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(54) Compactor with vibrating bottom plate

(57) A compactor (11) has a bottom plate (12) which for compacting of sand, gravel, macadam etc. is vibratable by means of a vibrating element (13), which is rigidly connected to the bottom plate (12). An upper part (15) which is elastically connected to the bottom plate (12) is adapted to weigh down the bottom plate (12) and supports a drive motor (16) for driving the vibrating element (13). The drive motor (16) is an electric motor, which is driven by an electric accumulator unit which is mounted on the upper part (15) and which comprises at least one rechargeable battery (23-25) which constitutes a weight for weighing down the bottom plate (12).

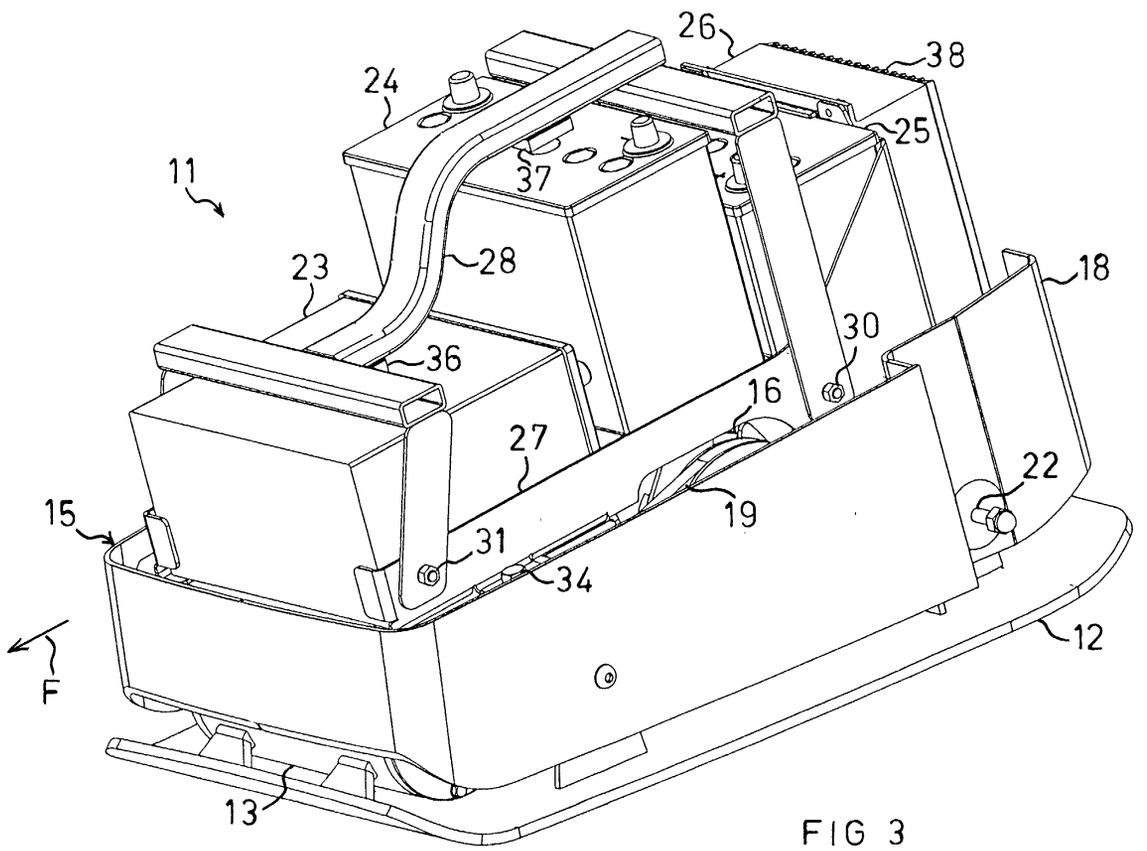

FIG 3

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Description

Field of the Invention

[0001] The present invention relates to a compactor, comprising a bottom plate which for compacting of sand, gravel, macadam etc. is vibratable by means of a vibrating element which is rigidly connected to the bottom plate, and an upper part which is elastically connected to the bottom plate and adapted to weigh down the bottom plate and which supports a drive motor for driving the vibrating element.

Background Art

[0002] Machines of the type mentioned by way of introduction have been known for a long time and are used when working with the soil, such as in connection with paving, road building, asphalting or preparation of foundations and ditches. They have a petrol- or diesel-powered internal combustion engine, which hydraulically or by means of a drive belt drives a rotary shaft of a vibrating element, on which shaft weights are eccentrically arranged to cause the vibrating element to vibrate at a frequency which is dependent on the speed of rotation of the rotary shaft.

