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Remarks:
Amended claims in accordance with Rule 86 (2) EPC.

(54) An earth moving machine

(57) An earth moving machine comprising a chassis (2) on which there is a control position (3) and on which drive means are mounted to allow the machine (1) to move relative to the ground. The machine (1) also has an articulated arm (8) comprising a first member (9) extending from a first end (11), pivoted to the chassis (2), to a second end (12), and a second member (10) having a first end (13) pivoted to the first member (9) and a second end (14) bearing a working part (15). The first member (9) has a first part of the first member (9) with a first width at the lower zone (20) and a second width, which is less than the first width, at the upper zone (19).

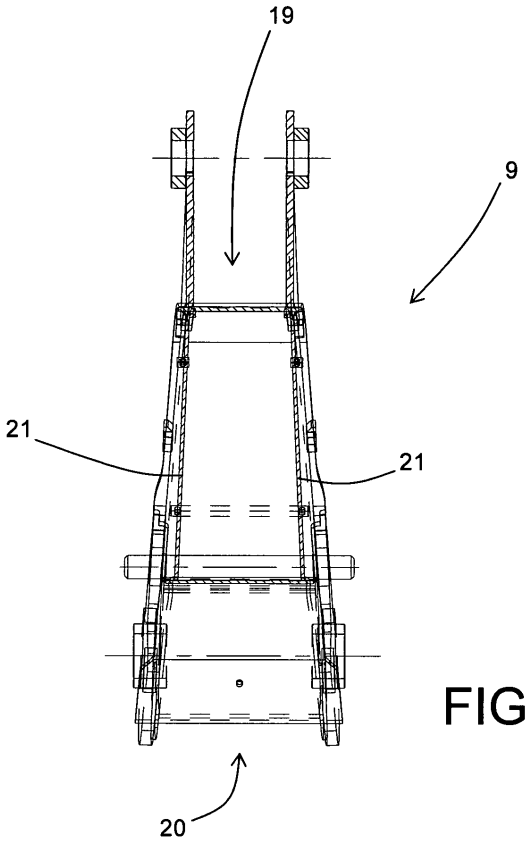

FIG. 10

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Description

[0001] The present invention relates to an earth moving machine of the type equipped with an articulated arm pivoted to the machine chassis.

[0002] In particular the present invention is intended for application on the rear articulated arms of backhoe loaders, and on the articulated arms of excavators (of any size).

[0003] Such articulated arms normally consist of two members pivoted to one another at their ends, with one member pivoted to the chassis and the other bearing the working part 15 (for example a bucket). However, in general, articulated arms may comprise a plurality of members connected in series. All of the various members are driven by hydraulic actuators.

[0004] Moreover, in general, in all of the arms known today, the first member has, across the main direction in which it extends, a substantially rectangular cross-section. However, in some types of arms, the cross-section of the first member reduces from the end pivoted to the chassis to the end to which the second member is pivoted, so as to reduce the projecting weight.

[0005] However, all of the known types of articulated arms of earth moving machines have the significant disadvantage of obstructing the operator's view, because, during movement, they come between the operator and the working zone.

[0006] In this situation the technical need which forms the basis of the present invention is to provide an earth moving machine which overcomes the above-mentioned disadvantages.

[0007] In particular, the technical need of the present invention is to provide an earth moving machine with an articulated arm that is less of an obstruction to the operator's view than happens in the machines known today.

[0008] The technical need specified and the aims indicated are substantially achieved by an earth moving machine as described in the claims herein.

[0009] Further features and the advantages of the present invention are more clearly illustrated in the detailed description which follows, with reference to the accompanying drawings, which illustrate several preferred embodiments of an earth moving machine, without limiting the scope of the inventive concept, in which:

- Figure 1 is a side view of a backhoe loader made according to the present invention, with the rear articulated arm in a first, operating position;
- Figure 2 is a view of the earth moving machine illustrated in Figure 1 with the articulated arm in a second, non-operating position;
- Figure 3 is a view of the earth moving machine illustrated in Figure 2;
- Figure 4 is a side view of a mini-excavator made according to the present invention;
- Figure 5 is a side view of another type of excavator to which the present invention is applied;
- Figure 6 is a front view of the excavator illustrated in Figure 5;
- Figure 7 is a side view of the first member of the articulated arm of the earth moving machine illustrated in Figure 1;
- Figure 8 is a top view of the first member illustrated in Figure 7;
- Figure 9 is a view from the left of the first member illustrated in Figure 7;
- Figure 10 is a cross-section of the first member illustrated in Figure 7 according to the line X - X;
- Figure 11 is a cross-section of the first member illustrated in Figure 7 according to the line XI - XI;
- Figure 12 is a cross-section of the first member illustrated in Figure 7 according to the line XII - XII;
- Figure 13 is a cross-section of the first member illustrated in Figure 7 according to the line XIII
- XIII; and
- Figure 14 is a cross-section of the first member illustrated in Figure 8 according to the line XIV - XIV.

[0010] With reference to the accompanying drawings, the numeral 1 denotes as a whole an earth moving machine according to the present invention.

[0011] In general, the present invention may be applied to earth moving machines 1 comprising a load-bearing chassis 2, on which a control position 3 is mounted for an operator (which may or may not be protected by a cab 4 as illustrated in the accompanying drawings). The chassis 2, in turn, may consist of a single part (Figures 1 - 3), or may be divided into two parts 2a, 2b placed one above the other, the upper part rotating relative to the lower part about a vertical axis of rotation (Figures 4 - 6).

[0012] On the chassis 2 there are also drive means designed to allow the machine 1 to move relative to the ground, comprising an engine, wheels 5 (with rubber tyres, railway style, etc.) or tracks 6, and controls 7 located in the control position 3 (steering wheel, pedals, operating levers, etc.).

