.6 % by weight. The steel from which the transverse member is made may have a carbon content of at least 0.5 % and at most 1.0 % by weight. A carbon content in this range provides the characteristics required for spring steel wires, for example.

The plural longitudinal members may comprise a first longitudinal wire and a second longitudinal wire. The at least one transverse member may comprises a transverse wire which is welded to the first longitudinal wire to form a first weld connection and to the second longitudinal wire to form a second weld connection.

The transverse wire may comprise an U- or V-shaped projection. The U-or V-shaped projection may be oriented such that it extends in a plane defined by the first longitudinal wire and the second longitudinal wire. Plural transverse wires may respectively be welded to the first longitudinal wire and to the second longitudinal wire. Thereby, a wire mat lumbar support may be formed.

The first longitudinal wire and the second longitudinal wire may also be formed from a steel having a carbon content of at least 0.5 % and at most 1.0 % by weight.

The at least one transverse member may comprise a bent portion of a longitudinal member. The bent portion may be welded to another longitudinal member. Each one of two longitudinal members may respectively have a bent portion, with the bent portions being welded together. Thereby, a U-shaped wire frame may be formed.

The at least one transverse member which is welded to a longitudinal member may comprises a guide member. The guide member may be used for attaching an actuation element to the lumbar support and for routing it as desired. The guide member may have a guide recess in which a Bowden wire cable or another actuation element may be arranged.

The method may also be used for producing a lumbar support which has a lumbar support basket attached to a wire frame. The wire frame may have at least one

transverse member made of high carbon grade steel, which is attached to a longitudinal member by welding. A lumbar support basket may be attached to the plural longitudinal members of the wire frame.

- 5 The welding may be performed by capacitor discharge welding. Other welding techniques may be used.

According to another embodiment, a lumbar support is provided which comprises plural longitudinal members which extend along a longitudinal direction and which
10 are offset from each other in a transverse direction which is transverse to the longitudinal direction. The lumbar support comprises at least one transverse member welded to a longitudinal member at a weld connection, with the transverse member extending from the weld connection along the transverse direction. The at least one transverse member is made of a high carbon grade steel.

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Additional features of the lumbar support and the effects attained thereby correspond to the features and effects described in the context of the method of producing a lumbar support.

- 20 The method of embodiments may be used for producing a lumbar support for a vehicle seat.

BRIEF DESCRIPTION OF DRAWINGS

- 25 Embodiments of the invention will be described with reference to the accompanying drawings in which like reference numerals refer to like elements.

Fig. 1 shows a lumbar support according to an embodiment.

- 30 Fig. 2 shows a lumbar support according to another embodiment.

Fig. 3 is a partial detail view of a lumbar support according to an embodiment.

Fig. 4 shows a lumbar support according to another embodiment.

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DETAILED DESCRIPTION OF EMBODIMENTS

Exemplary embodiments of the invention will be described with reference to the drawings.

Fig. 1 shows a lumbar support for incorporation into a seat frame, which may also be designated as a wire mat or a wire pad. The lumbar support is in particular adapted to provide support for upholstery of a respective seat, e.g. an automotive seat.

The lumbar support 2 comprises a pair of longitudinal members which are interconnected by a plurality of transverse wires 5, 8. The longitudinal members are configured as longitudinal wires 4 extending at the lateral sides of the lumbar support 2. The transverse wires 5, 8 extend between the longitudinal wires 4. The plurality of transverse wires 5, 8 is connected to both longitudinal wires 4. The transverse wires 5, 8 may extend through a center cord 12 or tube of paper or synthetic plastic material which serves to maintain a pre-defined vertical spacing between the transverse wires 5, 8.

In the process of producing the lumbar support 2, at least some of the transverse wires 5, 8 are attached to the longitudinal wires 4 by welding. The respective transverse wire is formed from a high carbon grade steel. The respective transverse wire may be formed from a steel which has a carbon content of at least 0.5 % and at most 1.0 % by weight. The high carbon grade steel may be spring steel to provide both resilient characteristics for the support function of the lumbar support 2 and weldability for connecting the transverse wire to the longitudinal wires 4. The longitudinal wires 4 may be made of a steel which has a carbon content of at least 0.5 % and at most 1.0 % by weight. In other embodiments, the longitudinal wires 4 are made of a material which is different from the material of the transverse wires 5, 8, in particular from a material other than high carbon grade steel. The longitudinal wires 4 may be made of a low carbon grade steel.

