



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.11.2003 Bulletin 2003/46

(51) Int Cl.7: **B66C 23/70**

(21) Application number: **03008464.4**

(22) Date of filing: **11.04.2003**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

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(30) Priority: **12.04.2002 GB 0208446**

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(54) **Boom for a load handling machine**

(57) A boom (12) for a load handling machine (10), the boom (12) has a mounting (20) by which the boom (12) is mounted on a body (11) of the machine (10), and first and second telescoped sections (24), the boom (12) carrying in use, at or towards its outermost end, a load handling implement (27), the second boom (24) section being telescoped within the first section and being extendible and retractable relative to the first boom sec-

tions (22) by actuating means, characterised in that at least one of the boom sections (22, 25) includes a plurality of walls (25a, 25b, 25c, 25d) each being a web made at least predominantly of a composite material, and where adjacent walls meet there being bearing members (30/35; 30a) which extend along a substantial length of the boom section (22, 25) to provide bearing surfaces (31) during sliding of the second boom section (25) relative to the first boom section (22).

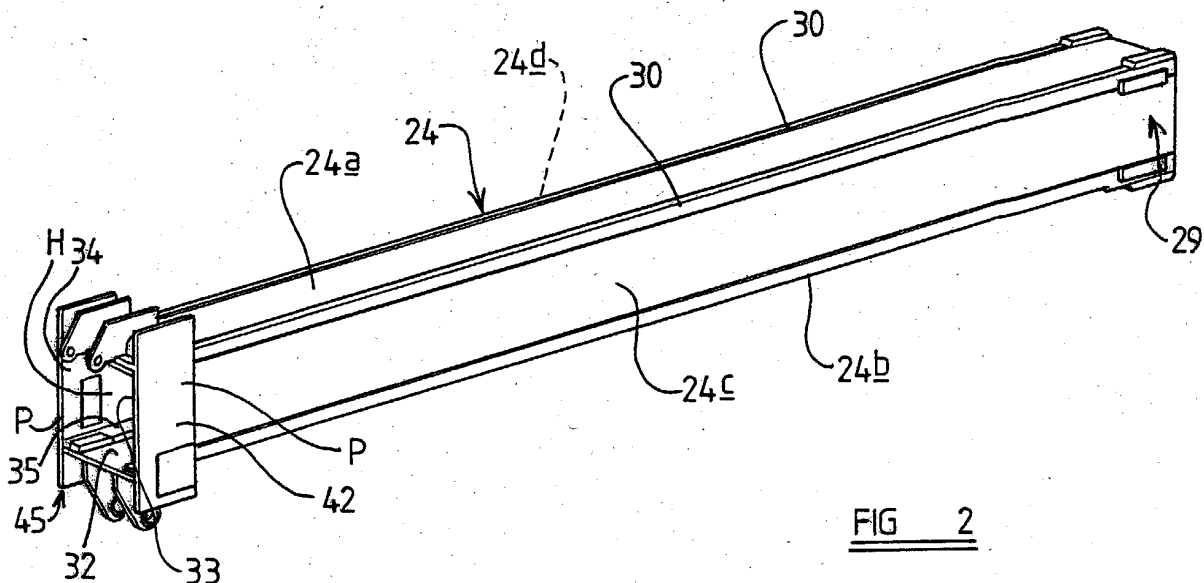


FIG 2

Description

Description of Invention

[0001] This invention relates to a boom for a load handling machine, and more particularly to a boom which includes a plurality of telescoped sections, with a load handling implement such as a bucket or loading forks for examples, carried at an outermost end of the boom, with the boom being mounted at an innermost end on a body of the machine.

[0002] In one example, the load handling machine is of the kind in which the boom is pivotal about a mounting axis which is generally horizontal, with the boom extending alongside and forwardly of an operator's cab of the machine, and the machine is movable over the ground on a ground engaging structure such as wheels carried on axles.

[0003] The boom conventionally is made of metal so as to be sufficiently strong to handle heavy loads but it will be appreciated that when the boom is fully extended, the load handled by the load handling implement exerts a substantial tipping moment about a front axle of such a machine, and thus regardless of the strength of the boom, there is a restriction on the load which can be handled. Moreover the weight of the conventionally metal boom is not an insignificant factor when determining a maximum safe load as the weight of the boom will contribute to the tipping moment, particularly when extended fully.

