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(54) **Boom for the distribution of concrete for work vehicles and relative production method**

(57) Extendable boom (10) for the distribution of concrete, installed on a heavy work vehicle (11), and comprising a plurality of articulated segments (12-16), pivoted with respect to each other at respective ends. At least one of the segments (12-16), or at least part of it, that form the extendable boom (10) is made of composite material throughout its section.

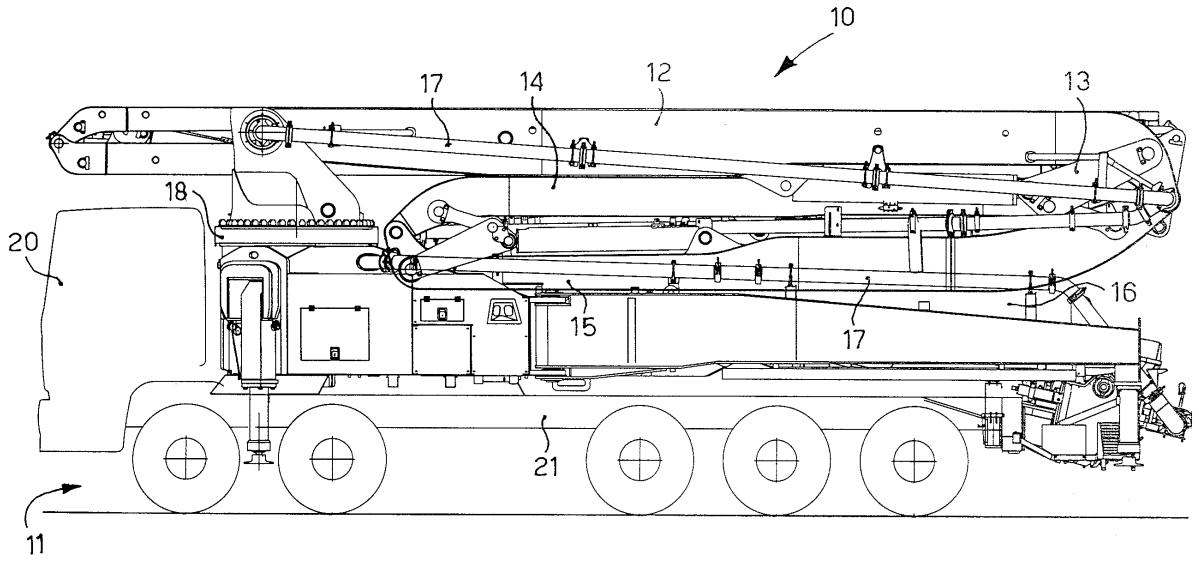

fig. 1

EP 1 970 344 A1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a boom for the distribution of concrete, or other building material similar to concrete, used on heavy work vehicles, such as for example a truck or a concrete mixer.

[0002] The distribution boom according to the invention comprises a plurality of articulated segments, pivoted to each other at the ends, which can be disposed either in a folded back configuration for transport, in which they define a minimum overall bulk, or in a working configuration in which they are progressively extended according to the overall length/height to be reached.

[0003] The boom for the distribution of concrete according to the invention comprises at least a length of at least an articulated segment made of composite material.

BACKGROUND OF THE INVENTION

[0004] Heavy work vehicles used in the building sector are known, normally consisting of a truck on which an extendable and/or telescopically removable boom is mounted, articulated for the distribution and casting of concrete. The trucks may or may not be equipped with a concrete mixer.

[0005] Extendable booms of the known type consist of a plurality of metal segments pivoted to each other and able to be folded back one over the other, so as to be able to assume a folded configuration in proximity with the truck, and a working configuration in which they are extended one with respect to the other and allow to reach areas even very distant from the truck.

[0006] One of the most important characteristics of these extendable booms, obviously, is the ability to reach the greatest heights and/or lengths possible, in order to be able to guarantee maximum flexibility and versatility of use with the same truck.

[0007] However, in order to respect current norms, both in terms of bulk and in terms of overall weight, there is a limit to the maximum length of every segment, with a consequent reduction in the maximum height reachable by the device, thus limiting possible applications.

[0008] Any increase in the number of articulated segments, or extension of the measurement of each of them, if on the one hand it gives the possibility to obtain greater overall lengths at maximum extension, on the other hand it entails an increase in weight and bulk which are not compatible either with the current norms or with the operativeness and functionality of the vehicle.