[0013] The machine 1 also comprises at least one articulated arm 8 which is in turn divided into a first member 9 and at least a second member 10.

[0014] The first member 9 extends, along its extension trajectory, from a first end 11, pivoted to the chassis 2, to a second end 12. The second member 10, in turn has a first end 13 pivoted to the second end 12 of the first member 9 and a second end 14 which bears, directly or by means of additional members 10a (Figures 5 and 6), a working part 15, such as a bucket.

[0015] In the known way, operation of the members 9, 10 and the working part 15 is guaranteed by special actuators 16 mounted between the member/working part 9, 10, 15 and the part of the machine 1 to which the member/part 9, 10, 15 is pivoted.

[0016] The category of earth moving machines 1 described above includes backhoe loaders, in which the articulated arm 8 described is located on the back of the machine 1, and excavators (large, medium, mini, midi)

in which the articulated arm 8 is located at a front zone of the machine 1.

[0017] As illustrated in Figures 1 and 2, in the case of a backhoe loader, the earth moving machine 1 also has a front arm 17 bearing a shovel 18.

[0018] According to the present invention, on the first member 9 it is possible to identify an upper zone 19 at least partly facing the control position 3 and a lower zone 20, at least partly facing the working part 15.

[0019] At least part of the first member 9 has, across the extension trajectory of said first member 9, a first width at its lower zone 20 and a second width, less than the first width, at its upper zone 19.

[0020] However, advantageously, in the preferred embodiment, not only a first part but the entire first member 9 has the second width less than the first width (therefore, hereinafter reference will be made to this preferred embodiment).

[0021] In contrast, when only part of the first member 9 is made according to the present invention, said first part should be at the zone of the articulated arm 8 towards which the operator looks while working.

[0022] In the embodiment illustrated, the first member 9 has a width which decreases from the lower zone 20 towards the upper zone 19. In particular, in the accompanying drawings, the first member 9 has two substantially flat sides 21 extending between the upper zone 19 and the lower zone 20. According to the present invention, the sides 21 converge with one another at the upper zone 19 (Figures 10 - 14). As illustrated, for example, in Figure 11, the first member 9 has, perpendicular to its extension trajectory, a substantially trapezoidal cross-section. In the trapezium which can be identified in the cross-section, the upper zone 19 of the first member 9 corresponds to the smaller base, the lower zone 20 to the larger base, and the sides 21 correspond to the two sides of the trapezium.

[0023] As illustrated in Figure 8, the first member 9 has a cross-section which decreases from the first end 11 to the second end 12.

[0024] As illustrated in Figures 7 to 9, the first member 9 illustrated in the accompanying drawings is fork-shaped at its ends and is formed only by the two converging flat sides 21. Moreover, in an intermediate portion, the first member 9 has a fork-shaped projection 22 which allows the attachment of the driving actuators 16 (Figure 1).

[0025] As indicated, the articulated arm 8 is pivoted relative to the chassis 2. In particular it is pivoted at least according to a first, substantially vertical axis of rotation and according to a second, substantially horizontal axis of rotation.

[0026] In the embodiment illustrated in Figures 1 to 3 (backhoe), the articulated arm 8 is pivoted not directly to the chassis 2, but instead to a supporting element 23 in turn slidably connected to the chassis 2 according to a substantially horizontal sliding axis transversal to a machine 1 longitudinal axis.

[0027] According to the present invention it is also possible to produce, in a similar way to that described above with regard to the first member 9, other members into which the articulated arm 8 of the earth moving machine 1 is divided. In any case, the further a member is from the control position 3 the less benefit the present invention can provide. Thanks to the innovative transversally tapering shape of the first member 9 of an articulated arm 8 produced according to the present invention, the zone of the first member 9 which in practice faces the operator is narrower that the known arms. As a result, the arm is less of an obstruction to the operator's view than known arms.

[0028] The width of the upper zone 19 of the first member 9 may also vary depending on production requirements. For example, in the case of the embodiment illustrated in Figures 1 to 3, the upper zone 19 of the first member 9 is "covered" by the relative actuator. Therefore, it is neither useful nor necessary to make the width of the first zone less than the width of the actuator (however, it should be noticed that in the earth moving machines 1 known today the actuator is always significantly narrower than the first member 9 of the articulated arm 8).

[0029] In contrast, in embodiments similar to those illustrated in Figures 4 to 6, where the actuator is at the lower zone 20 of the first member 9, the width of the upper zone 19 may be much more significantly reduced, even eliminating it (in this case the first member 9 could at least partly have a triangular cross-section).

[0030] The present invention therefore brings important advantages, since it allows increased visibility for the operator in a simple way and without drawbacks.

[0031] It should also be noticed that the present invention is relatively easy to produce and even the cost linked to implementation of the invention is not high.

[0032] The invention described can be subject to numerous modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all details may be substituted by other technically equivalent elements and, in practice, all of the materials used, as well as the shapes and dimensions of the various components, may be any according to requirements.

Claims

1. An earth moving machine comprising:

- a chassis (2);
- a control position (3) mounted on the chassis (2) ;
- drive means mounted on the chassis (2) to allow the machine (1) to move relative to the ground;
- at least one articulated arm (8) comprising a first member (9) extending, along its extension trajectory, from a first end (11), pivoted to the chassis (2), to a second end (12), and at least a second member (10) having a first end (13)

pivoted to the second end (12) of the first member (9) and a second end (14) bearing a working part (15);
- the first member (9) having an upper zone (19) at least partly facing the control position (3) and a lower zone (20);
the earth moving machine being **characterised in that** at least a first part of the first member (9) has, across the extension trajectory, a first width at the lower zone (20) and a second width, less than the first width, at the upper zone (19).

2. The earth moving machine according to claim 1, **characterised in that**, across the extension trajectory, at least the first part of the first member (9) has a width decreasing from the lower zone (20) towards the upper zone (19).

