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(54) SELF-LEVELLING EQUIPMENT FOR MANIPULATING SOLID SURFACES

SELBSTNIVELLIERENDE AUSRÜSTUNG ZUR MANIPULATION FESTER OBERFLÄCHEN

EQUIPEMENT DE NIVELLEMENT AUTOMATIQUE POUR LA MANIPULATION DE SURFACES SOLIDES

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EP 4 269 701 B1

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Description

[0001] The present invention relates to a self-levelling equipment for manipulating solid surfaces of the type specified in the preamble to the first claim.

[0002] More particularly, the present invention has as its object a milling machine suitable for being installed on a self-propelled machine to enable the removal or milling of a solid surface layer, for example made of asphalt or concrete.

[0003] As is well known, among the equipment for manipulating solid surfaces the road milling machines are widely used. The latter are auxiliary devices generally installed on self-propelled machines and used to remove or mill off predetermined portions of a solid surface that may be, for example, a road surface, soil or other solid pavement.

[0004] In particular, the milling machines allow a layer of the solid surface to be manipulated in order to restore, or excavate for subsequent filling, the surface.

[0005] In order to ensure that the surface is manipulated to the same depth, the milling machines of the known technique may comprise lateral support elements to the solid surface, essentially skids, which run on the surface and control the relative position between the cutting edges and the surface, in particular by keeping the depth of the cutting edges constant even when the milling machine varies its inclination with respect to the support surface.

[0006] In this case, the milling machines are therefore called self-levelling.

[0007] Such milling machines are described, for example, in patent documents IT1019900790697, EP-B-3191647, EP-B-1222333 and US-A-2019/127930.

[0008] Both documents describe, in fact, milling machines comprising working or digging means rotatably supported by a main frame, and an adjustment frame defining at least one substantially flat contact portion suitable for contacting a corresponding portion of the surface to be machined, wherein the position of the adjustment frame with respect to the main support frame can be set so as to control the working depth of the working means.

[0009] The movement of the adjustment frame is performed by means of adjustment means comprising a first attachment arm articulated on the support frame by means of a first attachment pin extending from the first attachment arm in such a way that rotating the first attachment arm around the pin in two opposite directions of rotation results in translation of the adjustment frame.

[0010] In particular, the adjustment frame is fixed to the main support frame in such a way as to be translatable with respect to the main support frame in a plane perpendicular to the rotation axis of the working or digging means or rotatable with respect to the main support frame in a main rotation axis substantially parallel to the rotation axis of the digging means.

[0011] In detail, the main support frame and the adjustment frame are coupled together by means of a first

engagement pin and guiding means.

[0012] The first engagement pin extends along a direction parallel to the main rotation axis and comprises at least one free end portion engaged in a first engagement slot extending along an arched, or semi-circular shape, suitable to allow the engagement pin to translate along the first engagement slot.

[0013] The guiding means comprise a proximity portion, extending along a direction substantially parallel to the rotation plane of the working or digging means, and an end portion, shaped like a plate extending from the proximity portion substantially parallel to the rotation plane of the working or digging means, defining therebetween an engagement gap in which a portion of the adjustment frame is smoothly received.

[0014] The known technique described includes some important drawbacks.

[0015] In particular, the end portion interacting with the engagement guides and pins does not allow the adjustment frame to be stably engaged to the main frame especially when the adjustment frame is subjected to vibratory transverse forces.

[0016] Furthermore, replacement of the end portion with corresponding pairs of engagement rails and pins, as for example indicated in paragraph 44 of document EP-B-3191647, may even worsen the stability of the adjustment frame.

[0017] In this situation, the technical task underlying the present invention is to devise a self-levelling equipment for manipulating solid surfaces capable of substantially obviating at least part of the aforementioned drawbacks.

[0018] In the context of said technical task, it is an important scope of the invention to obtain a self-levelling equipment for manipulating solid surfaces which is sufficiently stable.

[0019] Therefore, it is another important purpose of the invention to achieve a self-levelling equipment for manipulating solid surfaces that allows manipulations with high precision. The specified technical task and purposes are achieved by a self-levelling equipment for manipulating solid surfaces as claimed in the appended claim 1.