A weld connection 11 may be formed in the welding process to attach a transverse wire 5, 8 to the longitudinal wires 4. The weld connection 11 may be formed by capacitive discharge welding. Other welding techniques may be used.

As illustrated in Fig. 1, each one of a plurality of transverse wires 5, 8 may respectively be welded to the longitudinal wires 4. In this case, each one of the transverse wires 5, 8 which are welded to the longitudinal wires 4 may consist of a steel which has a carbon content of at least 0.5 % and at most 1.0 % by weight. The transverse

wires 5, 8 respectively extend in a transverse direction from the respective weld connection 11. The transverse direction is transverse and may in particular be perpendicular to a longitudinal direction defined by the longitudinal wires 4.

- 5 The transverse wires 5, 8 may have U- or V-shaped protrusions 6, 9 which are arranged in the plane of the lumbar support 2, so that the lumbar support 2 itself deflects under a load placed upon the seat. The transverse wires 8 may be provided with elongated end portions 10. The transverse wires 5 may terminate at the longitudinal wires 4. A diameter of the transverse wires 8 may be different from a diameter of the transverse wires 5. In particular, the transverse wires 8 may have a greater diameter than the transverse wires 5 in order to provide a greater degree of stiffness. The transverse wires 8 having the greater diameter may be positioned in a lower lumbar region to provide a more stable and rigid support for the seat occupant in the lumbar region. However, the support structure 2 may also use only transverse wires 15 5, 8 of identical diameters or transverse wires of more than two different diameters.

The elongated end portions 10 of at least some of the transverse wires 8 may serve to attach the support structure 2 to a seat frame. These elongated end portions 10 may be formed into hook-like fingers which can be used to easily attach the support structure 2 to a seat frame. The elongated end portions 10 extending beyond the longitudinal wires 4 may also form free ends that can flex independently of one another relatively to a portion of the wire framework. These free end portions can provide laterally contoured support in the lumbar region without interfering with an arching of the two longitudinal wires 4 which may be brought about by an actuator.

- 25 The lumbar support shown in Fig. 1 may be used to provide non-adjustable support in the lumbar region. In other embodiments, an adjustment mechanism is provided for arching the longitudinal wires 4 to enable adjustment of the lumbar support in a forward and rearward direction. Such an arching mechanism may comprise a Bowden cable arrangement, a spindle drive or other power actuation mechanisms.

35 Alternatively or additionally to welding high carbon-grade transverse wires to the longitudinal wires 4, welding connections may also be used for attaching other transverse components to the longitudinal members, as will be illustrated with reference to Fig. 2 to Fig. 4.

Fig. 2 shows a lumbar support 2 of another embodiment. The longitudinal wires 4 are made of a steel which has a carbon content of at least 0.5 % and at most 1.0 % by weight. At least one of the longitudinal wires 4 has a bent portion which extends in the transverse direction. In the implementation shown in Fig. 2, each one of the longitudinal wires 4 has a transverse portion 14. The transverse portions 14 of the longitudinal wires are welded to each other at a weld connection 21.

The lumbar support 2 may further comprises a plurality of transverse wires 5, 8 welded to the longitudinal wires 4, as explained with reference to Fig. 1.

Another example of a transverse member which may be welded to the longitudinal wires 4 is a guide member for an actuation element. Actuation elements are used in adjustable lumbar supports to couple the lumbar support to a power drive or manual actuator. Examples for actuation elements include Bowden cables, Bowden cable wires, Bowden cable outer sheaths, a spindle of a spindle drive, toothed racks, or other components.

Fig. 3 shows a detail view of a lumbar support according to an embodiment. A guide member 32 extends transversely from the longitudinal wire 4. The guide member 32 is made of a high carbon grade steel having a carbon grade of, for example, between 0.5 % and 1.0 % by weight. The guide member 32 is attached to the longitudinal wire 4 by welding such that a weld connection 31 is formed.

The guide member 32 may have a configuration which depends on the actuation element that is to be guided by the guide member 32. For illustration, the guide member 32 may have a recess 33. The actuation element 34 may be received in and protrude through the recess 33.

Several guide members 32 may be welded to one longitudinal wire 4 or to the two longitudinal wires 4 formed at the opposite lateral sides of the lumbar support, to define a routing path for one or several actuation elements.