3. The earth moving machine according to claim 1 or 2, **characterised in that** at least at the first part the first member (9) has two substantially flat sides (21) extending between the upper zone (19) and the lower zone (20), said sides (21) converging with one another at the upper zone (19).

4. The earth moving machine according to any of the foregoing claims, **characterised in that** at least at the first part the first member (9) has, perpendicular to the extension trajectory, a substantially trapezoidal cross-section, the upper zone (19) corresponding to the smaller base of the trapezium.

5. The earth moving machine according to any of the foregoing claims, **characterised in that** the first part of the first member (9) corresponds to the entire first member (9).

6. The earth moving machine according to any of the foregoing claims, **characterised in that** the first member (9) has a cross-section decreasing from the first end (11) to the second end (12).

7. The earth moving machine according to any of the foregoing claims, **characterised in that** the articulated arm (8) is pivoted relative to the chassis (2) at least according to a first, substantially vertical axis of rotation and according to a second, substantially horizontal axis of rotation.

8. The earth moving machine according to claim 7, **characterised in that** the articulated arm (8) is pivoted to a supporting element (23) slidably connected to the chassis (2) according to a substantially horizontal sliding axis transversal to a machine (1) longitudinal axis.

9. The earth moving machine according to any of the foregoing claims, **characterised in that** the articulated arm (8) comprises a plurality of members, each produced in a way similar to that claimed regarding the first member (9) in any of the foregoing claims.

10. The earth moving machine according to any of the foregoing claims, **characterised in that** it is a backhoe loader, the articulated arm (8) being positioned on the back of the machine (1).

11. The earth moving machine according to any of the foregoing claims, **characterised in that** it is an excavator, the articulated arm (8) being positioned at a front zone of the machine (1).

12. The earth moving machine according to any of the foregoing claims, **characterised in that** it is a mini-excavator, the articulated arm (8) being positioned at a front zone of the machine (1).

Amended claims in accordance with Rule 86(2) EPC.

1. An earth moving machine comprising:

- a chassis (2);
- a control position (3) mounted on the chassis (2) ;
- drive means mounted on the chassis (2) to allow the machine (1) to move relative to the ground;
- at least one articulated arm (8) comprising a first member (9) extending, along its extension trajectory, from a first end (11), pivoted to the chassis (2), to a second end (12), and at least a second member (10) having a first end (13) pivoted to the second end (12) of the first member (9) and a second end (14) bearing a working part (15);
- the first member (9) having an upper zone (19) at least partly facing the control position (3) and a lower zone (20), and two substantially flat sides (21) extending between the upper zone (19) and the lower zone (20), the connections between the flat sides (21) and the upper and lower zones (19), (20) defining each a corner;
the earth moving machine being **characterised in that** at least a first part of the first member (9) has, perpendicular to the extension trajectory, a substantially trapezoidal cross-section, the upper zone (19) corresponding to the smaller base of the trapezium, the lower zone (20) to the larger base, and the sides (21) to the two sides of the trapezium, so that said first part has a first width at the lower zone (20) and a second width, less than the first width, at the upper zone (19).

2. The earth moving machine according to claim 1, **characterised in that** the first part of the first mem-

ber (9) corresponds to the entire first member (9).

3. The earth moving machine according to any of the foregoing claims, **characterised in that** the first member (9) has a cross-section decreasing from the first end (11) to the second end (12).

4. The earth moving machine according to any of the foregoing claims, **characterised in that** the articulated arm (8) is pivoted relative to the chassis (2) at least according to a first, substantially vertical axis of rotation and according to a second, substantially horizontal axis of rotation.

5. The earth moving machine according to claim 4, **characterised in that** the articulated arm (8) is pivoted to a supporting element (23) slidably connected to the chassis (2) according to a substantially horizontal sliding axis transversal to a machine (1) longitudinal axis.

6. The earth moving machine according to any of the foregoing claims, **characterised in that** the articulated arm (8) comprises a plurality of members, each produced in a way similar to that claimed regarding the first member (9) in any of the foregoing claims.

7. The earth moving machine according to any of the foregoing claims, **characterised in that** it is a backhoe loader, the articulated arm (8) being positioned on the back of the machine (1).

8. The earth moving machine according to any claim from 1 to 7, **characterised in that** it is an excavator, the articulated arm (8) being positioned at a front zone of the machine (1).

9. The earth moving machine according to any claim from 1 to 7, **characterised in that** it is a mini-excavator, the articulated arm (8) being positioned at a front zone of the machine (1).