[0020] Preferred technical solutions are disclosed in the dependent claims.

[0021] The features and advantages of the invention are hereinafter clarified by the detailed description of preferred embodiments of the invention, with reference to the appended drawings, in which:

the **Fig. 1** illustrates a perspective view of a self-levelling equipment for manipulating solid surfaces according to the invention in a first configuration in which the support means are lowered relative to the frame and the manipulating means define a reduced penetration depth;
the **Fig. 2** illustrates a side view of the equipment of Fig. 1;
the **Fig. 3** is a perspective view of a self-levelling

equipment for manipulating solid surfaces according to the invention in a second configuration in which the support means are raised relative to the frame and the manipulating means define a greater depth of penetration than the configuration of Figs. 1-2; and the Fig. 4 represents a side view of the equipment of Fig. 3.

[0022] In the present document, the measurements, values, shapes and geometric references (such as perpendicularity and parallelism), when associated with words like "about" or other similar terms such as "approximately" or "substantially", are to be considered as except for measurement errors or inaccuracies due to production and/or manufacturing errors, and, above all, except for a slight divergence from the value, measurements, shape, or geometric reference with which it is associated. For instance, these terms, if associated with a value, preferably indicate a divergence of not more than 10% of the value.

[0023] Moreover, when used, terms such as "first", "second", "higher", "lower", "main" and "secondary" do not necessarily identify an order, a priority of relationship or a relative position, but can simply be used to clearly distinguish between their different components.

[0024] Unless otherwise specified, as results in the following discussions, terms such as "treatment", "computing", "determination", "calculation", or similar, refer to the action and/or processes of a computer or similar electronic calculation device that manipulates and/or transforms data represented as physical, such as electronic quantities of registers of a computer system and/or memories in, other data similarly represented as physical quantities within computer systems, registers or other storage, transmission or information displaying devices.

[0025] The measurements and data reported in this text are to be considered, unless otherwise indicated, as performed in the International Standard Atmosphere ICAO (ISO 2533:1975).

[0026] With reference to the Figures, the self-levelling equipment for manipulating solid surfaces according to the invention is globally referred to as 1.

[0027] The equipment 1 is substantially adapted to be installed on a self-propelled machine. Thus, the self-propelled machine may comprise the equipment 1 in addition to the organs known to enable self-propelled machines to move on a surface.

[0028] In particular, the equipment 1 is adapted, when in use on a self-propelled machine in motion, to allow the removal or milling of a solid surface or, more accurately, a solid surface layer of selectable thickness or depth.

[0029] The solid surface may be flat, curved or even irregular. It may, for example, be defined by a road surface and may, therefore, be made of asphalt or concrete.

[0030] In any case, the equipment 1 comprises at least one frame 2.

[0031] The frame 2 is essentially the portion of the equipment 1 capable of being integrally constrained to

the self-propelled machine. Thus, the frame 2 is configured to be operatively connected to a self-propelled machine. In this sense, the frame 2 may comprise constraining means configured to allow the overall equipment 1 to be constrained to the machine, for example at a front area of the machine.

[0032] The constraining means may, for example, comprise a mechanical hinge with adjustable friction and suitable for connection to a lifting arm.

[0033] The frame 2, moreover, is preferably a support frame. Thus, it is suitable for supporting the components of the equipment 1.

[0034] In this respect, the frame 2 may define shapes of various kinds. Preferably, the frame 2 comprises at least a first bulkhead 20. The first bulkhead 20 is substantially a plate element, expanding predominantly along a plane and defining dimensions on the plane that are significantly larger than the third dimension transverse to the plane. Furthermore, the first bulkhead 20 is preferably transverse to the ground, when the equipment 1 is in use. The term ground preferably means, naturally, the solid surface on which the equipment 1 moves.

[0035] The frame 2 may also include a pair of first bulkheads 20. The first bulkheads 20, if present in pairs, may expand parallel in such a way as to define, between them, a housing space. The latter, therefore, may contain one or more other components of the equipment 1. If present in pairs, preferably, the first bulkheads 20 are independent of each other.