[0003] For the thus achieved vibrations, which owing to the rigid connection between the vibrating element and the bottom plate are propagated to the bottom plate, to cause as good compacting as possible, it is crucial for the vibrating bottom plate to be weighed down against the ground. This is traditionally achieved by the upper part of the machine being made of very thick metal sheet or cast iron.

[0004] A great advantage of the prior art machines with their internal combustion engines is that after being filled with fuel they can operate freely and independently for relatively long periods.

[0005] A drawback of the prior art machines is that their internal combustion engines produce exhaust gases which influence the environment as such and in particular the operator's work environment, especially when working in deep ditches in which the exhaust gases often remain for a long time.

[0006] A further drawback is that the internal combustion engines also cause undesirable vibrations which via the operating handle of the machine are propagated to the operator and thus can injure him. Since the engine as well as the operating handle are mounted on the upper part of the machine, it is more difficult to keep these vibrations away from the operating handle than the vibrating motions from the bottom plate which in fact is elastically connected to the upper part of the machine.

[0007] One more drawback is that the prior art petrol-powered and, in particular the diesel-powered, engines of the machines cause heavy noise, which means that also driving on fine-grained materials, such as sand, which only cause a relatively faint sound, is accompanied by noise on acoustic pressure levels that are injurious to health.

Object of the Invention

[0008] In view of that stated above, the object of the invention is to provide a compactor of the type mentioned by way of introduction, which can operate freely and independently, does not cause any exhaust gases injurious to health, is easy to devibrate and has a motor which operates more silently than a petrol or diesel engine.

Summary of the Invention

[0009] According to the invention, this object is achieved in that the drive motor is an electric motor, which is driven by an electric accumulator unit which is mounted on the upper part and which comprises at least one rechargeable battery which constitutes a weight for weighing down the bottom plate.

[0010] Only by consciously using according to the invention the weight of the rechargeable battery to load or weigh down the bottom plate and, of course, by simultaneously minimising the weight of the upper part, will it be possible to provide a battery-operated compactor, whose total weight with regard to its power can be compared with that of a traditional machine with an internal combustion engine, with a battery capacity which suffices for about 1.5-2 hours of operation, which well satisfies the need during a normal work day for such a machine, for instance in connection with paving or preparation of ditches. The fact that the limit for the total weight is not exceeded, as well as a low point of balance, is important for the operability of a compactor, i.e. a traditional machine, originally intended for an internal combustion engine but provided with an electric motor and an associated battery, would be too heavy and unstable for practical use.

[0011] According to the invention, the vibrating element is preferably arranged at the front edge of the bottom plate seen in the travelling direction of the machine, and the electric motor is arranged behind and essentially on the same level as said element. Such an arrangement especially of the electric motor brings the advantage that the machine can be made very compact and low, which is advantageous for its operability.

[0012] Preferably, the electric motor is adapted to drive the vibrating element by means of a drive belt since this is the type of transmission that has the lowest weight and which consequently provides space for a maximum of battery capacity.

[0013] Alternatively, the vibrating element and the electric motor can form a unit, which with respect to the travelling direction of the machine is arranged at the front edge or centre of the bottom plate. The advantage of such a solution is that it is both relatively light-weight and compact and that it thus provides space for an ac-

cumulator unit with a very great capacity.

[0014] Conveniently, the upper part has impact absorbers which are directed towards the bottom plate and adapted to softly absorb great motions of the upper part which are directed towards the bottom plate. This is very important for the compactor according to the invention since otherwise there is a risk that the battery will be damaged, for instance when unloading the machine from a lorry platform in a careless manner.

[0015] The accumulator unit suitably comprises a charger which is directly connectable to mains for charging the rechargeable battery since in this way it will be easy to ensure that the battery of the machine is properly charged when necessary.

[0016] Preferably, the accumulator unit is a module which in one piece is mountable on and removable from the upper part. Such a solution involving a module is practical since it easily enables manufacture of machines with different battery capacities and/or with chargers of different capacities and since it facilitates maintenance.

[0017] Finally, the accumulator unit preferably comprises at least two rechargeable batteries and a yoke which extends over the batteries to retain them on the accumulator unit and which has a first end pivotally connected to the accumulator unit and a second end releasably connected to the accumulator unit, in such manner that the yoke, when its second end is released, is pivotable away for simultaneous release of the batteries. The advantage of this solution is that mounting and dismounting of the batteries is facilitated significantly and that incorrect mounting, which in the very demanding environment that is involved can easily cause damage to the batteries, is practically out of the question.

