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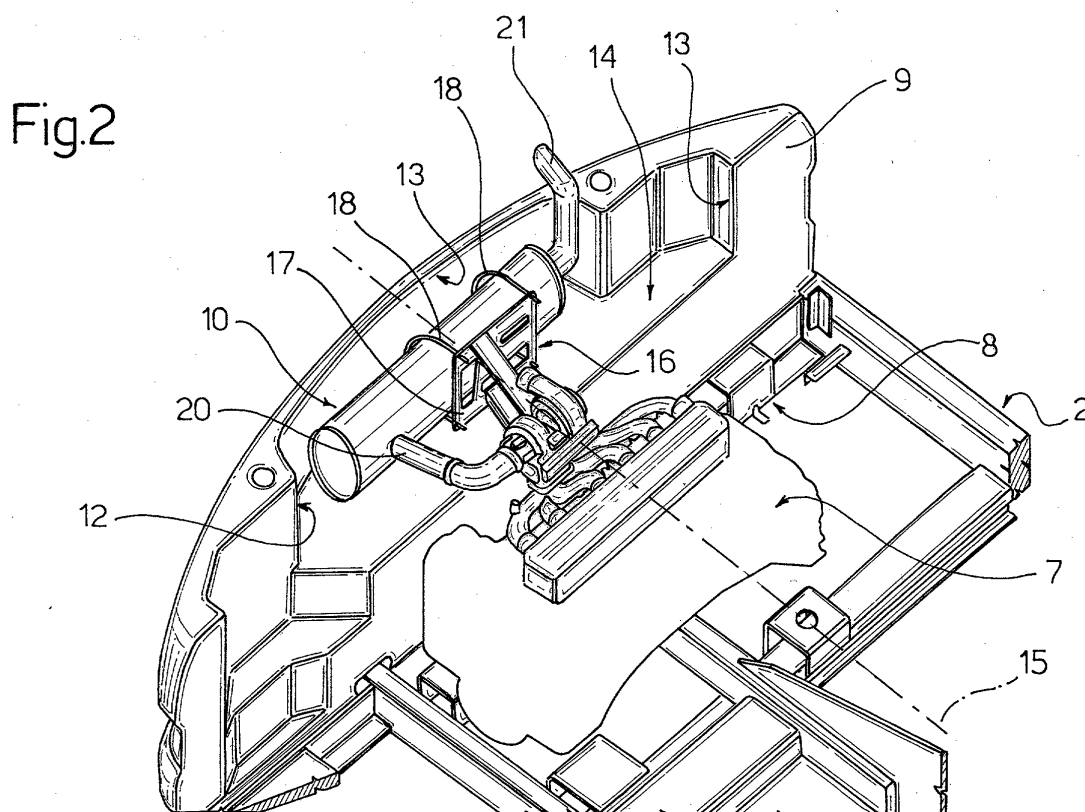
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(54) **Balance weight for an earthmoving machine**

(57) A machine (1), in particular an earthmoving machine, has an upper supporting frame (2), a movable operating member (5), a combustion engine (7) housed in an engine compartment (8) formed on the frame (2), a

muffler (10) connected to the combustion engine (7), and a balance weight (9) located on the opposite side of the combustion engine (7) with respect to the movable operating member (5); the muffler (10) being housed in the balance weight (9).



EP 1 327 722 A1

Description

[0001] The present invention relates to a machine, in particular an earthmoving machine, of the type comprising a frame, a user-controlled operating member, and a combustion engine housed in an engine compartment and having exhaust manifolds connected to an exhaust silencer or so-called muffler. The muffler is normally housed in the engine compartment and connected to the frame by brackets and/or dedicated supports.

[0002] Housing the muffler inside the engine compartment is justified in order to simplify the connection to the engine exhaust outlets. In such a position, however, the muffler, which is a major source of heat, further increases the already high temperature inside the engine compartment, thus impairing operation of the parts concerned.

[0003] Moreover, the size and shape of the muffler are, in most applications, dictated by those of the engine compartment.

[0004] Finally, in addition to emitting heat, known mufflers are also major sources of noise, which poses serious soundproofing problems, by the muffler normally being located adjacent to the operating cab, which therefore calls for additional soundproofing and air conditioning.

[0005] It is therefore an object of the present invention to provide a machine designed to eliminate the aforementioned drawbacks.