[0009] Documents EP-A2-968.955 and US-A-3,947,191 disclose articulated booms for crane, trucks, or the like, in which an inner core section of metal, particularly steel, is covered by one or more layers of composite fibers, in order to increase the strength in specific zones of the boom.

[0010] This solution, however, does not overcome the above problems particularly those related to the overall weight of the boom, especially when booms having high lengths and a great number of segments are used.

[0011] One purpose of the present invention is therefore to achieve an extendable boom for the distribution of concrete which can reach very great heights and/or lengths in its condition of maximum extension and which, in order to do this, does not entail unsustainable increases in weight and bulk.

[0012] Another purpose is to obtain said boom at limited cost compared with current costs. Another purpose is to obtain advantages in the step of constructing and assembling the articulated extendable boom.

[0013] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0014] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0015] In accordance with the above purposes, an extendable boom for the distribution of concrete according to the present invention is able to be installed on a heavy work vehicle, and comprises a plurality of articulated segments, pivoted to each other at respective ends.

[0016] According to a characteristic feature of the present invention, at least one of the segments, or at least part of it along its length, that form the extendable boom is completely made, throughout its section, of composite material.

[0017] In a preferential embodiment, the composite material used is carbon fiber.

[0018] According to a first variant, the composite material used consists of aramid fibers (Kevlar®), or other similar or comparable fibers, having characteristics substantially analogous to carbon in terms of resistance and rigidity.

[0019] According to the invention, the composite material is made with uni-directional fibers or, according to a variant, with intertwined and/or interwoven fibers.

[0020] The use of composite material, and in particular carbon fiber or aramid fiber for making at least part of the distribution boom allows to increase the length and/or number of segments used, with the same overall weight; alternatively, the invention allows to reduce the overall weight while retaining the same length and/or number of segments.

[0021] According to a variant of the invention, the composite material used is of the multi-layer type.

[0022] In a preferred solution, the boom has a rectangular box-like section with rounded edges or oval.

[0023] According to an evolved variant, the boom according to the invention has longitudinal and/or transverse metal inserts for stiffening and/or connecting to

specific equipment, for example the relative movement jack.

[0024] The metal inserts may consist, according to specific applications and/or assembly positions along the boom, of thin sheets, bushings, plates, bars or lattices.

[0025] In another formulation of the invention, the attachment for the jack, which allows the relative segment of the boom to be extended/folded, is also made of composite material.

[0026] In a first embodiment, the metal attachment for the movement jack is directly drowned in the boom of composite material.

[0027] According to a variant, the metal attachment is made in a metal plate drowned in the boom of composite material.

[0028] According to another variant, the metal attachment is fixed by means of pins inserted through bushings, rings, washers or suchlike, drowned in the composite material.

[0029] According to another variant, the attachment for the jack is glued externally or internally to the structure of composite material.

[0030] In another solution of the invention, at least one of the two terminals that allow to actuate the articulated movement of two adjacent segments is made of composite material.

[0031] In a variant, at least one of the two movement terminals is made of metal.

[0032] According to another constructional embodiment, the metal movement terminal has anchoring fins drowned in the composite material. In yet another solution, the metal movement terminal has anchoring fins connected to a plate, or to bushings or rings, drowned in the composite material.

[0033] In yet another variant, the terminal, whether it is made of metal or composite material, is glued externally or internally to the structure of composite material.

[0034] According to another variant, the articulated extendable boom has two or more longitudinal lengths of composite material alternating with intermediate lengths made of metal.

[0035] The method to produce said composite boom, although not restrictive, is preferably selected from among the techniques of filament winding, pre-preg manual deposition with autoclave polymerization, pultrusion, hot vacuum, or other method analogous or comparable to one or the other of the methods indicated above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a lateral view of a heavy work vehicle on which an extendable boom according to the present invention is installed, in a folded back condition for transport;
- figs. 2 and 3 are views of segments of composite material which form the extendable boom according to the invention;
- figs. 4 and 5 show, in two constructional variants, a cross section of the articulated segment in figs. 2 and 3;
- fig. 6 shows a longitudinal section of another variant of the present invention;
- fig. 7 shows a variant of the segment of composite material in fig. 2;
- figs. 8 to 10 show a section view of other embodiments of the invention.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0037] With reference to fig. 1, an extendable boom 10 according to the present invention, able to distribute concrete or analogous material for the building trade, is shown in an assembled position on a heavy work vehicle 11, folded back for transport.