[0004] According to a first aspect of the invention we provide a boom for a load handling machine, the boom having a mounting by which the boom is mounted on a body of the machine, and first and second telescoped sections, the boom carrying in use, at or towards its outermost end, a load handling implement, the second boom section being telescoped within the first section and being extendible and retractable relative to the first boom sections by actuating means, characterised in that at least one of the boom sections includes a plurality of walls each being a web made at least predominantly of a composite material, and where adjacent walls meet there being bearing members which extend along a substantial length of the boom section to provide bearing surfaces during sliding of the second boom section relative to the first boom section.

[0005] The bearing members may be made of any hard wear-resistant material such as metal, or a suitable polymeric, and by extending along the composite boom section, these provide wear-resistant bearing surfaces to facilitate telescoping the boom section and/or provide wear-resistant surfaces to facilitate the use of wear pads.

[0006] In one example, the first boom section includes the mounting and may be made of metal or composite, and the walls of the second boom section may be made at least predominantly of a composite material.

[0007] Thus the first, innermost, boom section which

has the mounting for mounting the boom on the body of the machine, and which needs to be sufficiently strong both to support the load and each other boom section, can be made in metal, whereas the or at least the outermost second boom section which makes the greater contribution to the tipping moment when the boom is extended and may not support any further boom section, is made of a lighter composite material.

[0008] The boom may include at least one further boom section telescoped within the second boom section, such further section or sections being made with walls predominantly of a composite material.

[0009] Preferably each of the boom sections is hollow, with the actuating means for extending and retracting the second boom section relative to the first boom section being provided in the hollow of the first and/or second boom sections.

[0010] The bearing members, where provided on the second boom section may be provided on the exterior of the boom section, but where a further telescoped section is provided which slides in the second boom section, bearing members may also be provided interiorly of the section to provide bearing surfaces as the further boom section slides. Where the bearing members are provided on the first boom section, the bearing members may be provided interiorly of the boom section.

[0011] Each of the bearing members may be right-angled strips which overlap respectively the webs of the adjacent walls.

[0012] The bearing members may be bonded to the composite material, and/or affixed by fasteners, or even located and affixed during moulding of the composite material in positions subject to wear or potentially subject to impact damage.

[0013] In an alternative arrangement, the second boom section may be generally rectangular in cross section, including a top wall and a bottom wall and side walls between the top and the bottom walls, each side wall being joined to the top and bottom walls by the bearing members. For example, each bearing member may include a groove to receive a side wall and a groove to receive a respective top or bottom wall, the bearing member providing bearing surfaces both as the second boom section slides relative to the first boom section, and as a further boom section slides relative to the second boom section.

[0014] The bearing members may provide support for boom fittings such as a mounting for an actuating means. The bearing members may also provide mountings for wear pads which conventionally are provided between relatively sliding boom sections.

[0015] The composite material may be a fibre matrix of for example, glass and/or carbon and/or aramid fibres, in a resin, such as epoxy, polyester or vinyl esters. The fibres of the matrix may be aligned along and/or around the boom section for optimal strength.

[0016] According to a second aspect of the invention we provide a section of a boom of the first aspect of the

invention, the section including a plurality of walls each being a web made at least predominantly of a composite material, and where adjacent walls meet there being bearing members which extend along a substantial length of the boom section to provide bearing surfaces during sliding of the boom section relative to another boom section.

[0017] According to a third aspect of the invention we provide a load handling machine having a boom according to the first aspect of the invention.

[0018] Embodiments of the invention will now be described with reference to the accompanying drawings in which:-

FIGURE 1 is an illustrative view of a load handling machine having a boom in accordance with the invention;

FIGURE 2 is a more detailed but illustrative perspective view from a side of an outermost section of the boom of the machine of figure 1;

FIGURE 3 is an enlarged end view of the boom section of figure 2;

FIGURE 4 is an enlarged by illustrative view of a part of a boom section of a boom in accordance with invention, showing one construction.

FIGURE 5 is a view similar to figure 4 but of an alternative embodiment.