[0036] The equipment 1, of course, comprises manipulating means 3.

[0037] The manipulating means 3 are substantially configured to manipulate the solid surface when the equipment 1 is in use.

[0038] In detail, preferably, the manipulating means 3 are adapted to scratch the solid surface by means of elements moved relative to the solid surface.

[0039] Preferably, the manipulating means 3 enable at least the removal or scarification of a surface layer of the solid surface.

[0040] In this regard, the manipulating means 3 are connected in a compliant way to the frame 2. In particular, the manipulating means 3 are configured to rotate, relative to the frame 2, around a rotation axis 3a.

[0041] The rotation axis 3a is preferably, but not necessarily, approximately parallel to the ground. Also preferably, the rotation axis 3a is transverse to the first bulkhead 20. The rotation axis 3a may, for example, be determined by a shaft rotating relative to the frame 2 and integral with at least part of the manipulating means 3.

[0042] If the frame 2 comprises two first bulkheads 20, the rotation axis 3a may be transverse to both first bulkheads 20. Furthermore, the manipulating means 3 may be positioned at least partially in the housing space defined between the first bulkheads 20. Thus, if the manipulating means 3 comprise a shaft rotating around the rotation axis 3a, it may be constrained to the frame 2 between the first bulkheads 20.

[0043] The manipulating means 3, in even greater detail, may comprise a toothed wheel integral with the shaft. Furthermore, the wheel may be configured to rotate so that the movement of the teeth relative to the solid surface is equivalent with respect to the movement of the driving machine, when the equipment 1 is in use.

[0044] As is obvious, the equipment 1 or the driving machine may also comprise handling means, for example motors, configured to control the rotation of the handling means 3 about the rotation axis 3a. Similar devices are, however, extremely well known to the person skilled in the art and are not particular subject matter of the present patent application.

[0045] The equipment 1 therefore also includes support means 4.

[0046] The support means 4 are substantially the portion of the equipment 1 that allows for levelling the frame 2, and thus also the manipulation depth of the manipulating means 3, with respect to the solid surface.

[0047] The support means 4 are preferably constrained in a compliant way to the frame 2. In particular, the support means 4 are constrained to the frame 2 in such a way that they can move, relative to the frame 2, at least along a main plane 4a.

[0048] The main plane 4a is preferably transverse to the rotation axis 3a. For example, the main plane 4a may be just normal to the rotation axis 3a.

[0049] In general, the main plane 4a is preferably transverse to the ground or solid surface. The support means 4, similarly to the frame 2, comprise at least a second bulkhead 40. The second bulkhead 40 is also substantially a plate element, expanding predominantly along a plane and defining significantly larger dimensions on the plane than the third dimension transverse to the plane.

[0050] In detail, preferably, the second bulkhead 40 expands parallel to the main plane 4a. Therefore, the second bulkhead 40 is also transverse to the ground or solid surface. The second bulkhead 40, in particular, preferably comprises at least one support surface 41.

[0051] The support surface 41 is configured to move, when the equipment 1 is in use, in support of the solid surface. Thus, it preferably slides on the support surface while, at the same time, supporting the frame 2 to which the support means 4 are constrained in order to maintain the manipulation depth of the manipulating means 3 constant.

[0052] Therefore, the support surface 41 may predominantly expand along a support plane 4c.

[0053] The support plane 4c is preferably transverse to the main plane 4a and parallel to the rotation axis 3a. It is also preferably parallel to the solid surface.

[0054] The support surface 41 therefore may be predominantly flat, but may also have curvatures.

[0055] As already mentioned, the support means 4 are constrained in a compliant way to the frame 2 and substantially translatable relative to it along the main plane 4a.

[0056] To control the mutual movement of the support

means 4 and frame 2, therefore, the equipment 1 preferably comprises further components.

[0057] Foremost, preferably, the equipment 1 further comprises adjustment means 5.

[0058] The adjustment means 5 are configured to adjust the relative position between frame 2 and support means 4. Thus, the adjustment means 5 are essentially the component of equipment 1 through which the manipulation depth of the manipulating means 3 can be controlled and determined.