[0038] The heavy vehicle 11 comprises a driver's cab 20 and a supporting platform 21 on which the boom is mounted.

[0039] The extendable boom 10 according to the present invention comprises a plurality of articulated segments, in this case five, respectively a first 12, a second 13, a third 14, a fourth 15 and a fifth 16, pivoted to each other at the respective ends. A tube 17 is also present, for feeding and discharging the concrete. In known manner, and with systems not shown here, the whole of the articulated segments 12-16 can be rotated, even up to 360°, with respect to the axis of the vehicle 11.

[0040] With reference to fig. 1, the first segment 12, in known manner, is pivoted to a turret 18, and is rotatable with respect thereto. The other segments 1-16 are sequentially pivoted to each other at respective ends and can be driven individually, by means of their own actuators, according to specific requirements.

[0041] Each segment 12-16 serves to bear a tube inside which the concrete is made to flow, sent from a feed pump (not shown). A length of flexible tube (not shown), from which the concrete is delivered to the place of application, is normally connected to the last segment.

[0042] It must be understood that the representation of fig. 1 is only an example, and must not be considered in any way restrictive of the field of protection to which the present invention refers.

[0043] According to the invention, one or the other of the articulated segments 12-16 is made, at least partly in its length but throughout its section, of composite material, preferably reinforced, for example carbon fiber, single- or multi-layer. The possible number of layers is a function of the mechanical characteristics that the boom 10 has to have.

[0044] Instead of or together with the carbon fibers, other types of fiber may be used, for example aramid fibers, or others analogous or comparable, in uni-directional or intertwined/interwoven form.

[0045] With reference to figs. 2 and 3, which show a possible example of embodiment, the articulated segment 12-16 comprises a box-like structure 22 made of composite material, to at least one end of which terminals or front pieces are applied, made of steel 23, and intermediate attachment elements 26 for the movement jack, or other accessory or auxiliary equipment in the functioning of the segment 12-16.

[0046] Both the terminal elements 23 and the intermediate elements 26 can be made of metal or they too can be made of molded composite material.

[0047] In the solution shown, the box-like structure 22 has a substantially rectangular section, reducing over its length, but it comes within the field of the invention that the section may be square or polygonal with more or less rounded angles, oval, or with other section suitable for the purpose.

[0048] In correspondence with or proximity with the terminal zones the box-like structure 22 advantageously has a metal insert 25, for example drowned and/or partly protruding from the box-like structure, or even glued externally or internally thereto.

[0049] The metal insert 25 can also be associated with a reinforcement structure made of fiber, as described in greater detail hereafter, in order to further stiffen the structure of the articulated segment in the terminal zone most subject to stress and wear during use.

[0050] As shown in detail in fig. 6, an insert 25 in the form of a metal plate can be drowned in the material of the box-like structure 22 of composite material and attached to it by means of binding fibers 32 made to pass through appropriate holes 29 made in the metal plate itself.

[0051] In the solutions shown in figs. 4 and 5, longitudinal reinforcement elements or inserts 25 are shown, made of metal and drowned in the composite material of the box-like structure 22. The longitudinal reinforcement elements 25 can be disposed in any intermediate position whatsoever along the box-like structure 22 and can assume the form of plates 30 (fig. 4), lattices 31 (fig. 5), bars, sheets or combinations of these.

[0052] In the variant shown in fig. 7, at least one terminal 23 and the intermediate element 26 are fixed to the box-like structure 22 of composite material by means of pins 33 which are inserted through bushings or rings 34 drowned in the composite material of the structure 22.

[0053] In the solution shown in fig. 3, the segment 12-16 is made to a large extent with a box-like structure 22 of composite material, at an intermediate position of which a metal insert or attachment 25 is drowned, with at least its base, with fins 26 for assembling the movement jack.

[0054] At the ends of the box-like structure 22 the steel terminals 23 are provided, suitable for connection to the segments immediately adjacent, which are connected to the structure of composite material 22 by means of suitable joining lengths made of steel-carbon fiber 28.

[0055] Other constructional solutions are shown in figs. 8, 9 and 10.