[0019] Referring to the drawings, a load handling machine 10 includes a body 11 which has an operator's cab 13 at one side thereof, and a boom 12 at another side, the boom 12 being mounted on the body 11 for pivotal movement about a generally horizontal boom mounting axis A behind the cab 13, so that the boom 12 extends forwardly from the mounting axis A alongside the cab 13 and forwardly of the cab 13 and body 11.

[0020] The body 11 of the machine is provided with a ground engaging structure which in this example includes a front axle 14, and a rear axle 16, each axle 14, 16 carrying wheels 18.

[0021] The boom 12 is mounted on the body 11 for pivotal movement about the axis A, at a mounting 20 which in this example is rearwardly of the cab 13, there being a first hydraulic actuator 19, in this example, which acts between the body 11 and boom 12, to raise and lower the boom 12 relative to the body 11.

[0022] The boom 12 is in the example of the machine 10 of figure 1, a three section boom 12, there being an innermost section 22 which is mounted on the body 12, an outermost boom section 24 which carries a load handling implement 27 (e.g. loading forks) at or towards its outermost end, and an intermediate, boom section 25, the three sections 22, 24 and 25 being telescopic as hereinafter described so that the boom 12 is extendible and retractable to move the load handling implement 27 towards and away from the body 11. In figure 1 the boom 12 is shown in full lines at a typical low position, with the boom partially 12 retracted, although the boom 12 may

be lowered further than shown by the actuator 19, and further retracted. In dotted lines, part of the boom 12 is shown in a raised condition with the boom 12 fully extended.

[0023] It will be appreciated than in the dotted line condition, with a full load L on the load handling implement 27, there will be a tipping moment about an axis B of the front axle 14 which tends to tip the machine 10 about the wheel axis B and so regardless of the strength of the boom 12, there is a restriction on the load L which can be handled which varies with boom extension and height.

[0024] The innermost boom section 22 may be made of metal or a suitably strong composite material, and supports not only the load L, but the intermediate boom section 25 and the outermost boom section 24, too. The intermediate boom section 25 and outermost boom section 24 are however made predominantly of a lighter composite material namely a material which is a matrix of fibres in a resin.

[0025] The composite material may be a fibre matrix of for example, glass and/or carbon and/or aramid fibres, in a resin, such as epoxy, polyester or vinyl esters. The fibres of the matrix may be aligned along and/or around the boom sections 24, 25 for optimal strength.

[0026] It can be seen that the outermost composite boom section 24 is in this example of generally rectangular cross section and having a top wall 24a, a bottom wall 24b, and a pair of side walls 24c, 24d in the form of webs which define an internal hollow H. However the boom section 24 may be of other configurations, as hereinafter described.

[0027] The cross section of the outermost boom section 24 is smaller than that of the intermediate section 25 which also is of generally rectangular hollow cross section having a top wall 25a, a bottom wall 25b and side walls 25c, 25d in the form of webs, and the outermost boom section 24 is received in telescoped fashion, within the hollow H of the intermediate boom section 25, and is slidable in and out relative to the intermediate boom section 25, by an actuator, e.g. a hydraulic actuator which is mounted within the hollow H of the at least the intermediate boom section 25, and is secured to the outermost second boom section 24.

[0028] It will be appreciated that the outermost boom section 24, being made of a composite material is liable to wear as the section 24 slides in and out of the intermediate boom section 25, and the intermediate boom section 25 is liable to wear both as the outermost section 24 slides in and out, and as the section 25 slides in and out of the innermost boom section 22.

[0029] Whereas wear pads 28 (see figure 3) may be provided at the four external comers of the outermost boom section 24 or elsewhere, at an innermost end 29 of the section 24, as is conventional in the art, the corners of the outermost boom section 24, where the top and side walls 24a, 24c/24d and bottom side walls 24b, 24c/24d meet, may well rub on internal surfaces of the

intermediate boom section 25 during relative sliding. Furthermore, when the outermost boom section 24 is loaded, the problem of wear of the composite material of the boom section 24 particularly at the corners will be exacerbated.