[0059] The adjustment means 5, in brief, comprise at least one first pin 50.

[0060] The first pin 50 preferably expands transversely to the main plane 4a. Furthermore, the first pin 50 is preferably engaged in a compliant way to the frame 2. In particular, the first pin 50 is engaged in a compliant way to the frame 2 such that it can rotate, on command, relative to the frame 2, around an axis parallel to the rotation axis 3a. Preferably, the axis around which the first pin 50 rotates relative to the frame 2 is spaced with respect to the first pin 50. In other words, the first pin 50 can rotate eccentrically with respect to the rotation axis disposed at the engagement portion with the frame 2 and is not centred with respect thereto.

[0061] Thus, the first pin 50 is engaged to the frame 2 in an indirect manner. Preferably, in this sense, the first pin 50 is engaged to the frame 2 via a transmission element 51.

[0062] The transmission element 51 is essentially a connecting element between the first pin 50 and the constraint portion of the frame 2 around which the first pin 50 rotates.

[0063] Thus, the transmission element 51 may be made from a simple bar, or an annular element, or more preferably from a triangular connector. The latter may be hinged on the frame 2 at its own vertex. In addition, the triangular connector may be laboriously constrained at another vertex to the first pin 50.

[0064] To control rotation, the adjustment means 5 may also comprise an arm 52.

[0065] The arm 52 is essentially a controllable extendable element. Therefore, the arm 52 may be realised by a linear actuator, for example a piston, having a fixed part and at least linearly movable rod.

[0066] Furthermore, the arm 52 may be pneumatic, hydraulic, electromechanical or other.

[0067] If present, the arm 52 defines a first end 52a and a second end 52b. The first end 52a and the second end 52b are mutually opposite. Therefore, the ends 52a, 52b are capable of being reciprocally approached or moved apart on command to reduce or increase the length of the arm 52.

[0068] The arm 52 is therefore preferably constrained, at the first end 52a, to the frame 2. In particular, the arm 52 is constrained to the frame 2 such that it can rotate about an axis parallel to the rotation axis 3a with respect to the frame 2.

[0069] Thus, the arm 52 may be constrained in a com-

pliant way to the arm 52, in detail at the second end 52b. The latter may be constrained to one of the vertices of the transmission element 51.

[0070] Thus, the transmission element 51 may rotate around an axis parallel to the rotation axis 3a relative to the arm 52.

[0071] In any case, the first pin 50 is capable of being constrained in a compliant way to the support means 4.

[0072] In this regard, preferably, the support means 4 comprise at least one first guide 42. The first guide 42 is preferably arranged at one side of the support means 4 opposite the support surface 41.

[0073] Thus, in use, the first guide 42 is substantially on the opposite side of the solid surface from the rotation axis 3a.

[0074] The first pin 50 is therefore movably engaged in the first guide 42 and is configured to move, in proportion to its rotation relative to the frame 2 as previously described, the support means 4 relative to the frame 2 along at least one direction parallel to the main plane 2a.

[0075] In other words, when the first pin 50 is rotated with respect to the frame 2, for example by virtue of an expansion of the arm 52 imparting a rotation of the transmission element 51 and thus of the first pin 50 with respect to the frame 2, the first pin 52 is capable of dragging the support means 4 along at least one direction parallel to the main plane 4a to move the support means 4 with respect to the frame 2.

[0076] Therefore, if present, the drive element 51 rotates about an axis parallel to the rotation axis 3a also relative to the frame 2 and support means 4.

[0077] The first guide 42 essentially defines a movement trajectory of the first pin 50 parallel to the main plane 4a. In particular, it allows the first pin 50 to move along the trajectory between two ends of the first guide 42.

[0078] More particularly, preferably, the first guide 42 is expanded along a circumferential arc with concavity towards the support plane 4c and approximately close to the intermediate trajectory 4b. Therefore, thanks to the first guide 42, the support means 4 are free to rotate at least partially around the rotation axis 3a, while maintaining the manipulation depth of the manipulating means 3 constant with respect to the solid surface.