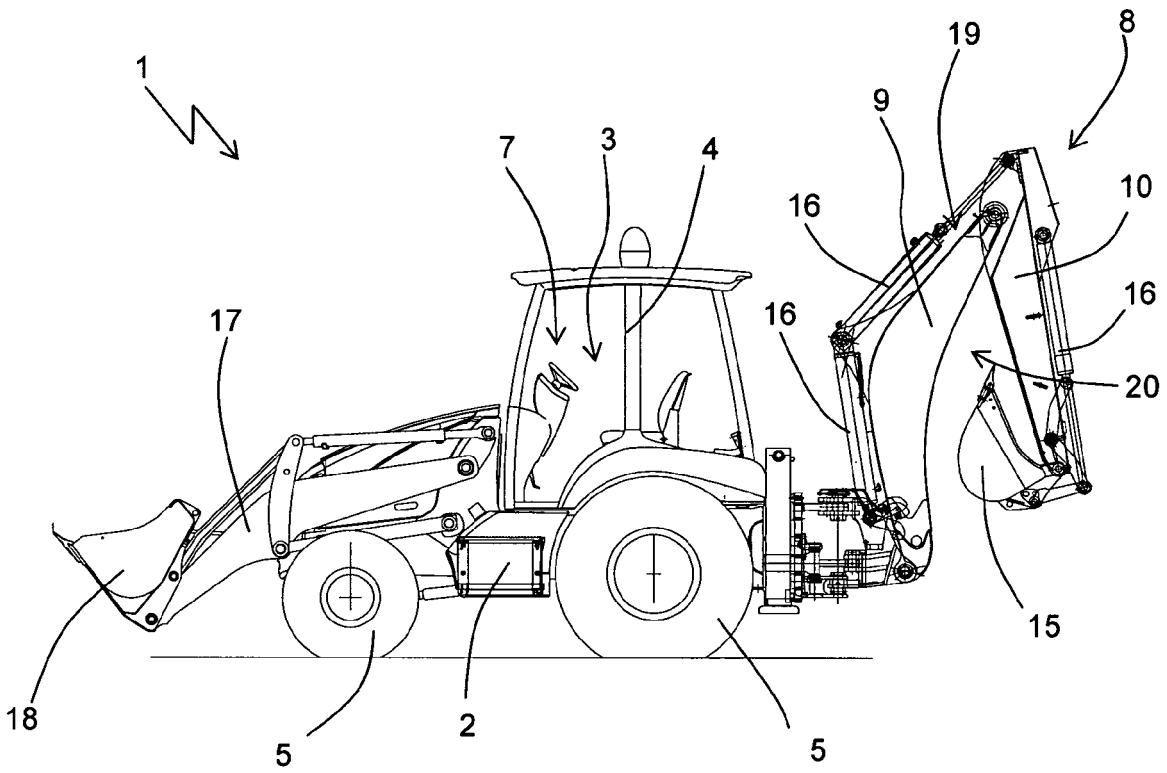


FIG. 1

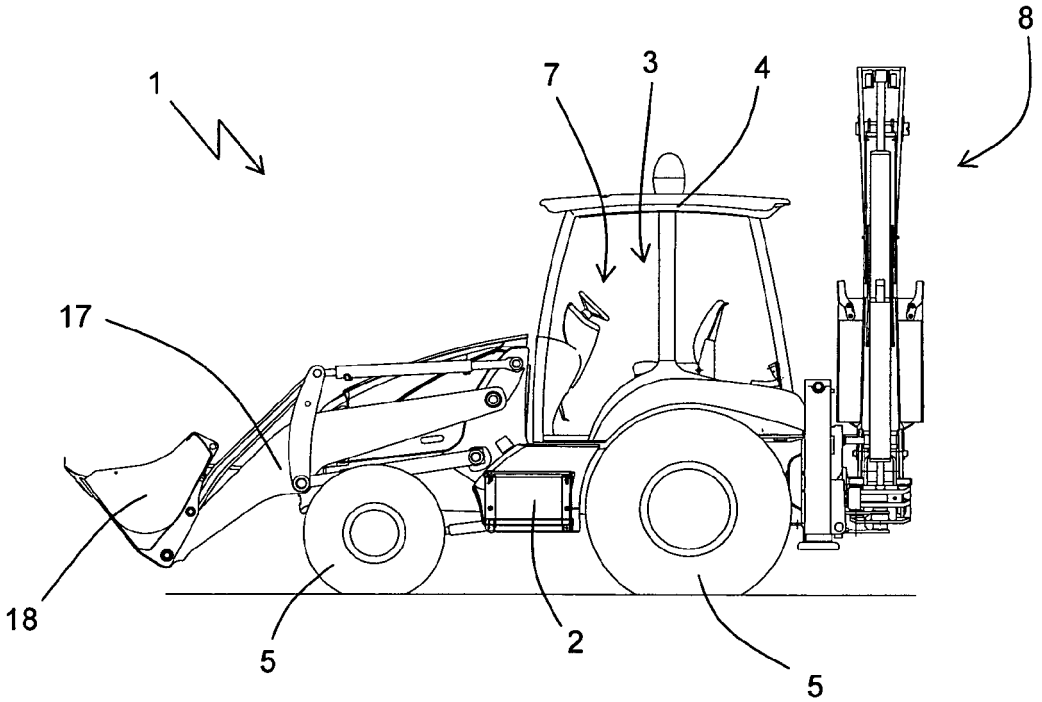
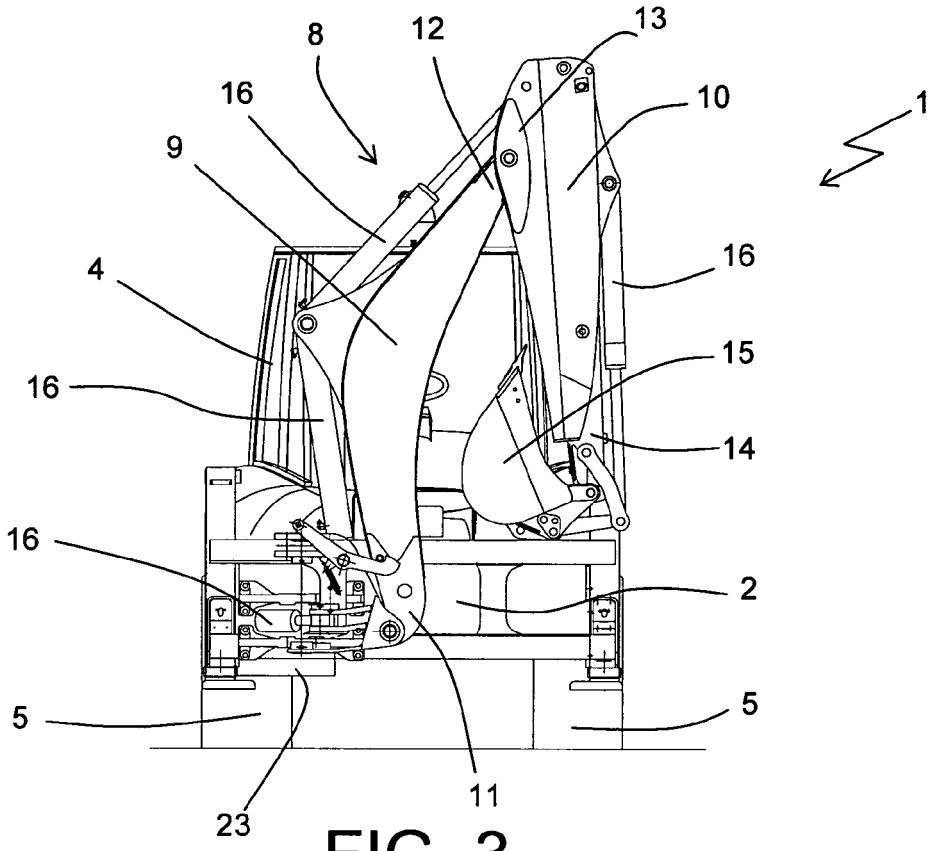