[0030] Thus elongate bearing members 30 are provided at each of the external corners of the outermost boom section 24, the members 30 in this example extending over a substantial portion of the length of the boom section 24. The bearing members 30 are made from a suitably hard material, such as for examples only steel or another metal, or a hard plastic material such as nylon. The bearing members 30 in this example are formed to be angle strips, which extend over and overlap a part of the webs at the top wall 24a or bottom wall 24b, and a part of a respective side wall 24c or 24d, to protect the corners of the second boom section 24 during sliding of the outermost boom section 24 within the intermediate boom section 25.

[0031] The intermediate boom section 25 may be made of metal or composite material as desired, although to provide minimum weight, and thus increase the load which the machine 12 can handle, preferably the intermediate boom section 25 is made of a composite material too.

[0032] In this case, to protect the intermediate boom section 25 from wear as the outermost boom section 24 slides in and out of the intermediate boom section 25, the intermediate boom section 25 may be provided with interior bearing members 35, again of angle section and made of metal or at least a material harder than the composite material of the webs of the walls 25a, 25b, 25c, 25d. For the purposes of illustration the outermost boom section 24 shown in figures 2 and 3, is shown provided with such interior bearing members 35 although these would not be required for providing wear resistance as no further boom section-slides inside the outermost boom section 24, but these may be provided for other purposes too, as hereinafter described. In figure 4, an end view of the intermediate boom section 25 shows the exterior 30 and interior 35 bearing members.

[0033] The innermost boom section 22 is also generally rectangular in this example, dimensioned so as to receive in telescoped fashion therein, the intermediate boom section 25. Thus the exterior corners of the intermediate boom section 25 where the respective top and side walls 25a, 25c/25d and bottom and side walls 25b, 25c/25d may be provided with bearing members 30, to give wear protection as the intermediate boom section 25 slides in and out of the innermost boom section 22.

[0034] In each case the bearing members 30, 35 may be fixed to the composite material either by bonding with a suitable bonding agent, and/or fasteners, which where interior 35 and exterior 30 bearing members are provided may pass through the composite material and be fixed to the bearing members 30, 35 so as to sandwich the composite material of the webs of the walls between the bearing members 30, 35. Alternatively or addition-

ally to either of those methods, the bearing members 30, 35 may be laid up with the composite material of the or the respective intermediate 25 and outermost 24 boom sections when the boom section(s) is/are made, the bearing members 30, 35 having formations which become integrated with the composite material and thus affixed relative thereto during moulding.

[0035] It will be appreciated that in use, the bearing members 30, 35 help to transmit forces experienced primarily in the webs of the top walls 24a, 25a and bottom walls 24b, 25b of the rectangular boom section 24 (and 25), to the side walls 24c/24d, and 25c/25d and thus distribute loads over the whole boom 12 structure.

[0036] If desired, additional bearing members may be provided elsewhere on the outermost 24 and/or intermediate boom section 25 where wear is likely to be experienced. These additional strips, and the exterior bearing members 30 and interior bearing members 35 where provided, as well as providing wear protection, may perform other functions.

[0037] It will be appreciated that composite material is more prone than metal say, to becoming damaged as a result of impact for example. Moreover, whereas a metal section would visibly dent, damage of a composite section can be invisible to the naked eye, as such impacts may result in internal disruption of the structure only.

[0038] The exterior bearing members 30 at least, being made of harder material than the composite material of the outermost and/or intermediate boom section 25 will afford the composite material protection against impact damage at the corners of the boom section 25 which are perhaps most prone to such impact damage.

[0039] Also the bearing members 30, 35 provide surfaces for the attachment of fittings to the composite boom sections 24, 25, such as for examples only, actuator mountings, one of which is shown at 40 at the inner end 29 of the boom section 24, and/or the load handling implement 27 mounting 42. Such mountings may include plates P which span the respective top 31, bottom 32 and side webs 33, 34 so as to be connectable to at least two bearing members 30, 35.

[0040] In the figure 2 view, it can be seen that the loading implement 27 mounting 42 is generally rectangular in cross section and extends around the exterior of the boom section 24 at an outermost end 45 thereof, interconnecting with all four exterior bearing members 30.

[0041] In the figure 3 view, at the innermost end 29, the actuator mounting 50 has plates P which extend interiorly and exteriorly of the bottom web 32 of the boom section 24, sandwiching the composite material therebetween, each interior and exterior plate P interconnecting respectively, the two lower bearing members 35, 30.