[0056] In fig. 8 the metal terminal 23 is glued, by means of its two sides cooperating with respective angled sides of the box-like structure 22, on the outside of the end of the box-like structure 22, and is anchored thereto by means of layers of fibers 32 which, during polymerization, accentuate the anchoring action.

[0057] The terminal 23 may include holes 29 both to lighten it and also for the possible passage of the anchoring fibers 32.

[0058] Fig. 9 shows a linear terminal 23 which is glued on the outside of the box-like structure 22 and attached thereto, on two sides, by means of layers of fibers 32.

[0059] Fig. 10, instead, shows an intermediate element 26, with holed fins 126 for connection to the movement jack, disposed astride on the outside of the box-like structure 22, for example glued to it, in which layers of fiber 32 accentuate the anchoring and render it definitive.

[0060] In correspondence with the join zones between steel and composite material holes may be made, and through said holes bundles of fibers may be made to pass in order to bind everything together.

[0061] It is clear, however, that modifications and/or additions of parts may be made to the extendable device 10 as described heretofore, without departing from the field and scope of the present invention.

[0062] It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of extendable device for the distribution of concrete, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Extendable boom (10) for the distribution of concrete, able to be installed on a heavy work vehicle (11), and comprising a plurality of articulated segments (12-16), pivoted with respect to each other at respective ends, **characterized in that** at least one of the segments (12-16), or at least part of it along its length, that form the extendable boom (10) is completely made, throughout its section, of composite material.

2. Extendable boom (10) as in claim 1, **characterized in that** the composite material used is chosen from carbon fiber, aramid fiber, or other analogous or comparable fiber.

3. Extendable boom (10) as in claim 1, **characterized in that** the composite material used includes uni-

directional or interwoven/intertwined fibers.

4. Extendable boom (10) as in claim 1, **characterized in that** the composite material used is of the multilayer type.

5. Extendable boom (10) as in claim 1, **characterized in that** said segment of composite material (12-16) consists of a box-like structure (22) with oval section, or rectangular with rounded edges.

6. Extendable boom (10) as in claim 1, **characterized in that** said segment of composite material (12-16) includes longitudinal and/or transverse metal inserts (25) for stiffening and/or connection to auxiliary equipment.

7. Extendable boom (10) as in claim 6, **characterized in that** said metal inserts (25) consist of thin sheets, plates (30), bars or lattices (31), bushings or rings (34).

8. Extendable boom (10) as in claim 6, **characterized in that** said metal inserts (25) include holes (29) for inserting fiber elements (32) to accentuate anchoring.

9. Extendable boom (10) as in claim 6, **characterized in that** said metal inserts (25) are glued externally or internally to said box-like structure (22).

10. Extendable boom (10) as in claim 1, **characterized in that** the metal attachment (26) for a movement jack includes at least a base drowned in the structure (22) of composite material.

11. Extendable boom (10) as in claim 1, **characterized in that** the attachment (26) for a movement jack is made of composite material.

12. Extendable boom (10) as in claim 1, **characterized in that** the metal attachment (26) for a movement jack is glued internally or externally to the structure of composite material (22).

13. Extendable boom (10) as in claim 1, **characterized in that** said segment (12-16) includes at least one of the two terminals (23) to connect to an adjacent segment (12-16) made of metal.

14. Extendable boom (10) as in claim 11, **characterized in that** said connection terminal (23) includes anchoring fins.

15. Extendable boom (10) as in claim 1, **characterized in that** the connection terminal (23) is glued internally or externally to the structure of composite material (22).

16. Extendable boom (10) as in claim 1, **characterized in that** said segment (12-16) includes two or more longitudinal lengths of composite material alternating with intermediate lengths of metal.

17. Method for the production of an extendable boom (10) for the distribution of concrete, able to be installed on a heavy work vehicle (11), and comprising a plurality of articulated segments (12-16), articulated with each other at respective ends, **characterized in that** it provides that at least one of the segments (12-16), or at least part of it along its length, that form the extendable boom (10) is made completely, throughout its section, of composite material using one or another of the techniques of filament winding, pre-preg manual deposition with autoclave polymerization, or pultrusion.