[0006] According to the present invention, there is provided a machine, in particular an earthmoving machine, comprising a supporting frame, a movable operating member, a combustion engine housed in an engine compartment formed on the frame, a muffler connected to said combustion engine, and a balance weight located on the opposite side of said combustion engine with respect to said movable operating member; characterized in that said muffler is housed in said balance weight.

[0007] In the machine defined above, said balance weight preferably at least partly defines a cavity having an opening for insertion/removal of said muffler.

[0008] A non-limiting embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a side view of a preferred embodiment of the machine according to the present invention;

Figure 2 shows a view in perspective, with parts removed for clarity, of a rear portion of the Figure 1 machine;

Figure 3 is similar to, and shows a variation of, a feature in Figure 2; and

Figure 4 shows a view in perspective, with parts removed for clarity, of a further variation of a feature in Figure 2.

[0009] Number 1 in Figure 1 indicates as a whole a machine, in particular an earthmoving machine, comprising a supporting frame 2 movable on a carriage 3; an operating cab 4; an operating arm 5 connected to frame 2; a combustion engine 7 housed in an engine compartment 8 formed on frame 2; and a balance weight 9, or so-called ballast, connected to frame 2 on the opposite side of combustion engine 7 with respect to operating arm 5.

[0010] As shown, particularly in Figures 2 to 4, the exhaust outlets of combustion engine 7 are connected to a known elongated exhaust silencer or so-called muffler 10 housed inside balance weight 9. More specifically, as shown in Figure 2, balance weight 9 comprises a cavity 12 which, in the example shown, has two openings 13 for inserting/removing muffler 10. One of the openings 13 is directed towards the top, and the other one towards engine compartment 8. The cavity 12 is further defined at the bottom by a substantially horizontal bottom surface 14 on which muffler 10 is positioned cross-wise so as to extend horizontally and perpendicularly to both the normal travelling direction 15 of machine 1 and the longitudinal members 2a of frame 2. Muffler 10 is locked in this position by a releasable retaining device 16 also housed in cavity 12 and which, in the embodiment described, comprises a bracket 17 integral with combustion engine 7, and two screw ties 18. Muffler 10 comprises an inlet sleeve 20 terminating directly inside engine compartment 8, and an outlet sleeve or tubular body 21 extending upwards and projecting rearwards and outwards of balance weight 9.

[0011] In the Figure 3 variation, balance weight 9 comprises a further inner wall 23 separating cavity 12, and therefore muffler 10, from engine compartment 8. Consequently, cavity 12 only communicates with the outside through an upward-facing opening 24 sized to permit insertion and removal of muffler 10 into and from cavity 12, in which the muffler is located at opening 24. To insert and/or remove muffler 10, wall 23 has a vertical slot 25 extending from and communicating with opening 24, and wider than sleeve 20.

[0012] In the Figure 4 variation, cavity 12 is also closed at the top by a top wall 26 of balance weight 9 integral with the rest of balance weight 9, and communicates with the outside through two facing lateral openings 27 (only one shown in Figure 4) coaxial with an axis A and formed in respective opposite lateral walls 28 of balance weight 9 facing respective sides of machine 1. Cavity 12 - which, in the example described, is a cavity running completely through the balance weight 9 - is substantially complementary in shape to that of muffler 10. The muffler 10 engages cavity 12 in axially-sliding manner and is inserted and removed through one of the openings 27 in a substantially horizontal direction parallel to axis A and again perpendicular to the normal travelling direction 15 and to longitudinal members 2a.

[0013] To insert and remove muffler 10, walls 23 and 26 comprise respective horizontal slots 23a and 26a

which extend from and communicate with insertion/removal opening 27, and are wider than respective sleeves 20 and 21, so that sleeves 20 and 21 slide freely inside respective slots 23a and 26a when inserting and removing the muffler into and from cavity 12.

[0014] Muffler 10 is locked inside said cavity 12 by a releasable retaining device, which comprises, for each opening 27, a threaded U-shaped tie 30, and a bracket 31 forced onto a relative end portion of wall 23.

[0015] As will be clear from the foregoing description, the particular location of muffler 10, i.e. inside balance weight or ballast 9, provides above all for reducing heat emission inside the engine compartment, thus greatly improving the operating conditions of the component parts housed in the engine compartment.