[0042] Wear pads 28 at the innermost end 29 of the boom section 24 are attached to the bearing members 30 too.

[0043] It will be appreciated that bearing members 30, 35 of other configurations may be provided particularly

where the boom 12 is of another configuration.

[0044] For example, the composite boom section or sections 24, 25, and even the metal boom section 22 may be other than rectangular cross sectional configuration as described and thus may have any plurality of walls with bearing members provided where adjacent walls meet.

[0045] If desired, the innermost first boom section 22 may be made of a composite material. Whereas such a composite innermost first boom section 22 may require bearing members interiorly only to provide wear protection as the intermediate boom section 25 slides in and out, exterior strips may be provided to facilitate providing the mounting 20 at mounting axis A, and/or a mounting for the actuator 19 which raises and lowers the boom 12.

[0046] In the examples described, the bearing members 30, 35 extend along the respective boom sections 22, 24, 25 preferably from end to end. If desired the bearing members may extend along a substantial part of the length only, for example in a region where bearing support for the composite material is desired. For one example only, the exterior and interior bearing members 30, 35 for the outermost boom section 24 may be provided locally of the respective end of the boom section 24 only, to provide support for the loading implement mounting or the actuator mounting in those regions only.

[0047] Referring now to figure 5 an alternative construction is illustrated for the intermediate boom section 25.

[0048] In this example, interior 35 and exterior 30 bearing members are integrally provided by a metal bearing member 30a which also serves to join the composite webs of the walls 25a, 25b, 25c, 25d, of the boom section 25.

[0049] The bearing member 30a has a groove G1 to receive an edge of the web of the top wall 25a, and a groove G2 to receive the edge of the web of one side wall 25d. The webs are secured in their grooves G1, G2 either as the composite material of the boom section 25 is moulded, or may be adhered in position or otherwise secured subsequent to the composite webs 25a, 25b, 25c, 25d being made.

[0050] The bearing member 30a provides exterior bearing surfaces 31 which protect the composite material as the intermediate boom section 25 slides in and out of the innermost boom section 25, and interior bearing surfaces 32 which protect the composite material as the outermost boom section 24 is slid in and out of the intermediate boom section 25.

[0051] The bearing member 30a could of course be made of an other material and to other configurations to join the adjacent walls and provide both interior and exterior bearing surfaces. For example, the bearing members 30a could provide round corners to the boom section (S) in which case the bearing members 30a would provide a single interior/exterior rounded bearing surface.

[0052] Where no further boom section 24 is provided,

the bearing member 30a may only provide exterior bearing surfaces 31.

[0053] It will be appreciated that whereas the invention has been described in relation to a machine 10 having a three section boom 12, if desired the boom may have only two sections, or more than one intermediate section.

[0054] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A boom (12) for a load handling machine (10), the boom (12) having a mounting (A) by which the boom (12) is mounted on a body (11) of the machine (10), and first (22) and second (25) telescoped sections, the boom (12) carrying in use, at or towards its outermost end, a load handling implement (27), the second boom section (25) being telescoped within the first section (22) and being extendible and retractable relative to the first boom sections (22) by actuating means, **characterised in that** at least one of the boom sections (22, 25) includes a plurality of walls (25a, 25b, 25c, 25d) each being a web made at least predominantly of a composite material, and where adjacent walls (25a, 25b, 25c, 25d) meet there being bearing members (30, 35, 30a) which extend along a substantial length of the boom section (25) to provide bearing surfaces (31) during sliding of the second boom section (25) relative to the first boom section (22).
2. A boom according to claim 1 **characterised in that** the first boom section (22) includes the mounting (A) and is made of metal and the walls (25a, 25b, 25c, 25d) of the second boom section (25) are made at least predominantly of a composite material.
3. A boom according to claim 1 or claim 2 **characterised in that** the boom (12) includes at least one further boom section (24), the or one of the further boom sections (24) being telescoped within the second boom section (25).
4. A boom according to claim 3 **characterised in that** the or one of the further boom sections (24) is made of composite material.
5. A boom according to any one of the preceding claims **characterised in that** each of the boom sections (22, 24, 25) is hollow, and the actuating means

for extending and retracting the second boom section relative to the first boom section, is provided in the hollows (H) of the first (22) and/or second (25) boom sections.