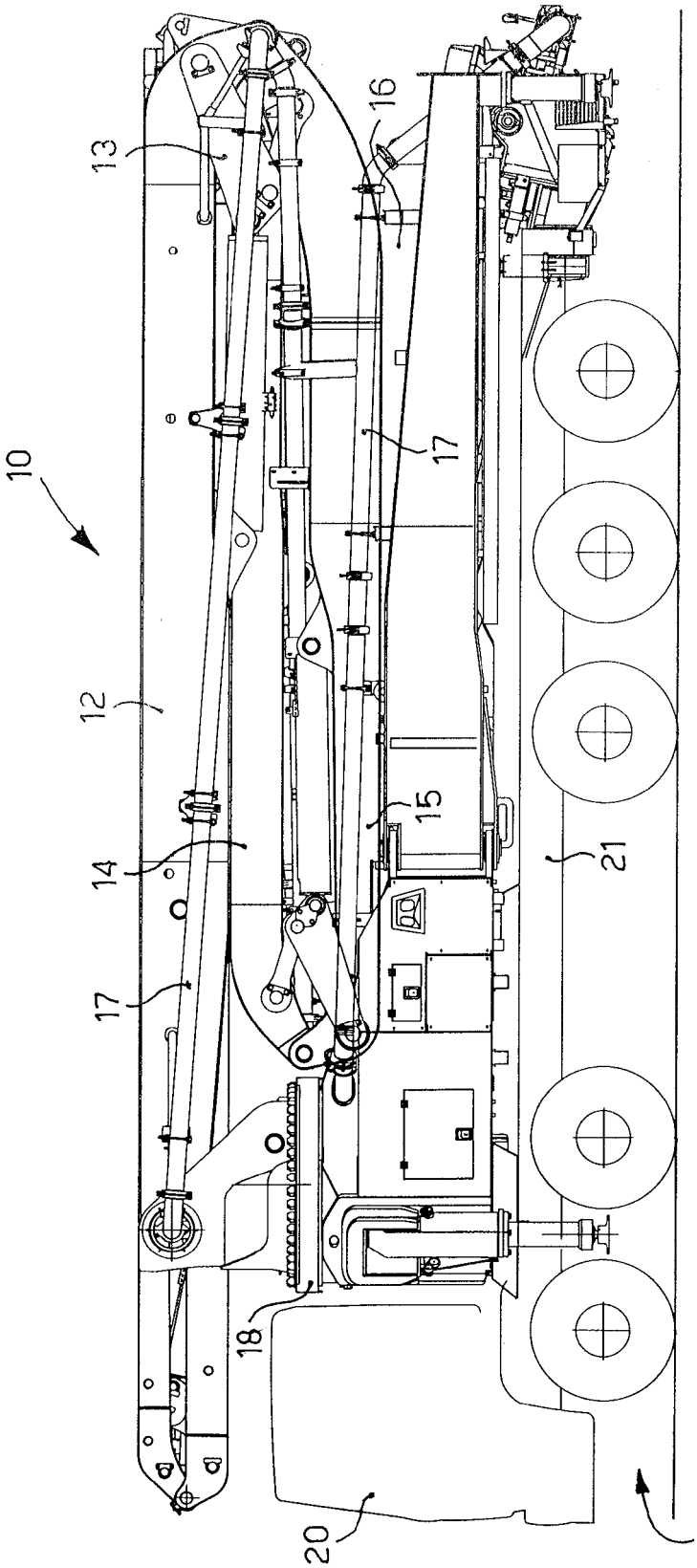

fig.1

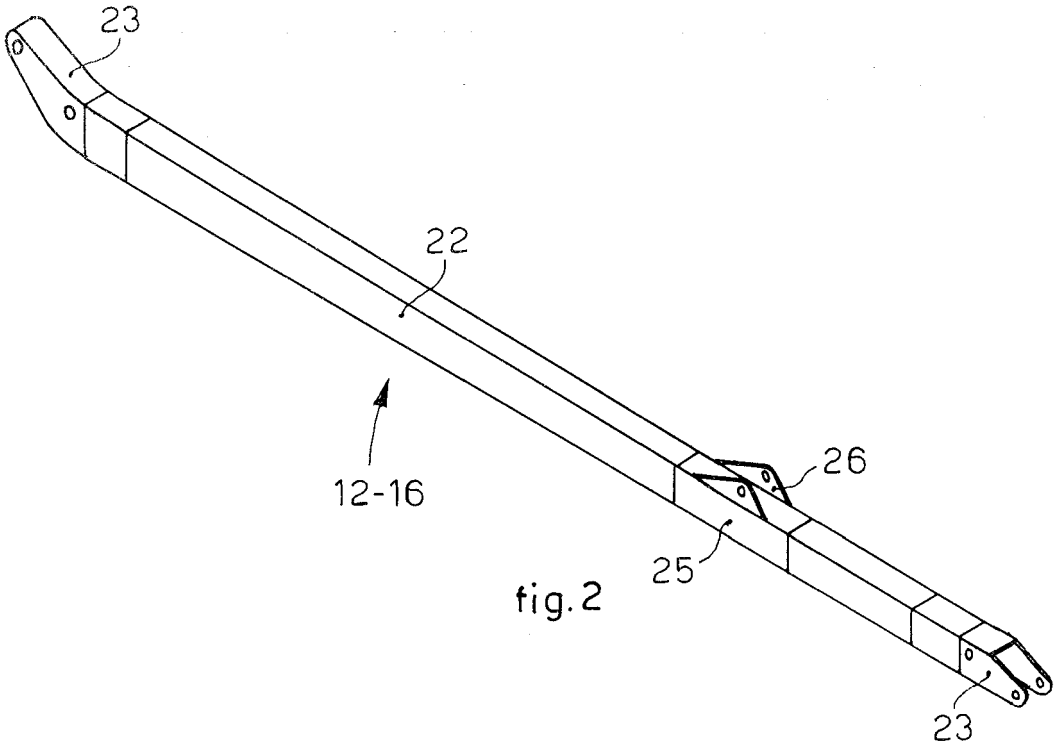

fig. 2

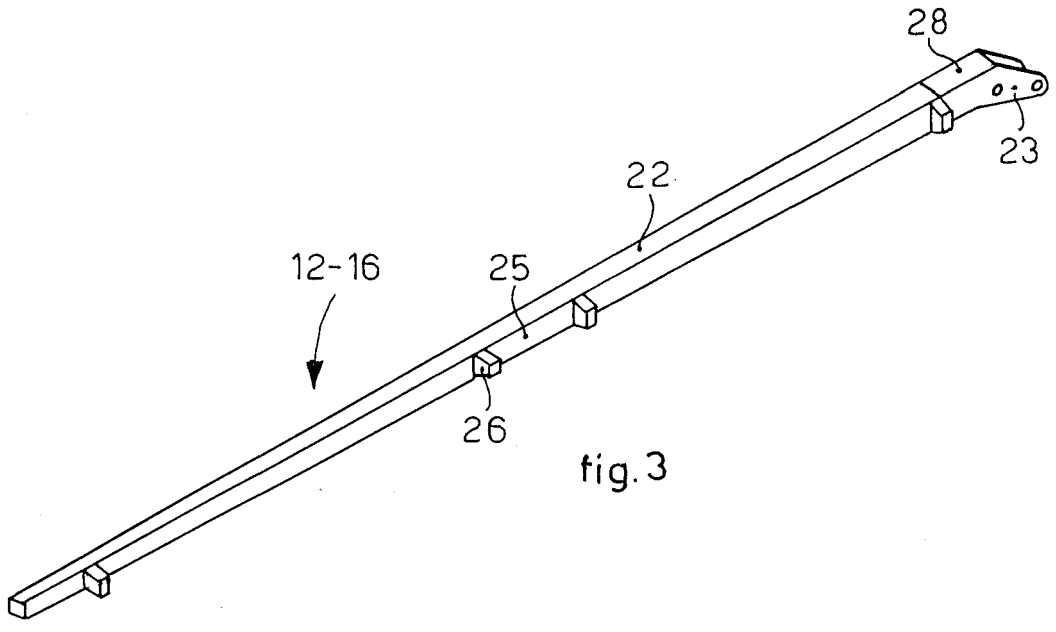

fig. 3

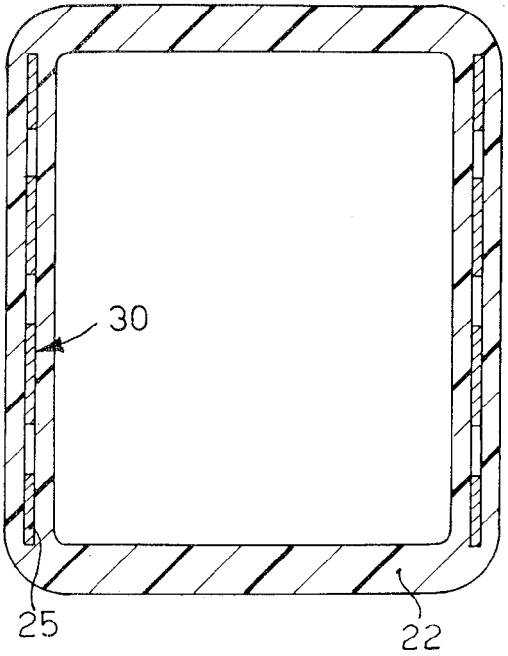