Brief Description of the Drawings

[0018] A prior art compactor and a preferred embodiment of the inventive compactor will be described in more detail below with reference to the accompanying drawings, in which

Fig. 1 is a side view of the prior art compactor;
Fig. 2 is a front view of the prior art compactor, however with a portion of a belt cover broken away;
Fig. 3 shows the most important parts of the machine according to the invention in perspective obliquely from the front;
Fig. 4 is a corresponding perspective view of the bottom plate of this machine and also some associated parts;
Fig. 5 is a corresponding perspective view of the drive motor of this machine and also some associated parts, however with a wall portion broken away; and
Fig. 6 is a corresponding perspective view of the accumulator package of this machine.

Description of an Embodiment

[0019] The prior art compactor 1 shown in Figs 1 and 2 has a bottom plate 2, which for compacting of sand, gravel, macadam etc. is vibratable by means of a vibrating element 3 of the above-mentioned type, which, seen in the travelling direction F of the machine 1 at the front edge of the bottom plate 2, is rigidly connected to this plate 2. Moreover, the machine 1 has an upper part 4 which is elastically connected to the bottom plate 2 by means of vibration insulators (not shown), is adapted to weigh down the bottom plate 2 and supports an internal combustion engine 5 for driving the vibrating element 3. The transmission between the engine 5 and the vibrating element 3 comprises a centrifugal clutch 6 on the output shaft of the engine and a drive belt 7 which runs over a pulley on the output shaft of the clutch 6 and over a pulley 8 on the shaft of the vibrating element. Finally, the machine 1 has an operating handle 9 fixed to the rear edge of the upper part 4 and, suspended from the operating handle, transport wheels 10 which, for moving the machine 1 in switched-off state, are attachable to the bottom plate 2 in a manner not shown.

[0020] The embodiment of the compactor 11 according to the invention as illustrated in Figs 3-6 also has a bottom plate 12 which is vibratable by means of a vibrating element 13 arranged at the front edge of the bottom plate 12 and which by means of four rubber pads 14 is elastically connected to an upper part 15, which is adapted to weigh down the bottom plate 12. In this machine 11, the upper part 15, however, supports an electric motor 16, which, seen in the travelling direction F of the machine, is arranged behind and essentially on the same level as the vibrating element 13 in a special, upwards open compartment 17 in a first sheet metal frame 18 associated with the upper part 15. The transmission between the motor 16 and the vibrating element 13 also in this case comprises a drive belt 19 which runs over pulleys 20, 21, but since the electric motor 16 need not be capable of idling, the centrifugal clutch of the prior art machine is missing and the driving pulley 21 is arranged on the shaft of the electric motor 16 instead. Of course, the machine 11 according to the invention also has an operating handle which is attached to the rear edge of the upper part 15. However, the handle is not shown in the drawings of the machine 11 since it may be designed in many different, but well-known, manners. On the other hand, it should be pointed out that the fixing points 22 of the handle on the first sheet metal frame 18 of the upper part 15 are consciously positioned at a low level in order to obtain as low a tilting moment as possible when operating the machine 11 sideways.

[0021] The electric motor 11, which is mounted on the machine 11 according to the preferred embodiment of the invention, is an enclosed direct-current motor. For driving of the motor, three rechargeable lead batteries 23-25 along with a charger 26 are mounted in such manner on a second sheet metal frame 27 associated with

the upper part 15 that they, together with this sheet metal frame 27 and a locking yoke 28 mounted on the sheet metal frame 27 which holds the batteries 23-25 in place, form a module 29 which is clearly illustrated in Fig. 6. As will be seen, the locking yoke 28 is designed and screwed to said second sheet metal frame 27 in such manner, that after removal of rear screws 30 on both sides of the second sheet metal frame 27, it can be pivoted forwards on front screws 31 on both sides of this sheet metal frame for simultaneous release of all three batteries 23, 25. Moreover the second sheet metal frame 27 has in its lower part lugs 32, 33 extending sideways, through which screws 34 can be inserted for attaching the second sheet metal frame 27 and, thus, the module 29 to the first sheet metal frame 18 of the upper part 15.

[0022] In order to ensure that neither the vibration insulators 14 nor the batteries 23-25 are damaged in careless handling of the machine 11, for instance when loading and unloading the same or when changing batteries and in connection with service, impact absorbers of rubber are arranged between the upper part 15 and the bottom plate 12, on the one hand in the front part at 34 on the underside of the upper part 15 and, on the other hand, in the rear part at 35, which impact absorbers 34, 35, for operation, only come into contact with the respective opposite machine parts (the vibrating element 13 for the front impact absorbers 34 and the first sheet metal frame 18 for the rear impact absorbers 35) in connection with great motions of the upper part 15 towards the bottom plate 12. Moreover, especially for protecting the batteries, rubber pads 36, 37 are arranged between said locking yoke 28 and the batteries 23, 24, and the batteries 23, 25 can rest on a yieldable base of e.g. foam rubber (not shown) .