6. A boom according to any one of the preceding claims **characterised in that** the second boom section (25) includes bearing members (30) which are provided on the exterior of the boom section (25).

7. A boom according to claim 6 where dependent upon claim 3 **characterised in that** bearing members (30) are provided on the exterior of the second boom section (25) to provide bearing surfaces as the second boom section (25) slides relative to the first boom section (22), and interiorly of the section (25) also to provide bearing surfaces as the further boom section (24) slides relative to the second boom section (25).

8. A boom according to any one of claims 1 to 5 **characterised in that** first boom section (24) includes bearing members (35) which are provided interiorly of the boom section (22).

9. A boom according to any one of claims 1 to 8 **characterised in that** each of the bearing members (30, 35) are right-angled strips which overlap respectively the webs of the adjacent walls and are bonded to the composite material, and/or affixed by fasteners, and/or located and affixed during moulding of the composite material

10. A boom according to any one of claims 1 to 5 **characterised in that** the second boom section (25) is generally rectangular in cross section, including a top wall (25a) and a bottom wall (25b) and side walls (25c, 25d) between the top and the bottom walls, each side wall (25c, 25d) being joined to the top and bottom walls by the bearing members (30, 35).

11. A boom according to claim 10 where appended to claim 3 **characterised in that** each bearing member (30a) includes a groove (G2) to receive a side wall (25d) and a groove (G1) to receive a respective top or bottom wall (25a), the bearing member (30a) providing bearing surfaces (31) both as the second boom section (25) slides relative to the first boom section (22) and as the further boom section (24) slides relative to the second boom section (25).

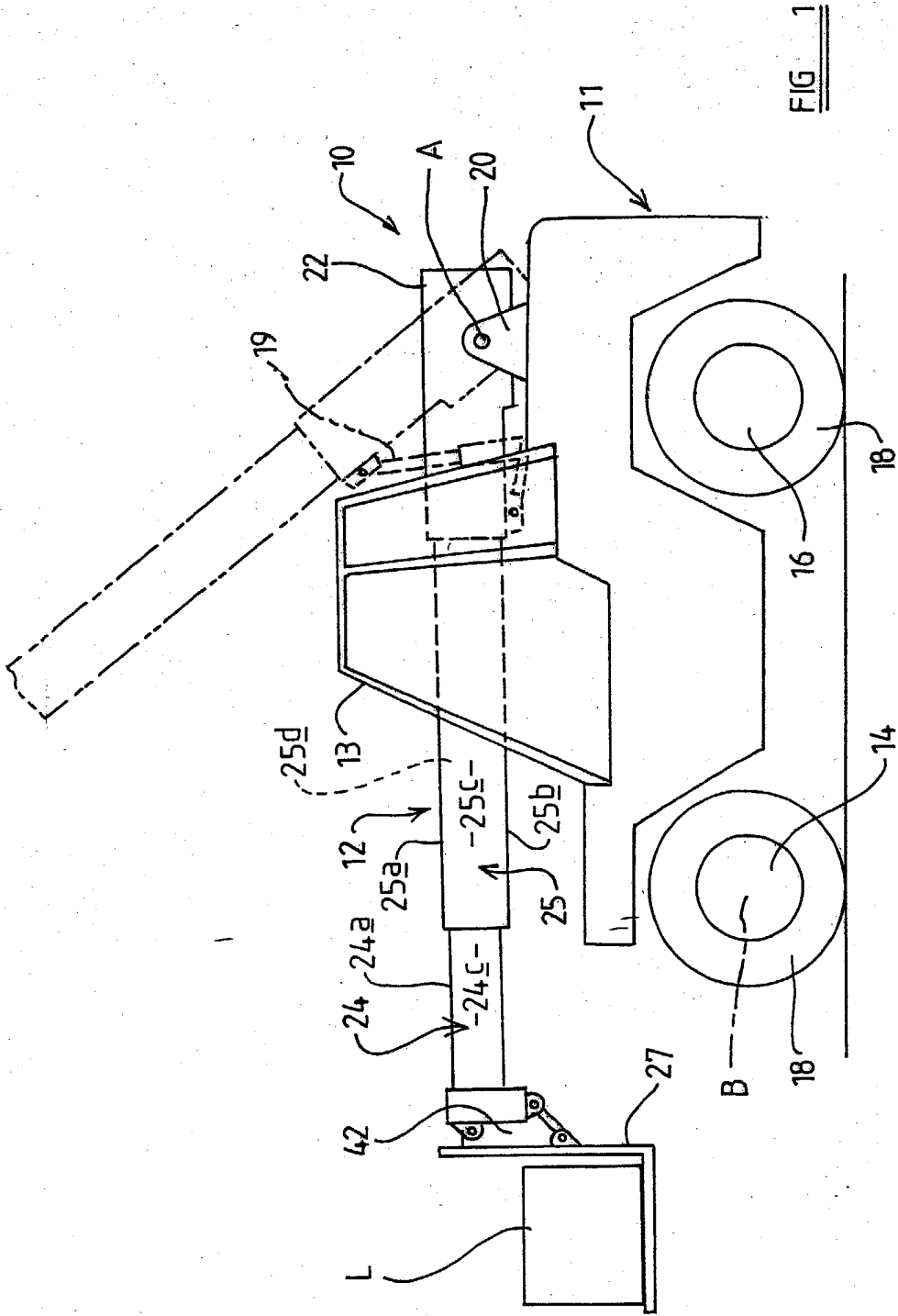
12. A boom according to any one of the preceding claims **characterised in that** the bearing members (30, 35; 30a) provide support for a boom fitting (42).