FIG. 2


8
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13
16
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1
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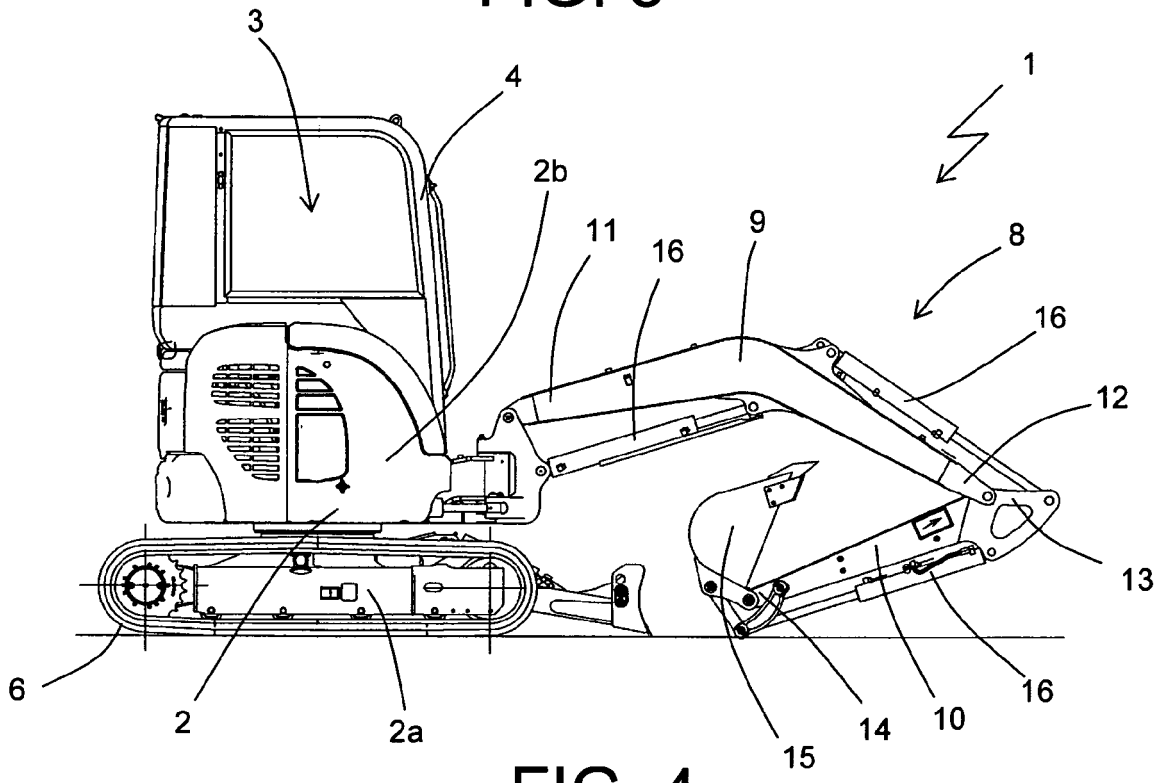
16
4
15
16
14
16
2
5
5
11
23

FIG. 3


3
4
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2b
11
16
9
8
16
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13
6
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2a
15
14
10
16