[0023] The shown charger 26 has a very great capacity and can, by being connected to mains, recharge the batteries completely within a few hours. Owing to its great capacity, the charger has a relatively great cooling requirement which is satisfied by means of cooling flanges 38 which cover one side of the charger 26. This side is in the shown embodiment of the compactor 11 directed to the rear of the machine so that its cooling flanges 38 for maximum cooling extend essentially vertically and preferably are uncovered in a special vent opening in a machine cover (not shown) which covers and protects at least said module 29.

[0024] It will be appreciated that the above described embodiment of the compactor 11 according to the invention can be modified in various ways within the scope of the claims and that, for instance, the vibrating element instead of the illustrated simple variant may have a forward-back function, the transmission instead of the shown drive belt solution may comprise hydraulic transmission, the batteries instead of the shown lead batteries may be some other convenient type and the charger instead of the shown quick charger may have a lower capacity for recharging of the batteries by night.

Claims

1. A compactor, comprising a bottom plate (12) which for compacting of sand, gravel, macadam etc. is vibratable by means of a vibrating element (13) which is rigidly connected to the bottom plate (12), and an upper part (15) which is elastically connected to the bottom plate (12) and adapted to weigh down the bottom plate (12) and which supports a drive motor (16) for driving the vibrating element (13), **characterised in that** the drive motor (16) is an electric motor, which is driven by an electric accumulator unit which is mounted on the upper part (15) and which comprises at least one rechargeable battery (23-25) which constitutes a weight for weighing down the bottom plate (12).

2. A machine as claimed in claim 1, **characterised in that** the vibrating element (13) is arranged at the front edge of the bottom plate (12) seen in the travelling direction (F) of the machine, and that the electric motor (16) is arranged behind and essentially on the same level as said element (13).

3. A machine as claimed in claim 1 or 2, **characterised in that** the electric motor is adapted to drive the vibrating element (13) by means of a drive belt (19).

4. A machine as claimed in claim 1, **characterised in that** the vibrating element (13) and the electric motor form a unit, which with respect to the travelling direction (F) of the machine is arranged at the front edge of the bottom plate (12).

5. A machine as claimed in claim 1, **characterised in that** the vibrating element (13) and the electric motor form a unit which with respect to the travelling direction (F) of the machine is arranged in the centre of the bottom plate (12).

6. A machine as claimed in any one of claims 1-5, **characterised in that** the upper part (15) has impact absorbers (34, 35) which are directed towards the bottom plate (12) and adapted to softly absorb great motions of the upper part (15) which are directed towards the bottom plate (12).

7. A machine as claimed in any one of claims 1-6, **characterised in that** the accumulator unit comprises a charger (26) which is directly connectable to mains for charging the rechargeable battery (23-25).

8. A machine as claimed in any one of claims 1-7, **characterised in that** the accumulator unit is a module (29) which in one piece is mountable on and removable from the upper part (15).

9. A machine as claimed in any one of claims 1-8, **characterised in that** the accumulator unit comprises at least two rechargeable batteries (23-25) and a yoke (28) which extends over the batteries (23-25) to retain them on the accumulator unit and which has a first end (31) pivotally connected to the accumulator unit and a second end (30) releasably connected to the accumulator unit, in such manner that the yoke (28), when its second end is released, is pivotable away for simultaneous release of the batteries (23-25).