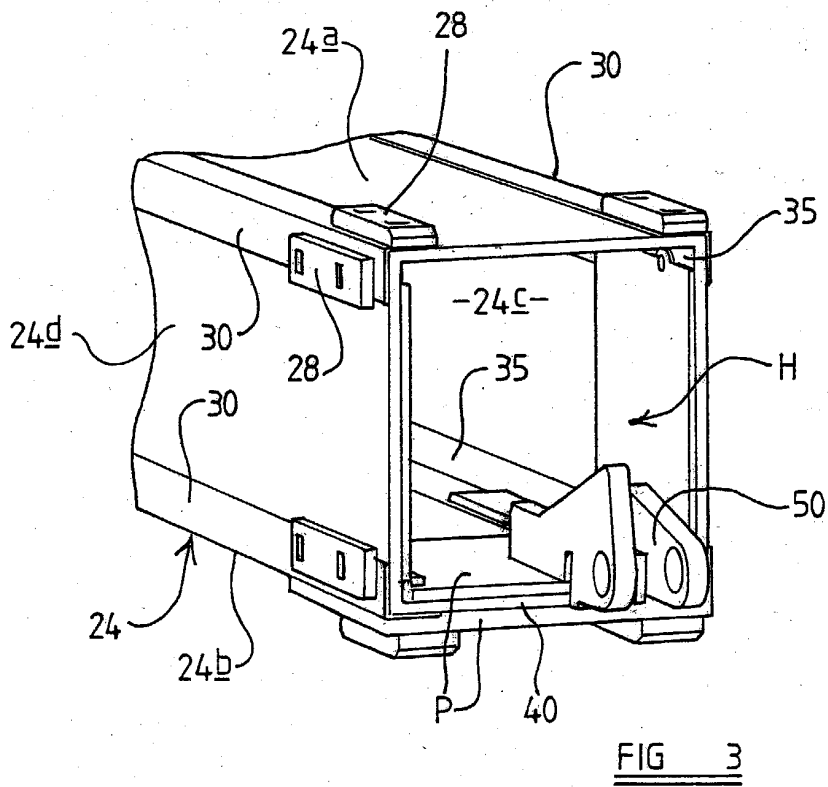
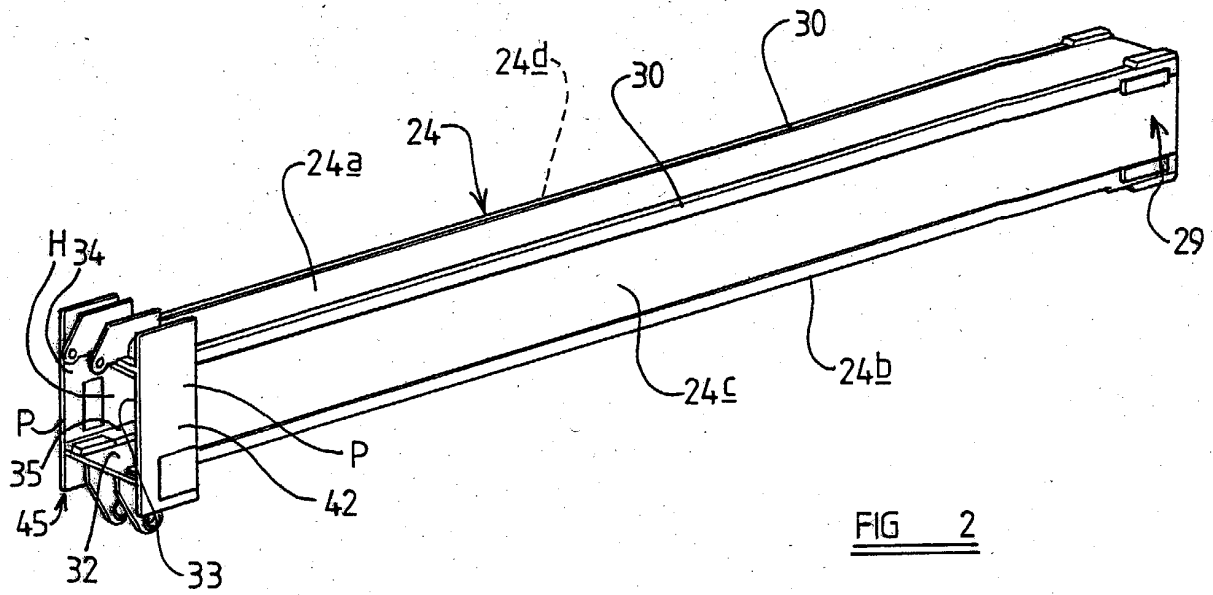
13. A boom according to any one of the preceding claims **characterised in that** the composite material is a fibre matrix of glass and/or carbon and/or