[0079] The frame 2 and the support means 4 are also mutually constrained in a compliant way by means of particular elements.

[0080] In particular, preferably, the first bulkhead 20 runs parallel to the main plane 4a. Thus, the first bulkhead 20 is developed parallel to the second bulkhead 40.

[0081] Furthermore, the first bulkhead 20 includes at least two second pins 21.

[0082] The second pins 21 are substantially protruding elements from the first bulkhead 20. In particular, the second pins 21 expand transversely to the main plane 4a. Accordingly, the second pins 21 each define a constrained end to the first bulkhead 20 and a free end.

[0083] Preferably, the second bulkhead 40 comprises two second guides 43.

[0084] Preferably, the second guides 43 are separate from each other. Furthermore, the second guides 43 are mutually spaced apart. In detail, the second guides 43 are positioned at opposite sides of the support means 4 with respect to an intermediate trajectory 4b.

[0085] The intermediate trajectory 4b is essentially a trajectory, preferably a line, that is virtual. It is preferably defined, when the equipment 1 is in use, by the normal to the solid surface passing through the rotation axis 3a. In any case, of course, the intermediate trajectory 4b turns out to be transverse, in some cases precisely normal, to the support surface 41, in detail to the support plane 4c. Therefore, in other words, the support surface 41, the second pins 43 and the first pin 42 are distributed around the rotation axis 3a almost quadrilateral.

[0086] Preferably, the two second pins 21 are each movably engaged in a respective second guide 43. Therefore, the second guides 43 also substantially define movement trajectories for each second pin 21 parallel to the main plane 4a.

[0087] In particular, preferably, one of the second guides 43 expands along a trajectory parallel to the main plane 4a and transverse to the support plane 4c. The other second guide 43 defines, on the other hand, an approximately quadrangular movement area. In particular, the area may be approximately parallelogram-shaped.

[0088] Thus, the second guides allow the second pins 21 to move in the second guides 43 respectively along a single direction parallel to the main plane 4a and a plurality of directions parallel to the main plane 4a and, thus, allow the support means 4 to move relative to the frame 2 in relation to what is allowed by the second pins 21 and second guides 43.

[0089] The guides 42, 43 could be defined by grooves made on the second bulkhead 40 within which the pins 50, 21 can be engaged. Or, each of the guides 42, 43 could be made from a through-hole defined on the second bulkhead 40.

[0090] Naturally, especially but not only in the latter case, in order to prevent disengagement, transversely to the main plane 4a, between support means 4, in particular the rails 42, 43, and the pins 50, 21, each or at least part of the pins 50, 21 could comprise heads, at the free ends, configured to define an obstacle to mutual movement between pins 50, 21 and rails 42, 43 transversely to the main plane 4a.

[0091] Advantageously, the equipment 1 also comprises a side plate 6.

[0092] The side plate 6 is substantially an element for stabilising the mutual movement between the frames 2, 4 in particular with reference to directions transverse to the main plane 4a.

[0093] Therefore, advantageously, the side plate 6 is constrained to the second pins 21 at ends of the second pins 21 opposite the first bulkhead 20.

[0094] Furthermore, the side plate 6 runs parallel to the main plane 4a. Thus, the side plate 6 is configured

to prevent relative translations between the frame 2 and the support means 4 transversely to the main plane 4a.

[0095] The side plate 6 may, therefore, be part of the support means 4 themselves. For example, the second bulkhead 40 could comprise the side plate 6. Even more in detail, the latter could be a portion of the second bulkhead 40. Furthermore, the side plate 6 could expand between the second pins 21 at least close to the rotation axis 3a. Furthermore, the side plate 6 could be a portion of the second bulkhead 40 defining a substantially L-shape and the second pins 21 could be constrained at ends of the side plate 6.

[0096] The side plate 6, of course, could correspond to a reinforced portion of the second bulkhead 40.

[0097] Or, the frame 2 could comprise the side plate 6.

[0098] In this embodiment, shown in the Figs. 1-4, the second bulkhead 40 is distinct from the side plate 6. Furthermore, the second bulkhead 40 is engaged between the first bulkhead 20 and the side plate 6.