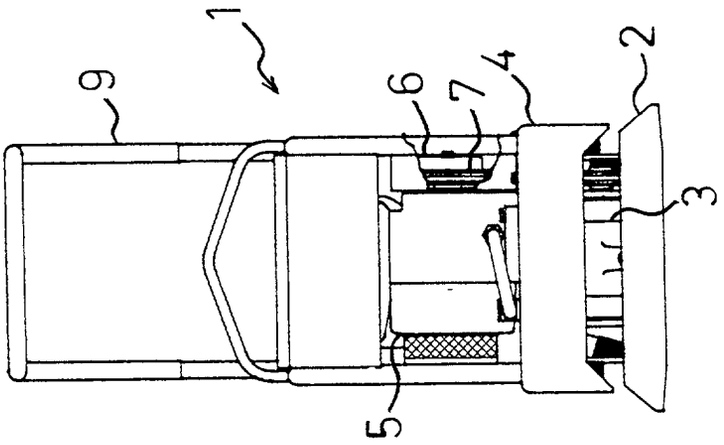

FIG 2

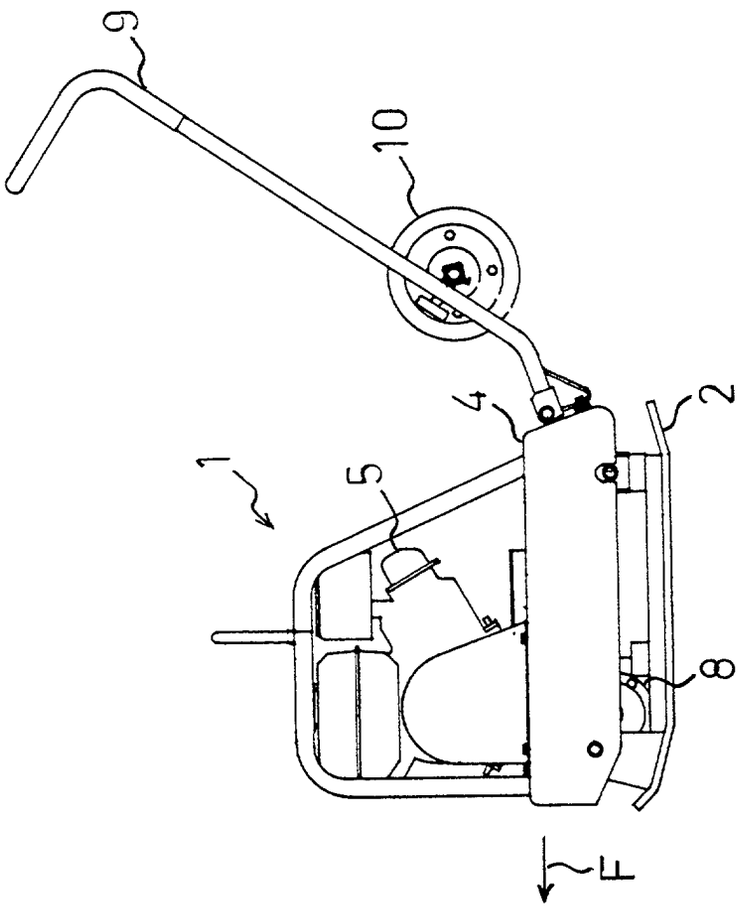

FIG 1

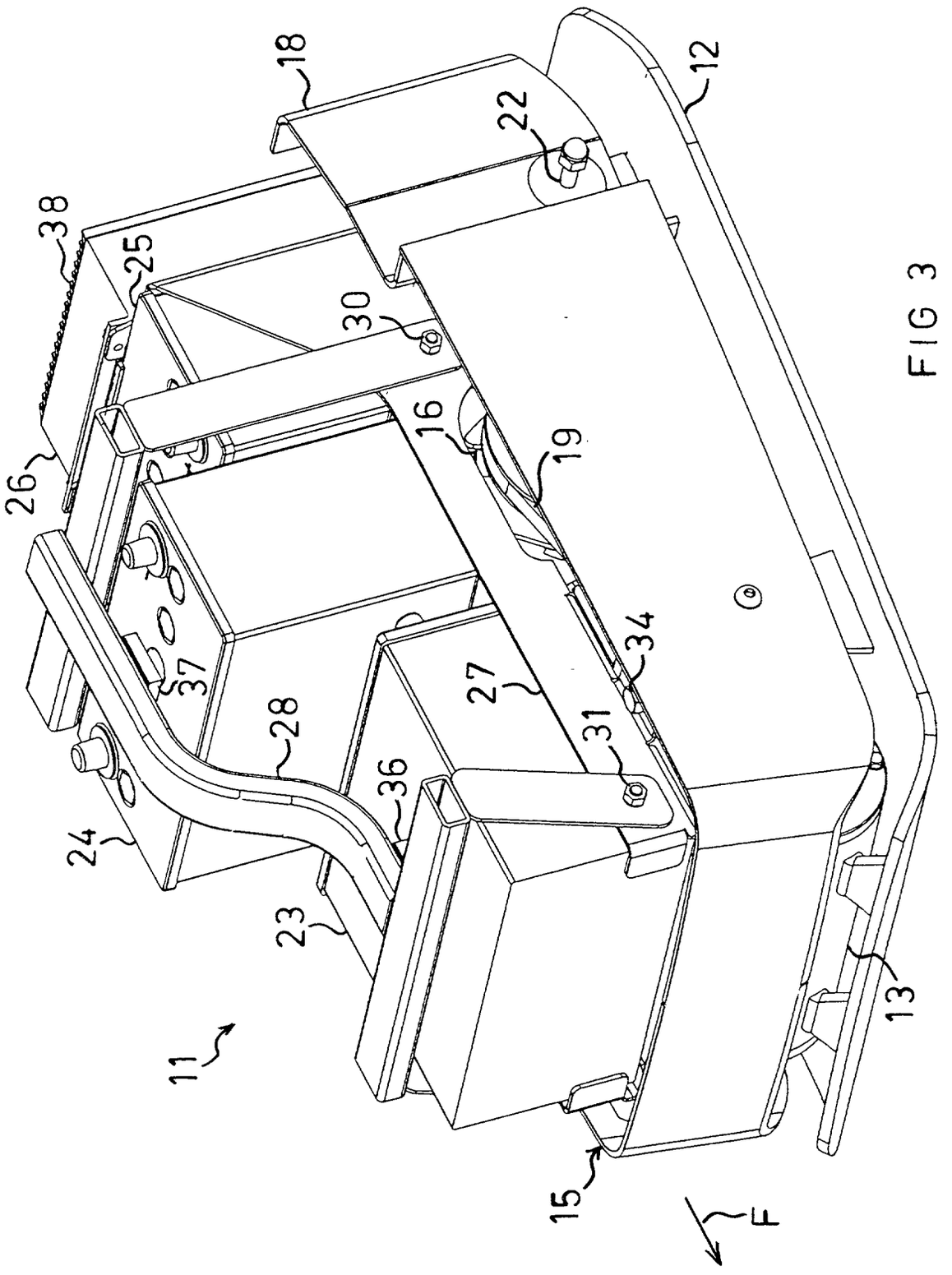

FIG 3

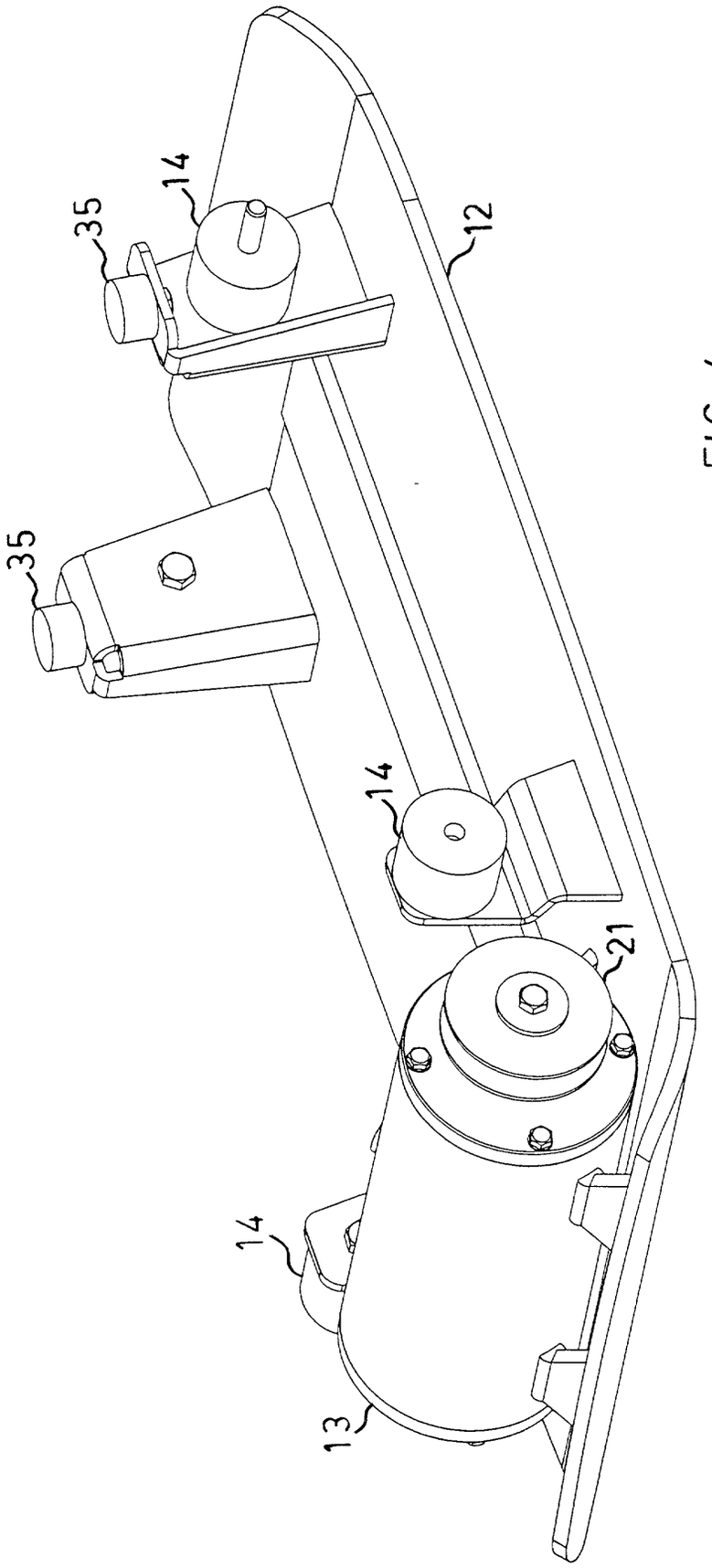

FIG 4

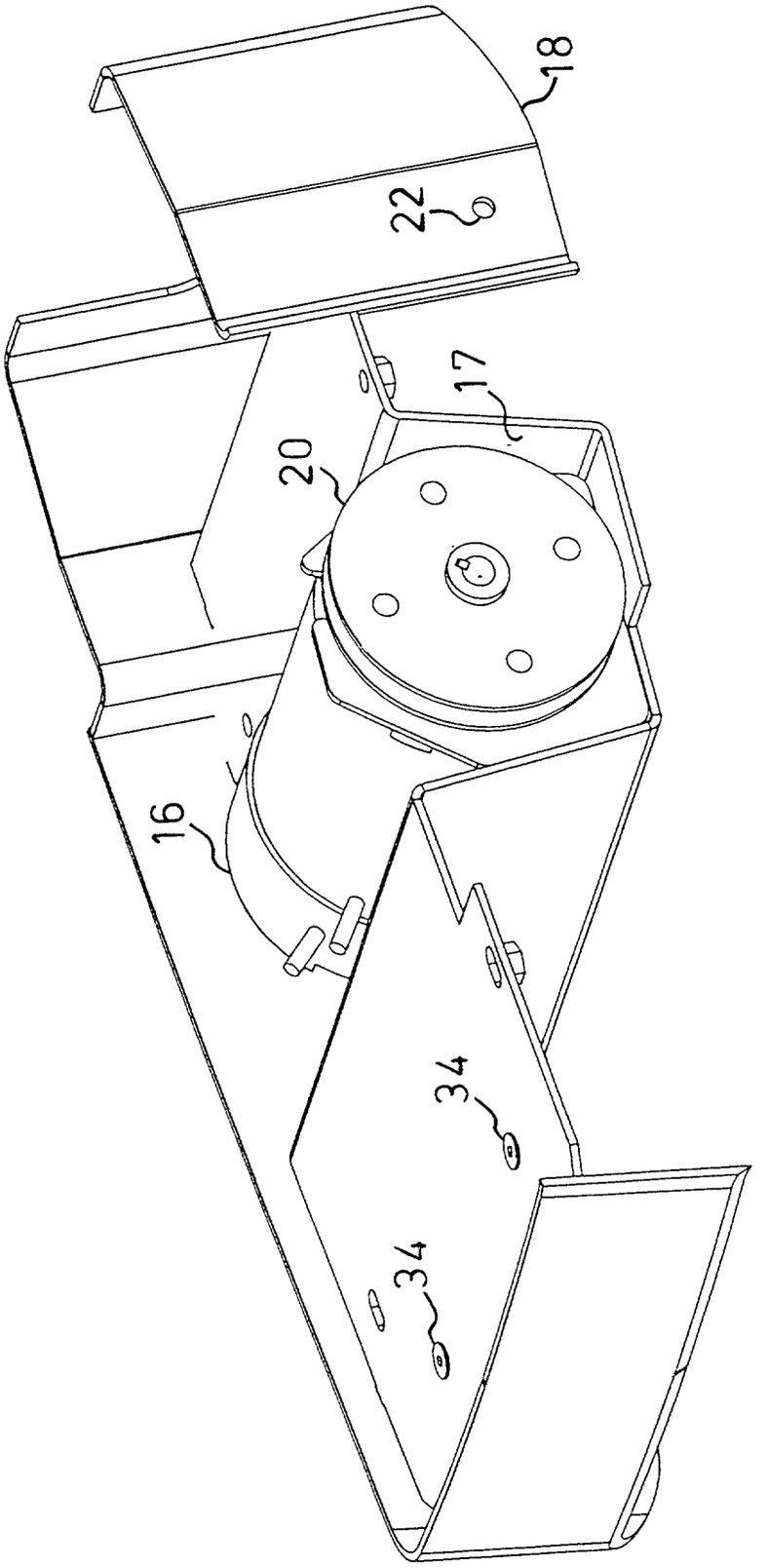

FIG 5