The configuration of a lumbar support which has a transverse member of high carbon grade steel welded to a longitudinal member may be used both in lumbar supports which have a wire mat configuration, as illustrated in Fig. 1 and Fig. 2, and in lumbar supports which comprise a support basket formed of a material other than metal.

Fig. 4 illustrates a lumbar support according to another embodiment. The lumbar support comprises a support basket 42 attached to longitudinal wires 4 of the lumbar support. A transverse wire 44 is attached to the longitudinal wires 4. The transverse wire 44 is made of a high carbon grade steel. The transverse wire 44 may consist of steel having a carbon content of 0.5 % and 1.0 % by weight. The transverse wire 44 is welded to the longitudinal wires 4 at a weld connection 41. The transverse wire 44 in combination with the longitudinal wires 4 defines a wire frame on which the support basket 42 is supported. The wire frame is attached to a seat frame of a seat.

As illustrated in Fig. 4, the lumbar support may be adjustable. Adjustment mechanisms may be provided to adjust a curvature and/or apex position of the support basket 42. One adjustment mechanism may be provided to adjust a curvature of the support basket 42. Another adjustment mechanism may optionally be provided to adjust a height at which the apex of the support basket 42 is positioned. The adjustment mechanisms may comprise power actuators which adjust the curvature and/or apex position of the support basket 42 in response to a control signal. The adjustment mechanism may respectively comprise a motor 45, a gear box 46, and a Bowden cable 47. A bias mechanism 48 may be attached to the support basket 42 to bias the support basket 42 into a rest position.

While lumbar supports and methods of producing the same according to embodiments have been described in detail with reference to the drawings, modifications thereof may be implemented in further embodiments. For illustration, additional mechanisms may be integrated into or coupled to the lumbar support to implement additional functionalities.

For further illustration, while lumbar supports have been described which have two longitudinal wires at the lateral sides thereof, other longitudinal members may be used to define the lateral sides of the lumbar support. The lumbar support may comprise more than two longitudinal members.

Lumbar supports according to embodiments may be used in an automotive seat, in particular in a vehicle seat, without being limited thereto.

CLAIMS

1. A method of producing a lumbar support, wherein the lumbar support comprises plural longitudinal members (4) which extend along a longitudinal direction and which are offset from each other in a transverse direction which is transverse to the longitudinal direction, the method comprising:
- 5 welding at least one transverse member (5, 8; 32; 44) to a longitudinal member (4) to form a weld connection (11; 21; 31; 41), with the at least one transverse member (5, 8; 32; 44) extending from the weld connection (11; 21; 31; 41) along the transverse direction,
- 10 wherein the at least one transverse member (5, 8; 32; 44) is made of a high carbon grade steel.
- 15 2. The method of claim 1, wherein the at least one transverse member (5, 8; 32; 44) is made of a steel which has a carbon content of at least 0.5 % and at most 1.0 % by weight.
3. The method of claim 2,
- 20 wherein the plural longitudinal members (4) comprise a first longitudinal member (4) and a second longitudinal member (4), and wherein the at least one transverse member comprises a transverse wire (5, 8; 44) which is welded to the first longitudinal member (4) to form a first weld connection (11; 41) and to the second longitudinal member (4) to form a second weld connection
- 25 (11; 41).
4. The method of claim 3, wherein the transverse wire (5, 8) comprises an U- or V-shaped projection (6, 9).
- 30 5. The method of claim 3 or claim 4, wherein plural transverse wires (5, 8) are respectively welded to the first longitudinal member (4) and to the second longitudinal member (4).
6. The method of any one of the preceding claims,
- 35 wherein the at least one transverse member comprises a bent portion (14) of a longitudinal member (4), wherein the bent portion (14) is welded to another longitudinal member (4).

7. The method of any one of the preceding claims,
wherein the at least one transverse member comprises a guide member (32) having
a guide recess (33).

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8. The method of claim 7, further comprising
mounting a flexible actuation element (34) to the guide member (32).

9. The method of any one of the preceding claims, further comprising:
10 attaching a lumbar support basket (42) to the plural longitudinal members (4).

10. The method of any one of the preceding claims,
wherein the welding is performed by capacitor discharge welding.

15 11. A lumbar support, comprising:
plural longitudinal members (4) which extend along a longitudinal direction and
which are offset from each other in a transverse direction which is transverse to the
longitudinal direction, and
at least one transverse member (5, 8; 32; 44) welded to a longitudinal member
20 (4) at a weld connection (11; 21; 31; 41), with the at least one transverse member (5,
8; 32; 44) extending from the weld connection (11; 21; 31; 41) along the transverse
direction, wherein the at least one transverse member (5, 8; 32; 44) is made of a high
carbon grade steel.