[0016] Locating the muffler inside the ballast 9 and communicating directly with the outside also provides, on the one hand, for concealing the muffler 10 from the outside, and, on the other, for dissipating the heat produced by the muffler 10 both directly outwards - by part of the radiant surface of the muffler communicating directly with the outside at all times - and via the balance weight.

[0017] The particular location of the muffler also provides for reducing acoustic emissions directed towards the operator, by the muffler not only being located further away from the operating cab than in known solutions, but also being housed in a body which, in addition to balancing, also acts as an effective sound barrier and vibration damping element.

[0018] As compared with known solutions, the working conditions of the operator are therefore improved, and the machine calls for less thermal insulation and soundproofing of the cab, thus reducing cost, while at the same time greatly improving appearance.

[0019] Since a cavity of any size and/or shape can be formed in the balance weight, there is no limit to the size and/or shape of the muffler, which may therefore be selected freely at the design stage.

[0020] Clearly, changes may be made to machine 1 as described herein without, however, departing from the scope of the present invention. In particular, muffler 10 may be of a size and shape other than those indicated, and may be connected to parts of balance weight 9 and in locations other than those described by way of example. Also, machine 1 may comprise a frame and a movable arm other than those indicated, and the relative locations of the engine, cab, and movable arm may differ from those described and illustrated.

Claims

1. A machine (1), in particular an earthmoving machine, comprising a supporting frame (2), a movable operating member (5), a combustion engine (7) housed in an engine compartment (8) formed on the frame (2), a muffler (10) connected to said combustion engine (7), and a balance weight (9) located on the opposite side of said combustion engine (7) with respect to said movable operating member (5); and

characterized in that said muffler (10) is housed in said balance weight (9).

2. A machine according to claim 1, **characterized in that** said balance weight (9) at least partly defines a cavity (12) having an insertion/removal opening (13; 24; 27) for insertion/removal of said muffler (10).

3. A machine according to claim 2, **characterized in that** said insertion/removal opening (13; 24) for insertion/removal of said muffler (10) faces upwards.

4. A machine according to claim 3, **characterized in that** said muffler (10) is elongated in shape, and is positioned horizontally inside said cavity (12) and entirely at said insertion/removal opening (13; 24).

5. A machine according to any one of claims 2 to 4, **characterized in that** said cavity (12) is defined by an inner lateral wall (23) of said balance weight (9) facing said combustion engine (7); said inner lateral wall (23) separating said cavity (12) from said engine compartment (8).

6. A machine according to claim 5, **characterized in that** said inner lateral wall (23) comprises a slot (25) extending from said insertion/removal opening (24) and engaged by a tubular inlet body (20) of the muffler (10) terminating in said engine compartment (8); said slot (25) having transverse dimensions greater than the outer transverse dimensions of said tubular inlet body (20).

7. A machine according to claim 5 or 6, **characterized in that** said insertion/removal opening (27) extends through a lateral wall (28) of said balance weight (9); said muffler (10) being inserted into and removed from said cavity (12) in a substantially horizontal direction.

8. A machine according to claim 7, **characterized in that** said frame (2) comprises two longitudinal members (2a); and **in that** said direction is substantially perpendicular to said longitudinal members (2a).

9. A machine according to claim 7 or 8, **characterized in that** said cavity (12) is defined at the top by a top wall (26) of said balance weight (9); said top wall (26) comprising an end slot (26a) extending from said insertion/removal opening and partly engaged by a tubular outlet body (21) of said muffler (10); said slot (26a) having transverse dimensions greater than the transverse dimensions of said tubular

outlet body (21).

10. A machine according to any one of claims 2 to 9,
characterized in that said cavity (12) has outer di- 5
mensions greater than the corresponding outer di-
mensions of said muffler; releasable retaining
means (16; 30,31) being provided to lock said muf-
fler (10) inside said cavity (12).
11. A machine according to claim 10, **characterized in** 10
that said retaining means (16) are at least partly
housed in said cavity (12).
12. A machine according to any one of claims 2 to 11,
characterized in that said cavity (12) is substan- 15
tially complementary in shape to that of said muffler
(10); and **in that** the muffler (10) is fitted to said cav-
ity (12) in sliding manner.