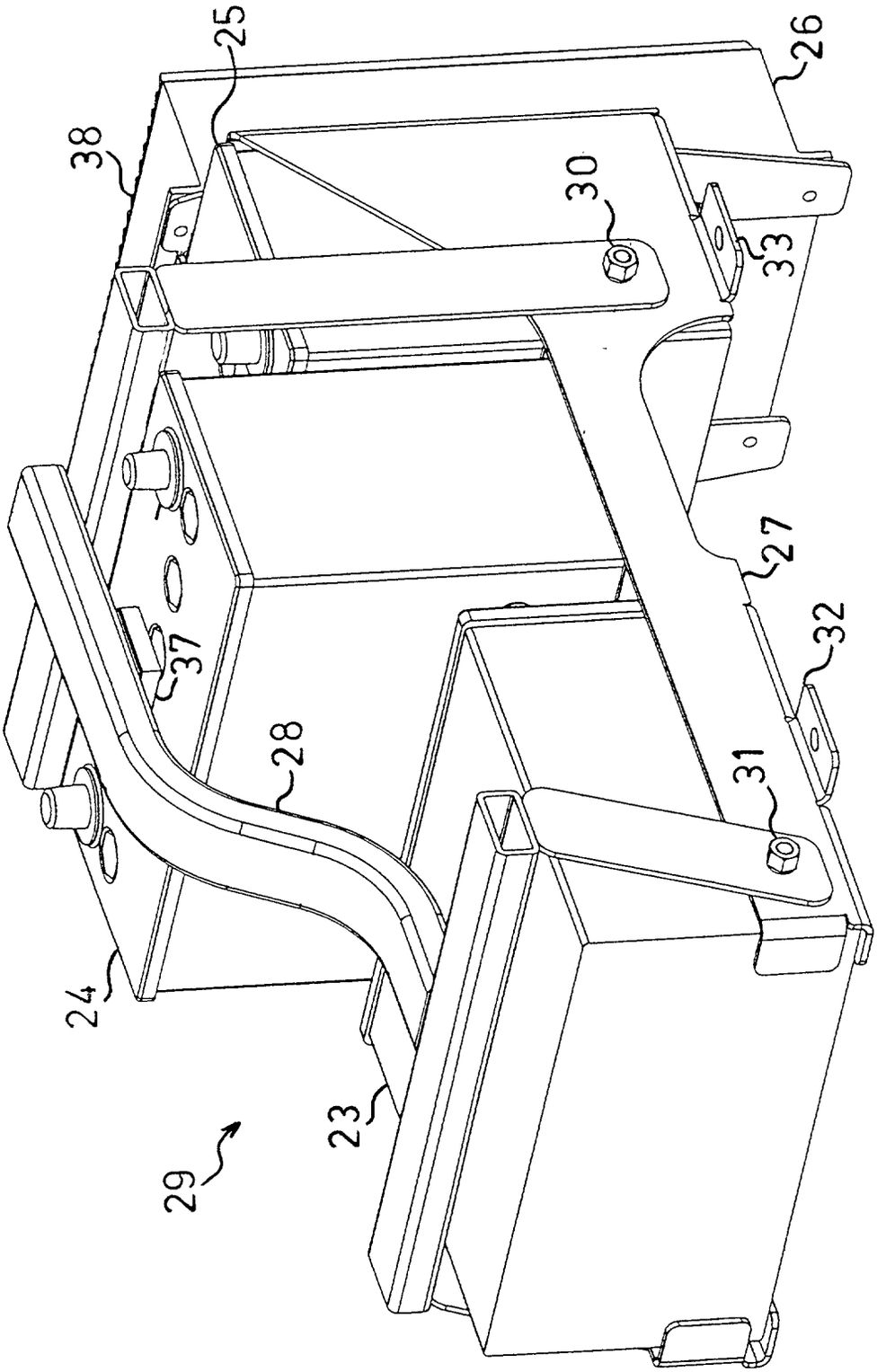

FIG 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 85 0105

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)
A	GB 2 289 490 A (MAWSLEY MACHINERY LTD) 22 November 1995 (1995-11-22) * page 2, line 12 - line 14 * * page 2, line 20 - page 3, line 18; figure *	1,3,6	E01C19/38 E02D3/074
A	DE 199 53 553 A (MOZDZANOWSKI JOACHIM) 21 June 2000 (2000-06-21) * column 3, line 38 - line 45; figure 5 *	1,6	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E01C
E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 November 2001	Dijkstra, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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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05-11-2001

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