25 12. The lumbar support of claim 11,
wherein the at least one transverse member (5, 8; 32; 44) is made of a steel which
has a carbon content of at least 0.5 % and at most 1.0 % by weight.

13. The lumbar support of claim 11 or claim 12,
30 wherein the plural longitudinal members (4) comprise a first longitudinal member (4)
and a second longitudinal member (4), and
wherein the at least one transverse member comprises a transverse wire (5, 8; 44)
which is welded to the first longitudinal wire (4) to form a first weld connection (11)
and to the second longitudinal wire (4) to form a second weld connection (11).

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14. The lumbar support of any one of claims 11 to 13,

wherein the at least one transverse member comprises a bent portion (14) of one of the longitudinal members (4).

15. The lumbar support of any one of claims 11 to 13,

5 wherein the at least one transverse member comprises a guide member (32) having a guide recess (33).

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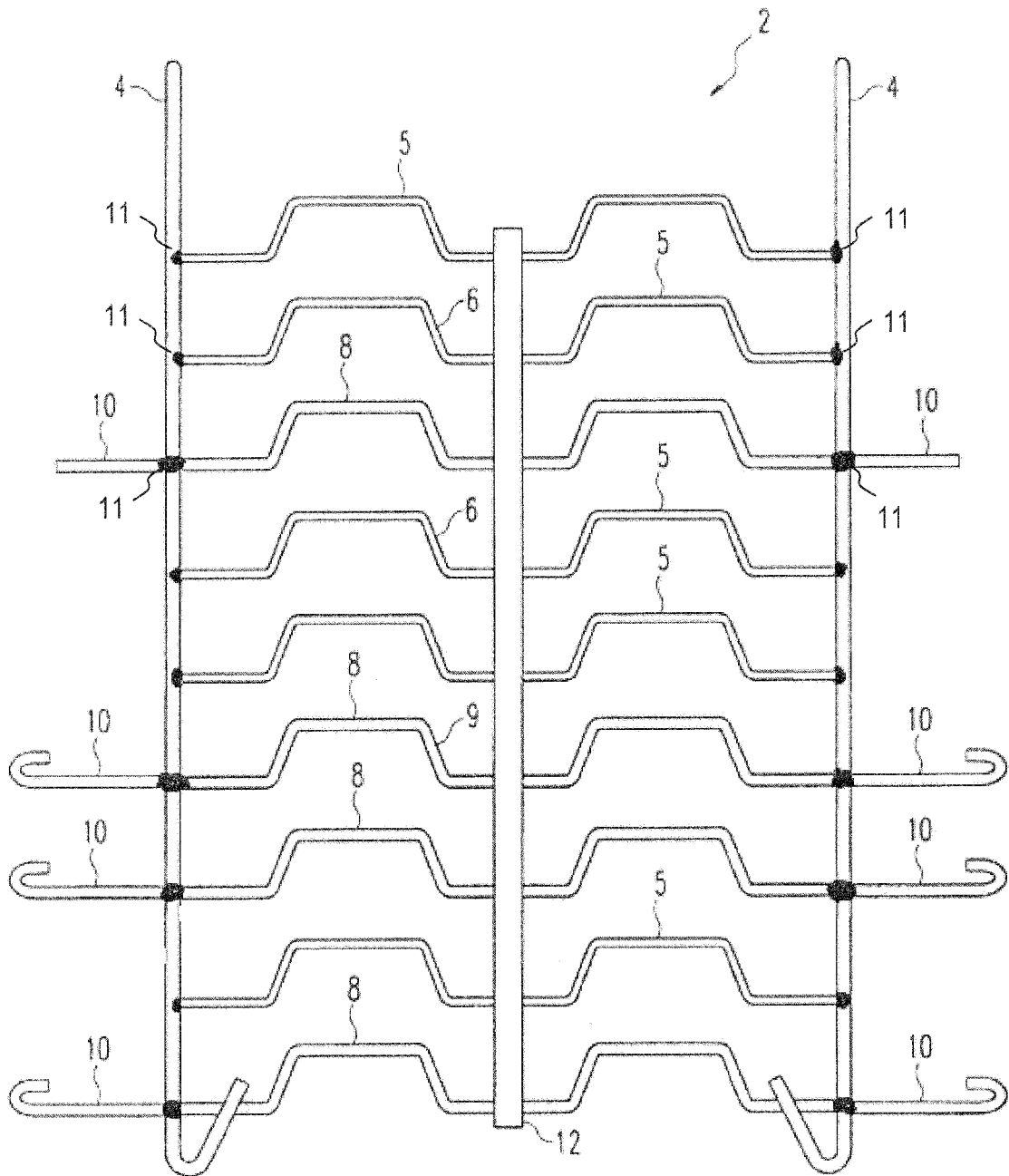