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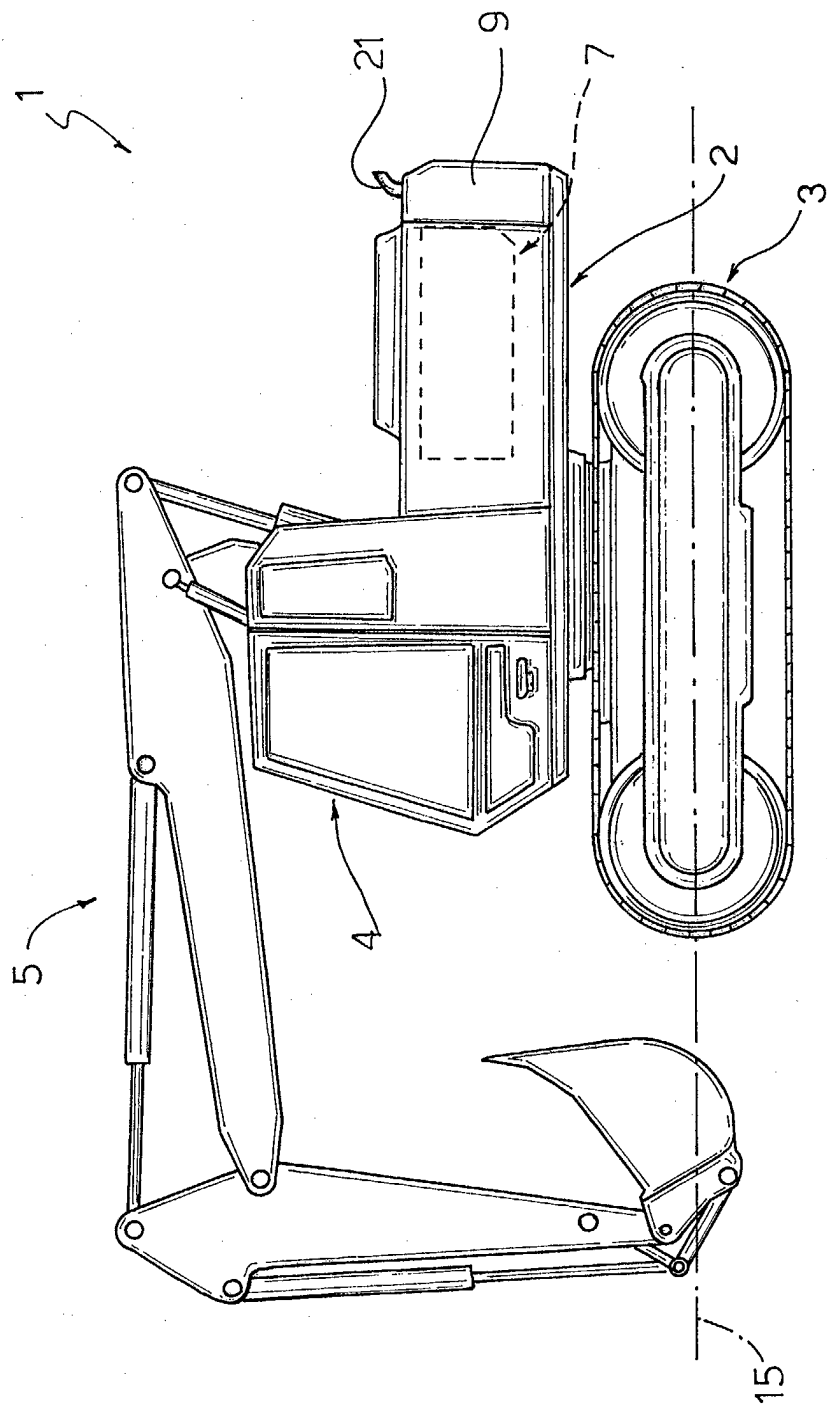