aramid fibres, in an epoxy, polyester or vinyl ester resin, and the fibres of the matrix are aligned along and/or around the boom section (22, 25) for optimal strength.

14. A section of a boom of any one of the preceding claims, the section (24, 25) including a plurality of walls (24a, 24b, 24c, 24d; 25a, 25b, 25c, 25d) each being a web made at least predominantly of a composite material, and where adjacent walls meet there being bearing members (30, 35; 30a) which extend along a substantial length of the boom section (24, 25) to provide bearing surfaces (31) during sliding of the boom section (24, 25) relative to another boom section (22, 25).

15. A load handling machine (10) having a boom (12) according to any one of the preceding claims.





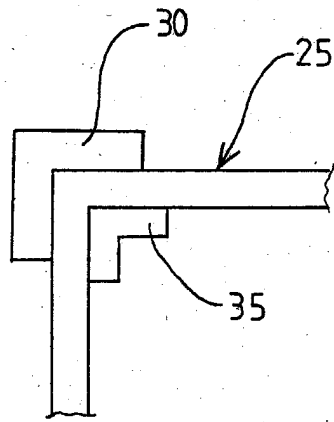


FIG 4

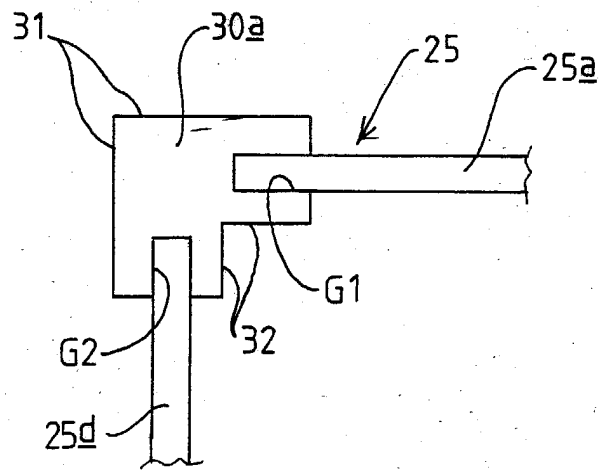


FIG 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)					
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The present search report has been drawn up for all claims					
Place of search MUNICH		Date of completion of the search 9 July 2003	Examiner Masset, M		
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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 03 00 8464

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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