Fig. 1

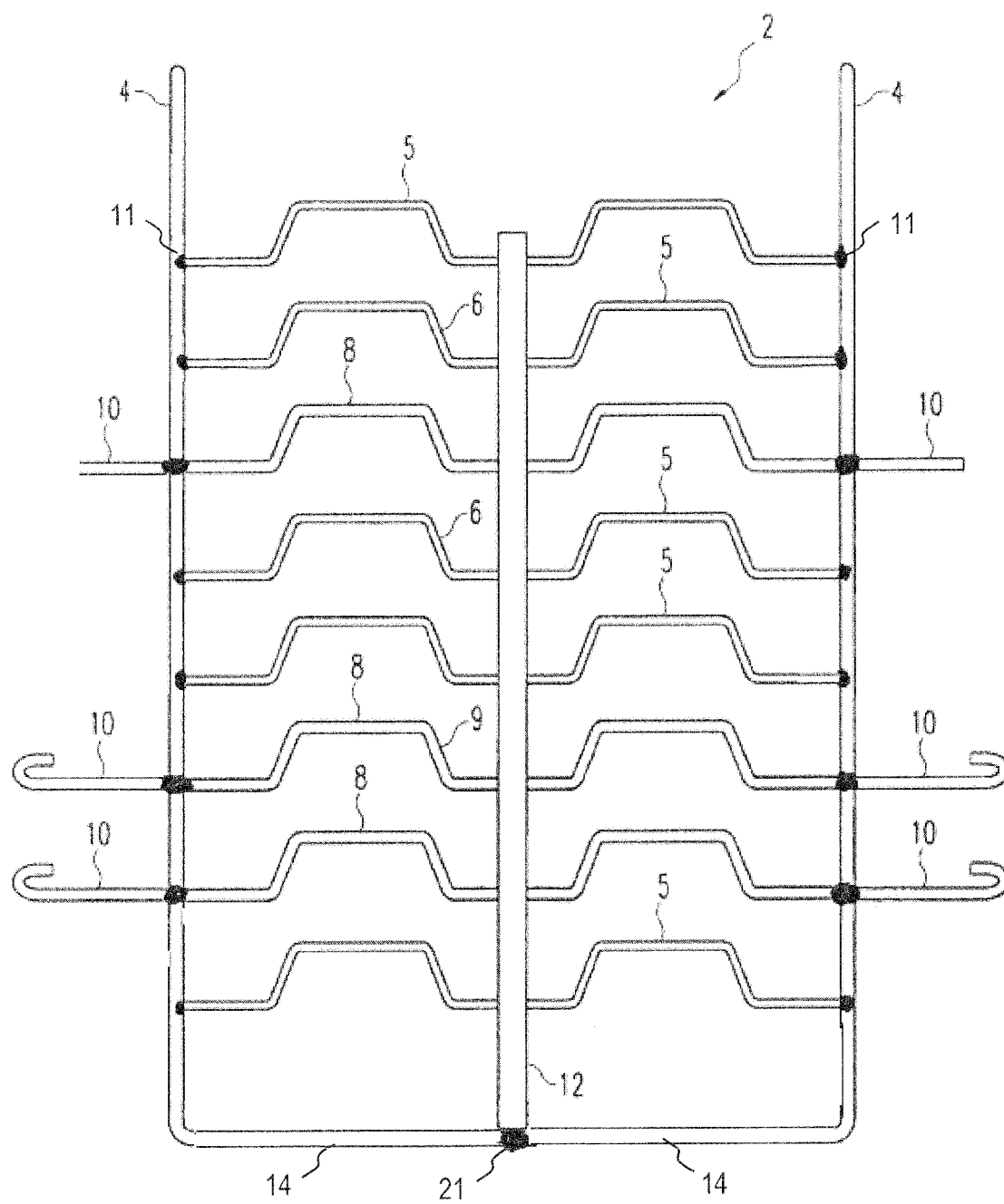


Fig. 2

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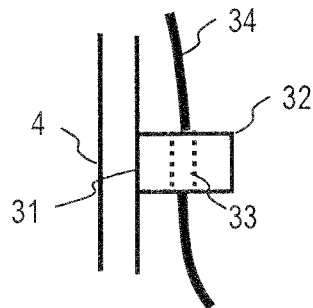