FIG. 4

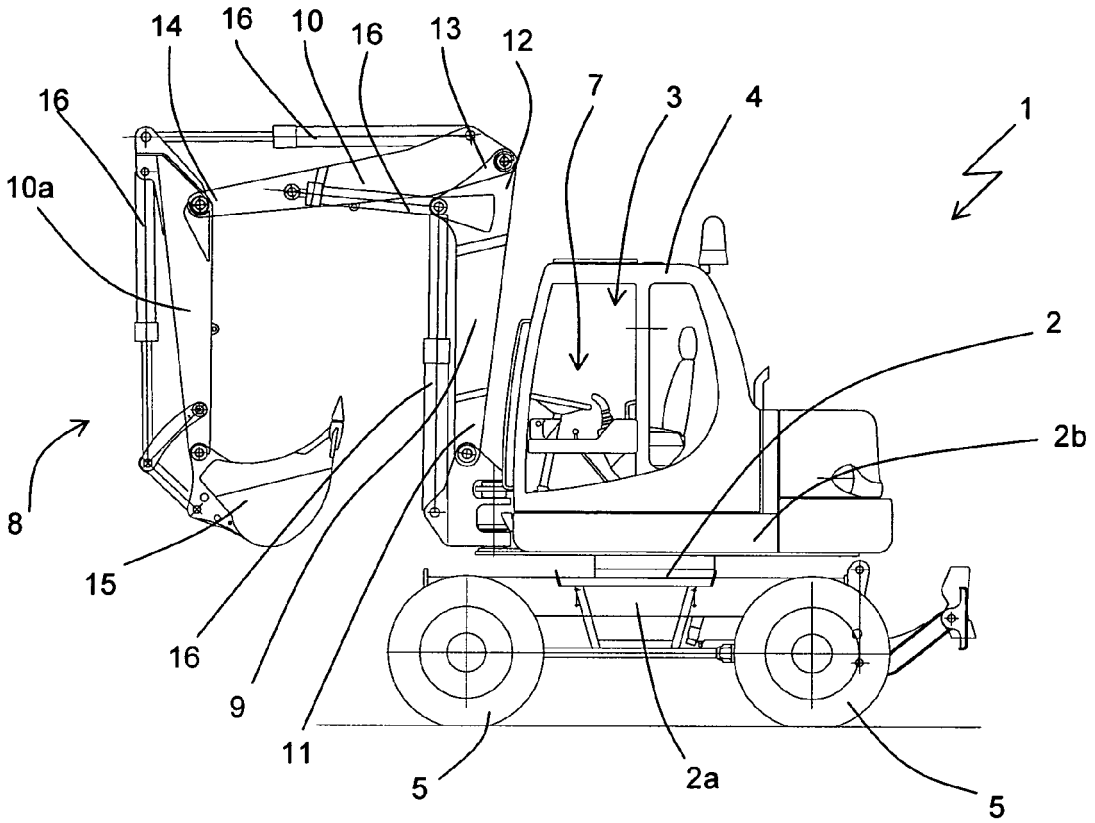

FIG. 5

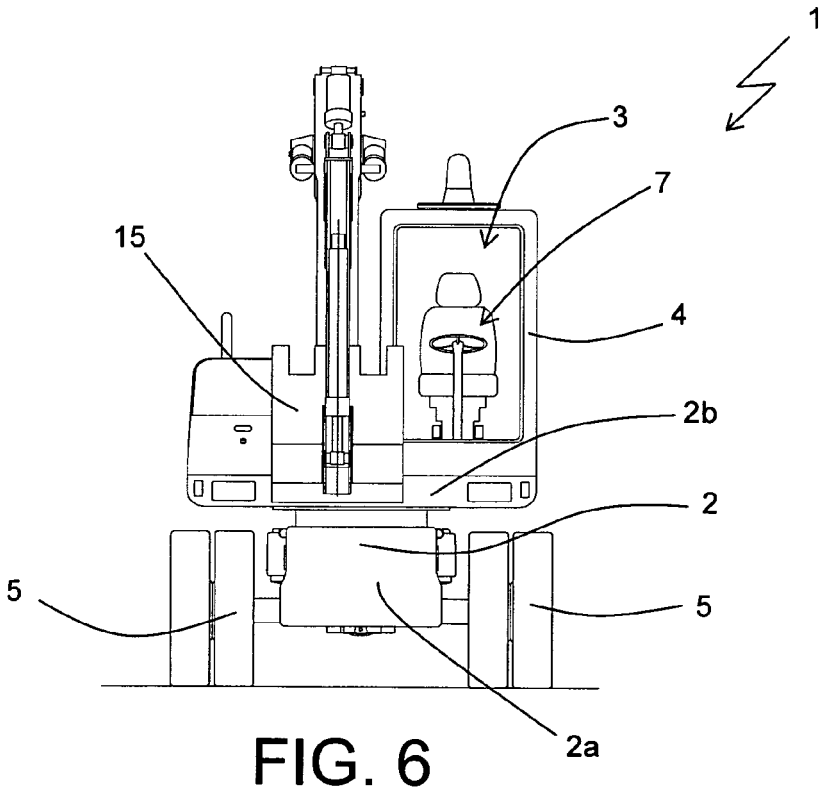

FIG. 6

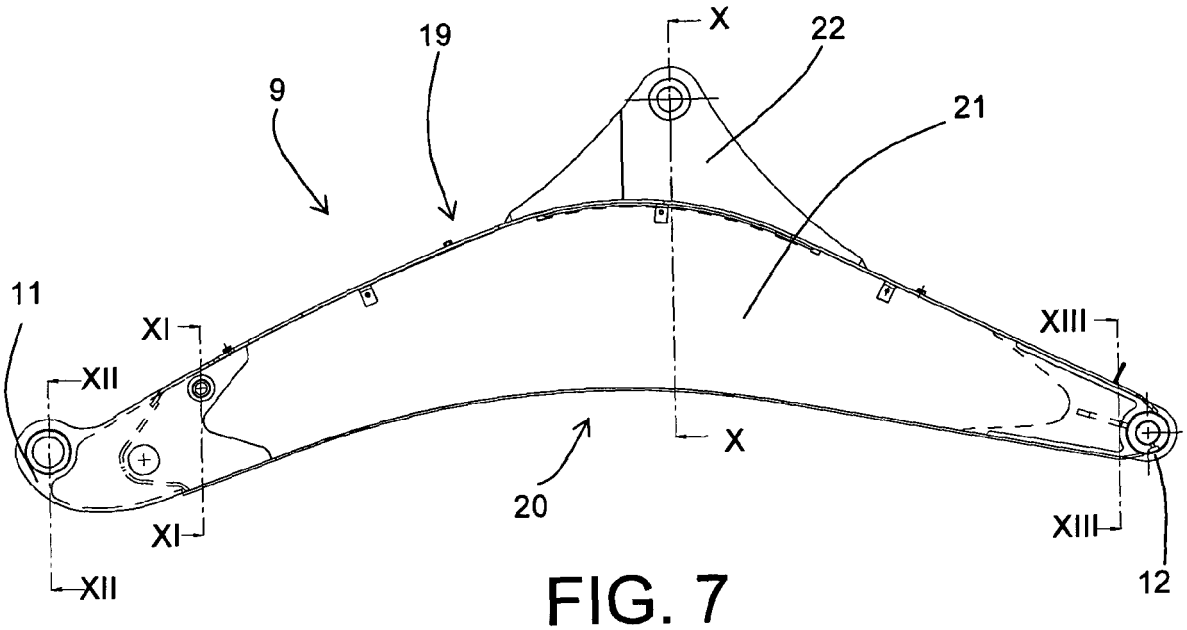

FIG. 7

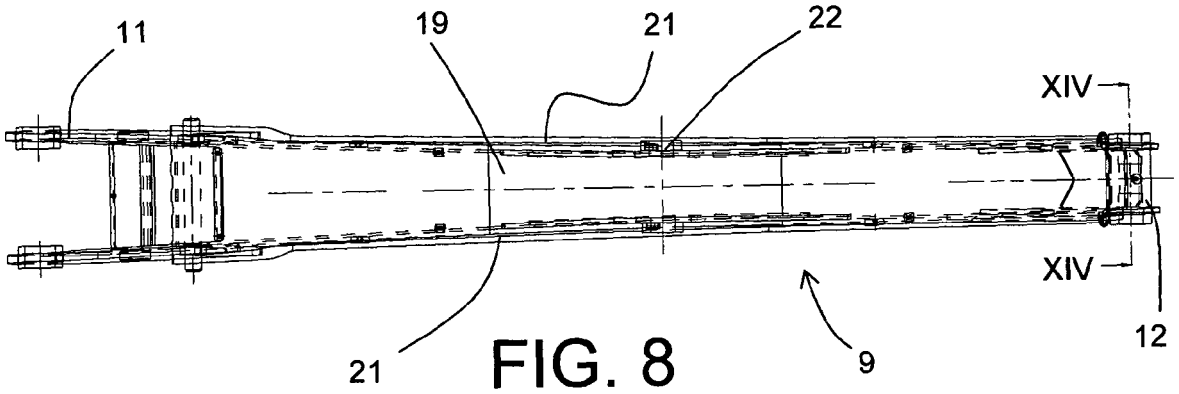

FIG. 8

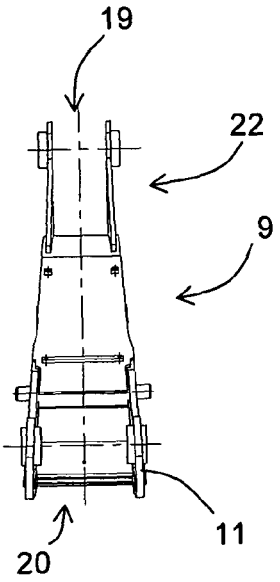

FIG. 9

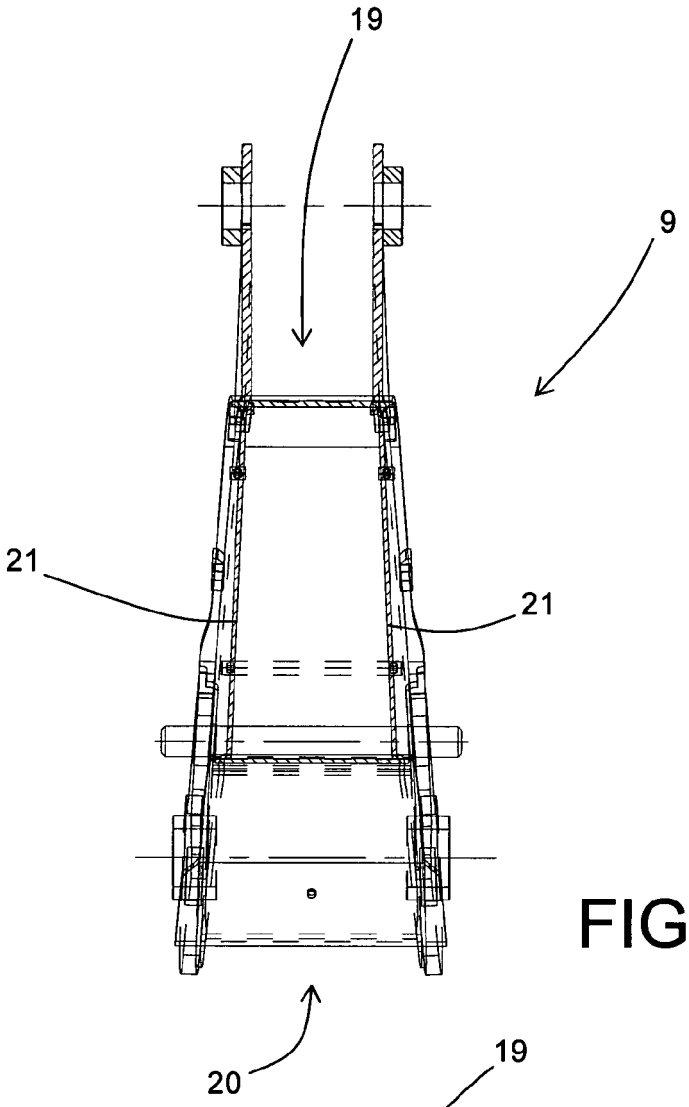

FIG. 10

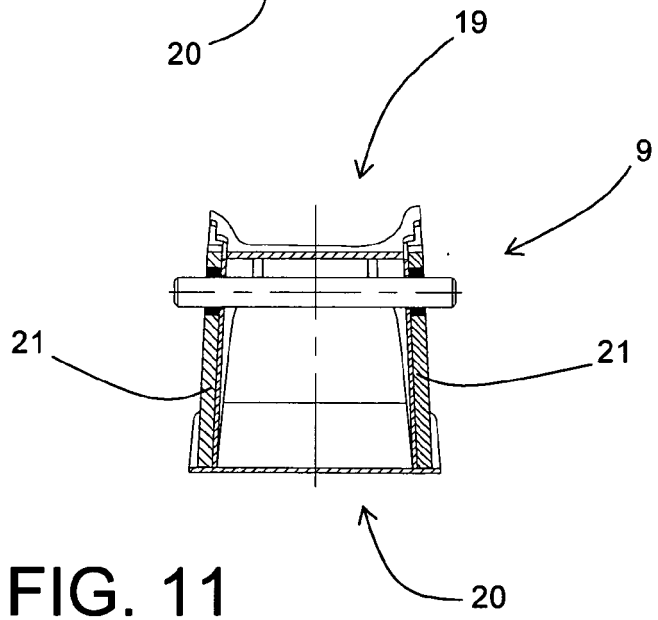

FIG. 11

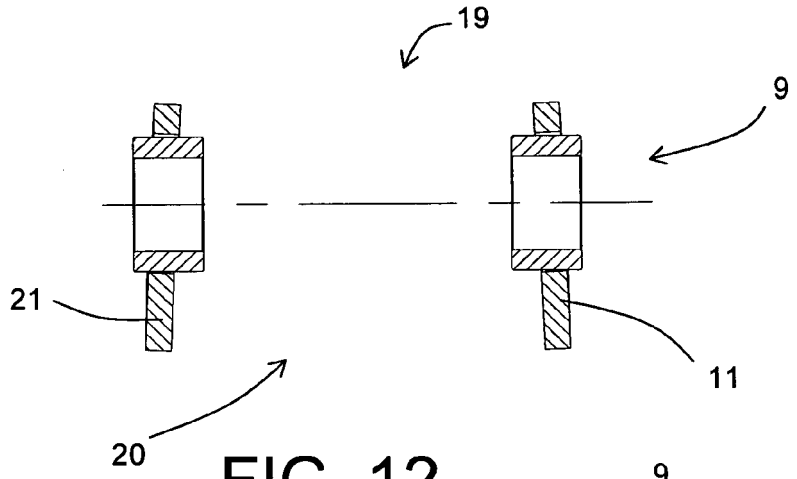

FIG. 12

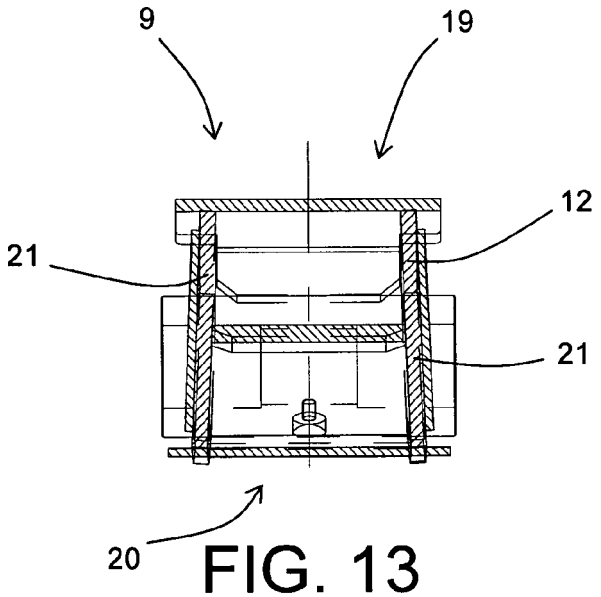

FIG. 13

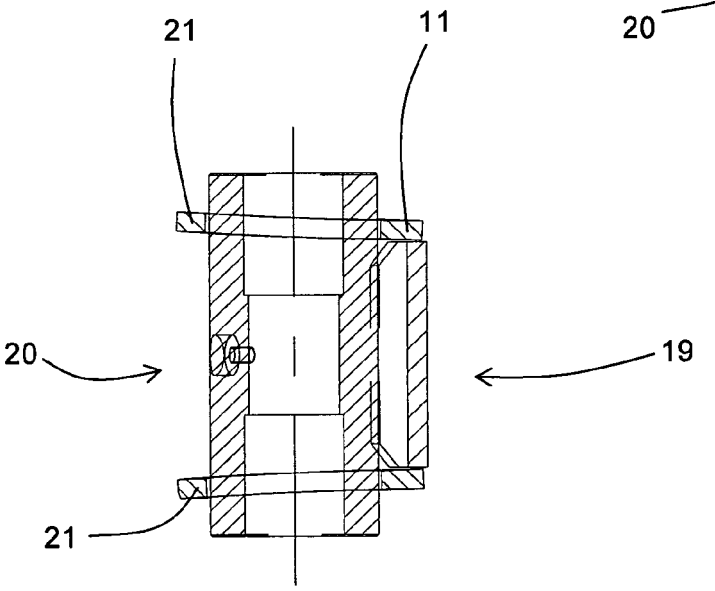

FIG. 14

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 42 5274

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 2002/170212 A1 (SASAKI HIDETOSHI ET AL) 21 November 2002 (2002-11-21) * abstract * * paragraph [0072] - paragraph [0075] * * paragraph [0112] - paragraph [0114] * * figures 1,2,7-10,27,32,22 * -----	1-5,11	E02F9/14 E02F3/38
A	WO 2005/035882 A (THE CHARLES MACHINE WORKS, INC; SEWELL, CODY, L; LUMBERS, MICHAEL, T;) 21 April 2005 (2005-04-21) * abstract * * paragraph [0002] * * paragraph [0022] * * figures 1-6 * -----	7,10,12	
A	GB 2 364 042 A (* KOMATSU LTD) 16 January 2002 (2002-01-16) * abstract * * figures 1,6-9,34,35 * -----	6,9	
A	EP 1 405 954 A (J.C. BAMFORD EXCAVATORS LIMITED) 7 April 2004 (2004-04-07) * abstract * * paragraph [0014] - paragraph [0019] * * figures 1,3 * -----	7,8	TECHNICAL FIELDS SEARCHED (Int.Cl.7) E02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 September 2005	Sheppard, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 42 5274

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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29-09-2005

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82