Fig.1

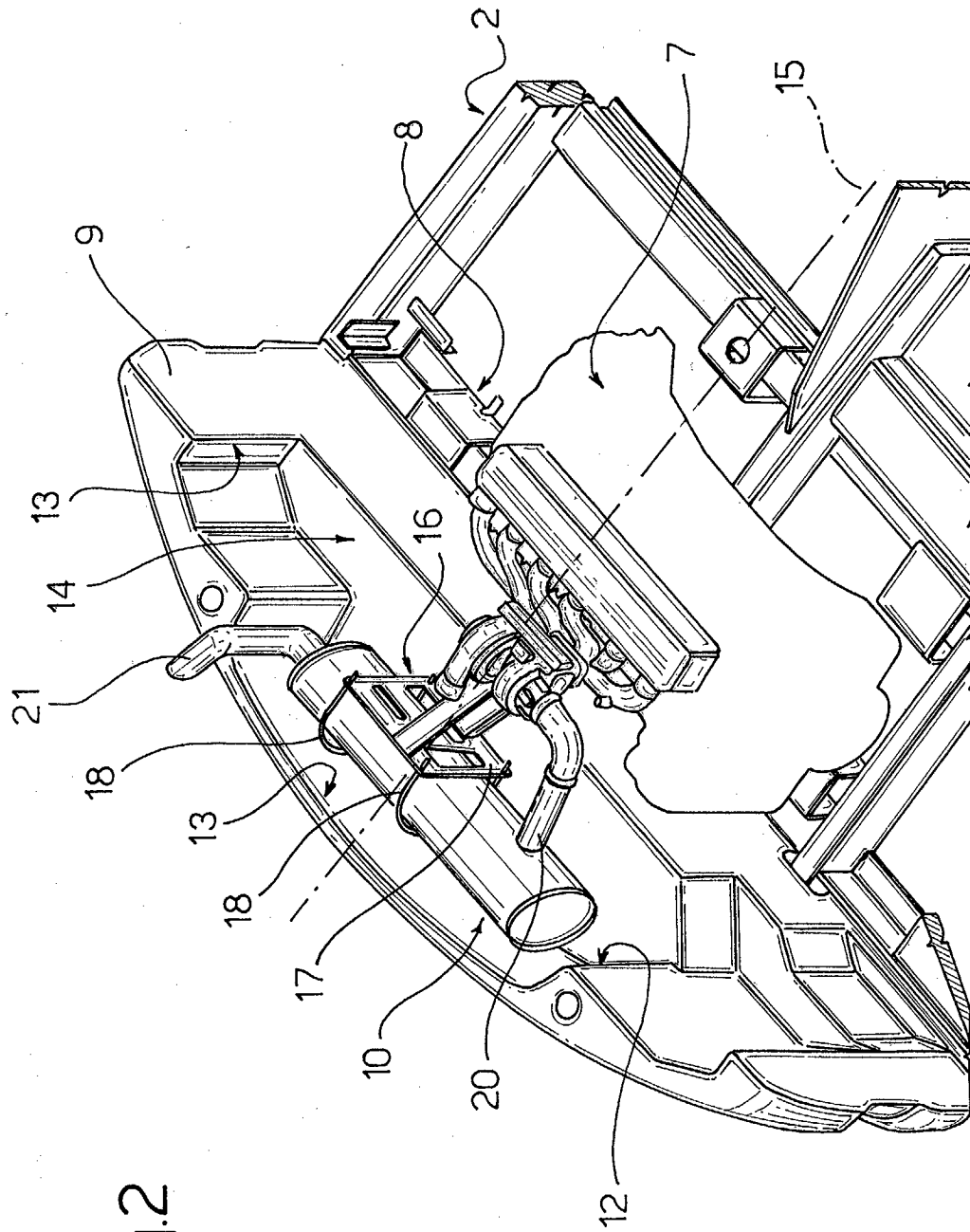


Fig.2

Fig.3

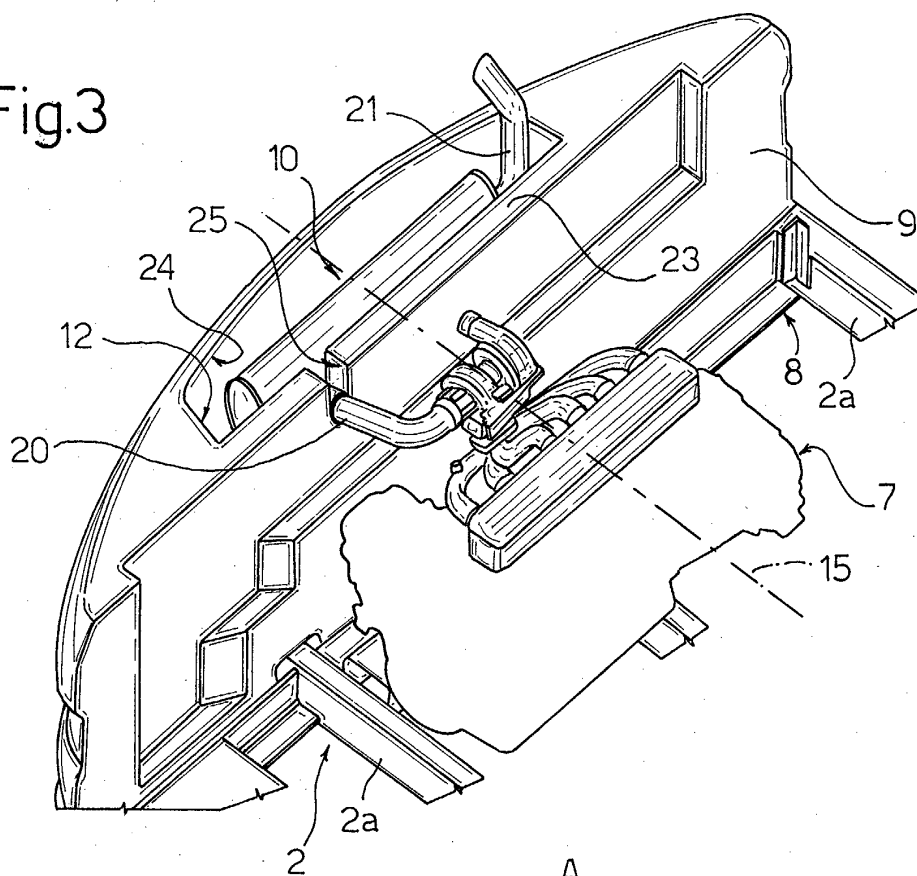
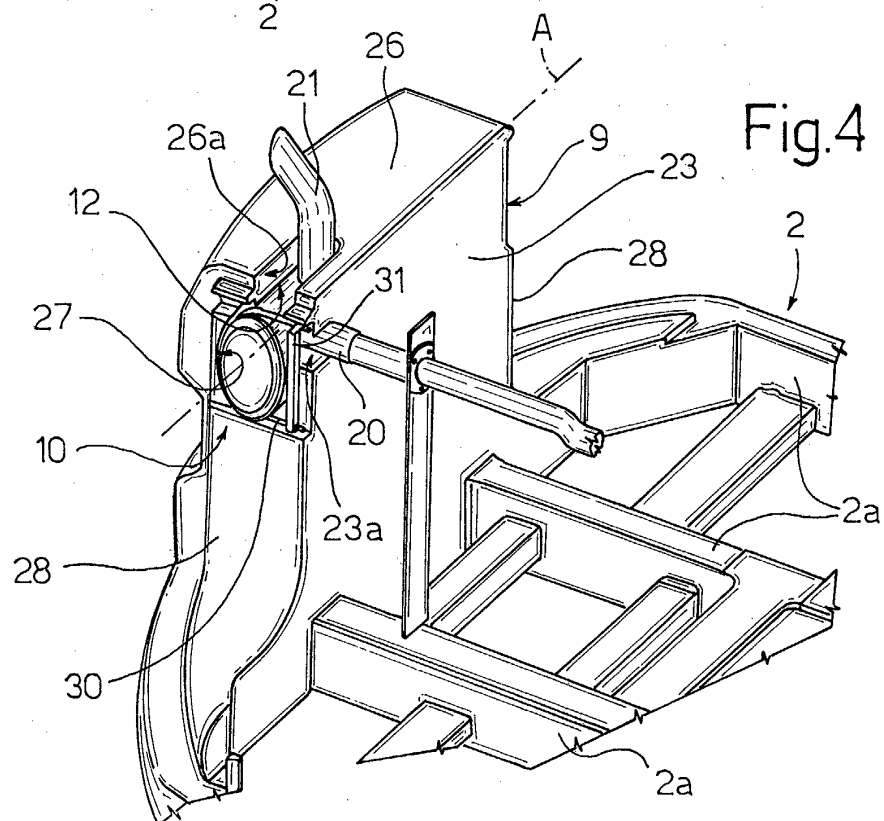


Fig.4





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EUROPEAN SEARCH REPORT

Application Number
EP 02 08 0538

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 March 2003	Examiner Guthmuller, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EUROPEAN SEARCH REPORT

Application Number
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Place of search THE HAGUE		Date of completion of the search 17 March 2003	Examiner Guthmuller, J
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