Fig. 3

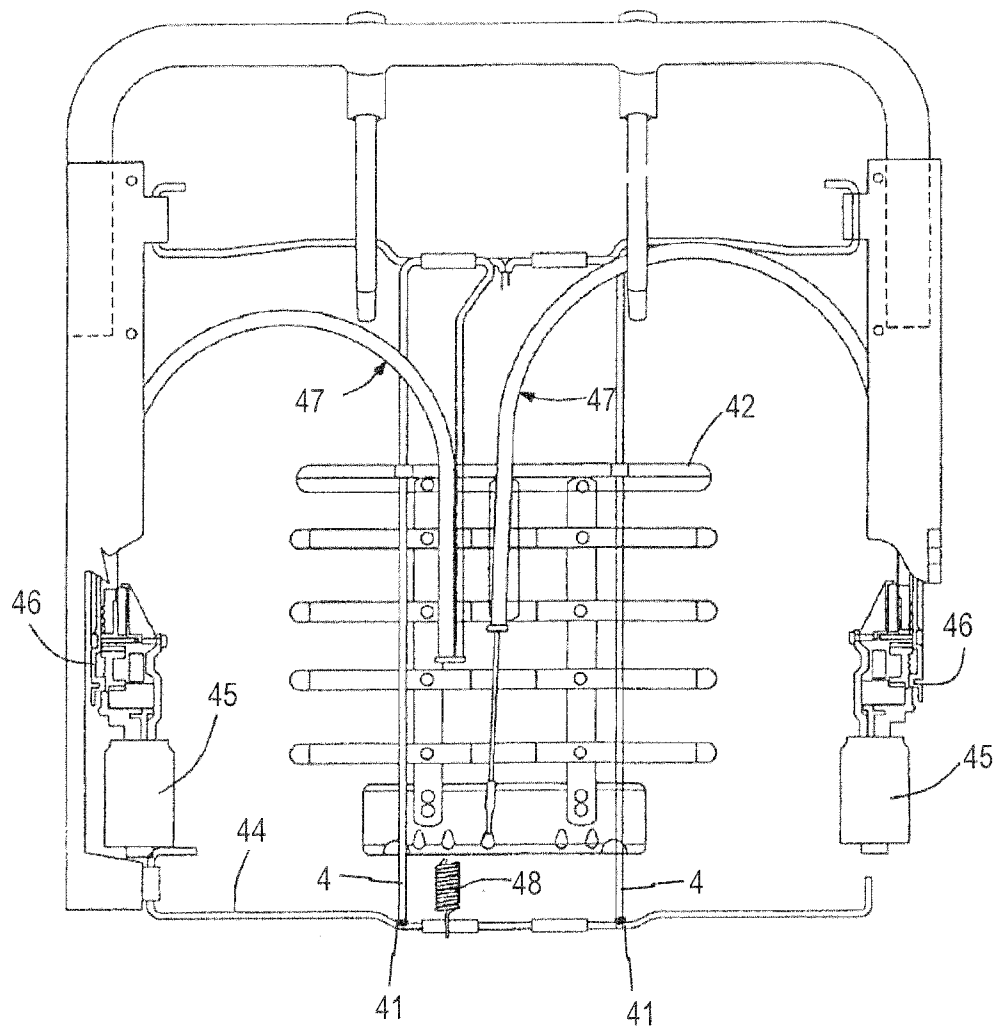


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER INV. B60N2/66 B60N2/70 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) B60N A47C		
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.
X	DE 10 2009 016714 A1 (ATINHA GMBH [DE]) 18 November 2010 (2010-11-18)	1-3,5,6, 11-14
Y	abstract; figures 1-2 paragraphs [0002], [0005], [0008], [0009], [0012], [0018], [0019] -----	4,7-10, 15
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 24 February 2014		Date of mailing of the international search report 03/03/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Chevallier, Frédéric

INTERNATIONAL SEARCH REPORT

International application No

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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