fig. 4

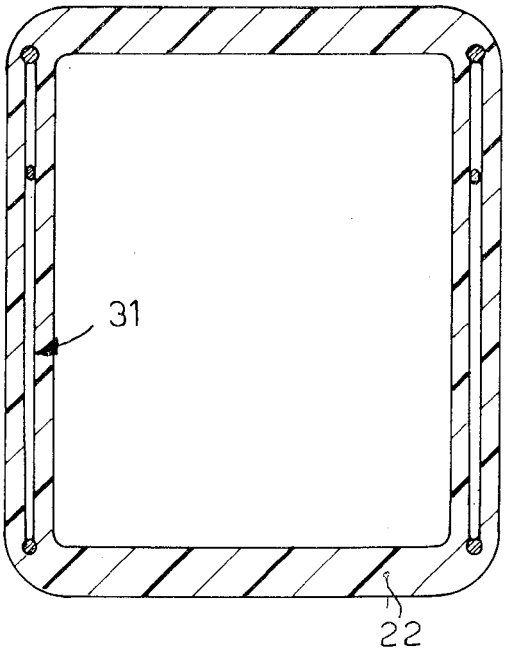

fig. 5

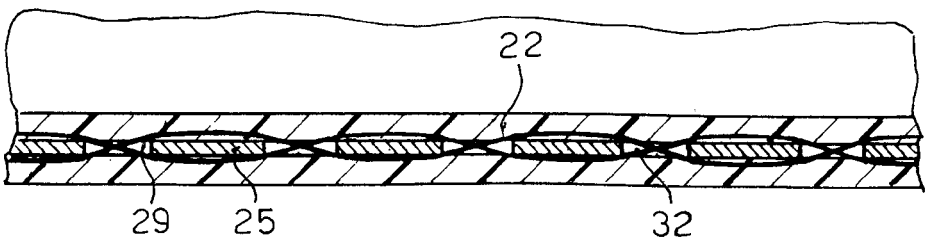

fig. 6

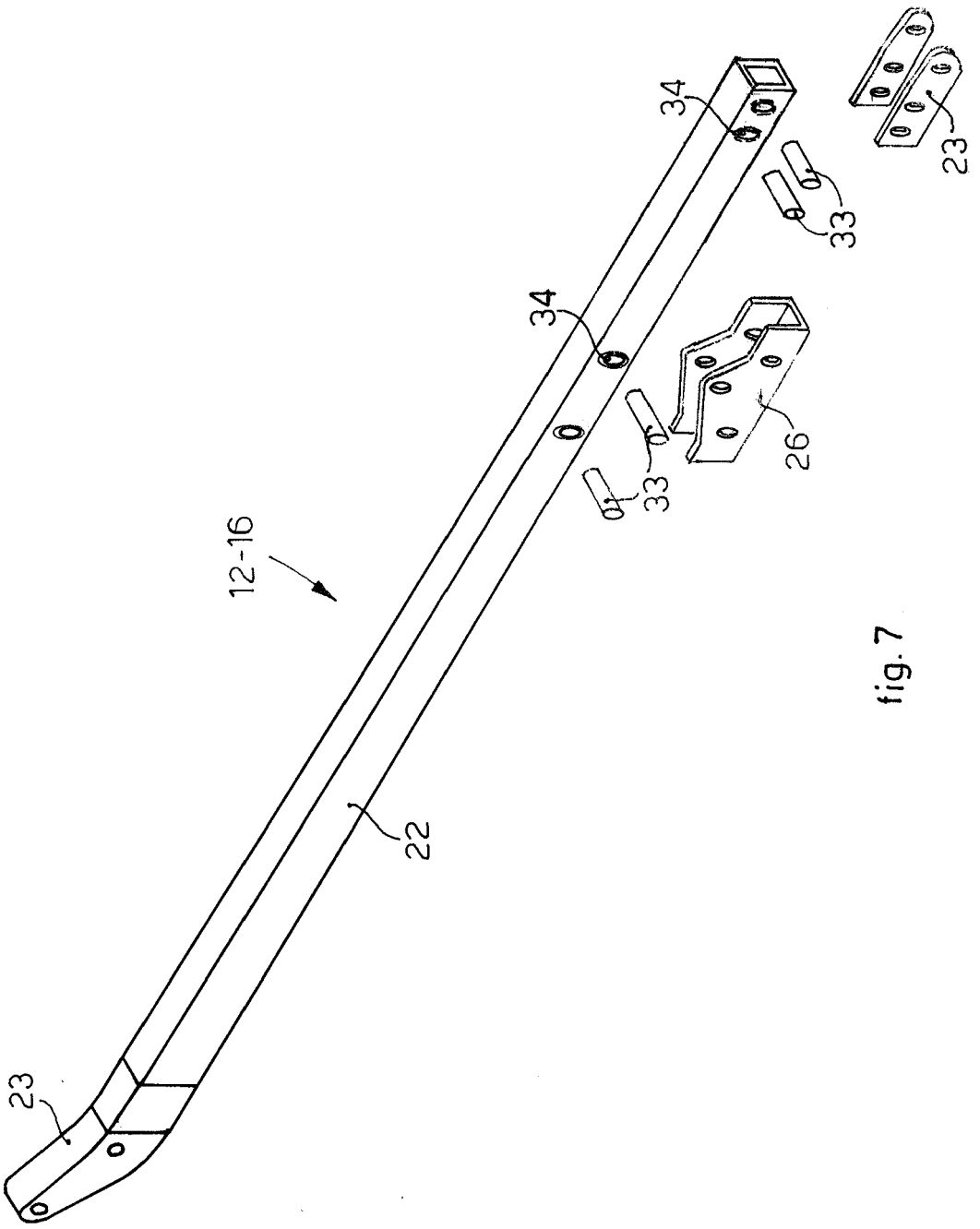

fig. 7

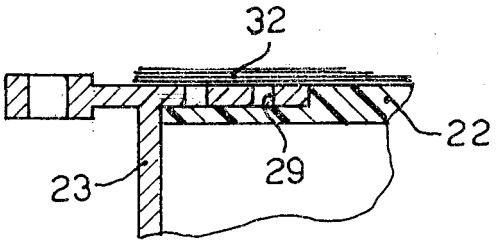

fig. 8

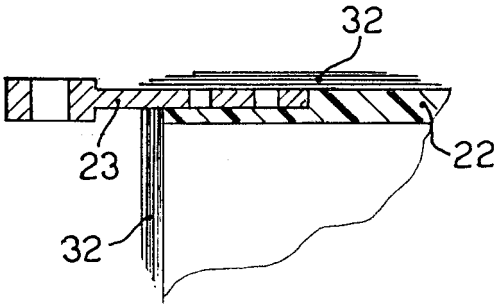

fig. 9

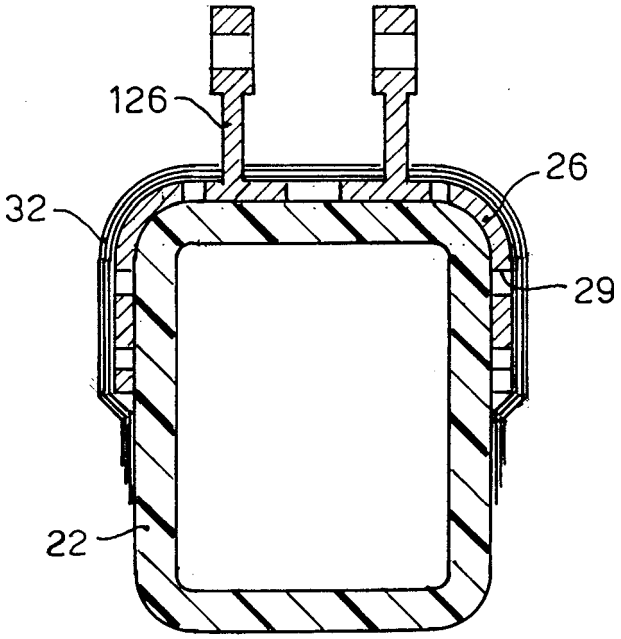

fig. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 15 2672

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 May 2008	Sheppard, Bruce

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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