[0099] Again, preferably, the side plate 6 may expand between the second pins 21 at least close to the rotation axis 3a. Furthermore, the side plate 6 may, also in this embodiment, define a substantially L-shape and the second pins 21 may be constrained at the ends of the side plate 6.

[0100] As mentioned above, the frame 2 may comprise a pair of first bulkheads 20.

[0101] In this case, preferably, the support means 4 also comprise a pair of second bulkheads 40. If present in pairs, preferably, the second bulkheads 40 are separate and distinct from each other. Accordingly, each of the second bulkheads 40 may move relative to the frame 2, in particular to a first bulkhead 20, independently of each other. Alternatively, the second bulkheads 40 may also be integral with each other, possibly in one piece.

[0102] Furthermore, each second bulkhead 40 may be positioned between the manipulating means 3 and a respective first bulkhead 20, or, each first bulkhead 20 may be positioned between the manipulating means 3 and a respective second bulkhead 40. In other words, the second bulkheads 40 may move relative to the first bulkheads 20 within the accommodation space defined between the first bulkheads 20, or, the second bulkheads 40 may move outside the accommodation space and in fact contain the first bulkheads 20 and the handling means 3.

[0103] In a preferred embodiment, the frame 2 comprises a pair of mutually parallel first bulkheads 20 arranged at opposite sides of the manipulating means 3 and the support means 4 comprises a pair of second bulkheads 40 each arranged between a respective first bulkhead 20 and a side plate 6.

[0104] Where the frame 2 and support means 4 comprise pairs of bulkheads 20, 40, preferably the adjustment means 5 also comprise a pair of first pins 50.

[0105] Each of the first pins 50 is then constrained to a respective second bulkhead 40.

[0106] The operation of the self-levelling equipment 1

for manipulating solid surfaces described above in structural terms is substantially similar to the operation of the equipment of the known technique.

[0107] However, the self-levelling equipment 1 for manipulating solid surfaces according to the invention achieves important advantages.

[0108] In fact, the equipment 1 results to be highly stable, thanks to the provision of the side plate 6, whether it is part of the second wall 40 and the frame 2.

[0109] In this sense, it is intended that no mutual translation, transverse to the main plane 4a, is allowed between frame 2 and support means 4.

[0110] Thus, the self-levelling equipment 1 for manipulating solid surfaces allows for high-precision manipulations, wherein substantially the constancy of the manipulation depth is always ensured.

[0111] The invention is susceptible to variations within the scope of the inventive concept as defined by the claims.

[0112] Within this scope, all details are substitutable by equivalent elements and the materials, shapes and dimensions may be any.

25 Claims

1. Self-levelling equipment (1) for manipulating solid surfaces comprising:

30 - a support frame (2) configured to be operatively connected to a self-propelled machine,
 - manipulating means (3) connected in a compliant way to said frame (2) so as to be able to rotate, relative to said frame (2), around a rotation axis (3a) and configured to handle said solid surface,
 35 - support means (4) constrained in a compliant way to said frame (2) so as to be able to move, relative to said frame (2), along a main plane (4a) transversal to said rotation axis (3a) and including at least a second bulkhead (40) expanding parallel to said main plane (4a) and comprising at least

45 - a support surface (41) configured to move, when said equipment (1) is in use, in support of said solid surface,
 - a first guide (42) arranged on a side of said support means (4), opposite said support surface (41),
 50 - two second guides (43) which are separate and positioned at opposite sides of said support means (4) with respect to an intermediate trajectory (4b) normal to said solid surface, when said equipment (1) is in use, and passing through said rotation axis (3a),

55 - adjustment means (5) configured to adjust the

relative position between said frame (2) and said support means (4) and comprising a first pin (50) extending transversally to said main plane (4a), movably engaged in said first guide (42) and constrained in a compliant way to said frame (2) so as to be able to rotate on command, relative to said frame (2), around an axis spaced from said first pin (50) and parallel to said rotation axis (3a) in order to move, in proportion to said rotation, said support means (4) relative to said frame (2) along at least one direction parallel to said main plane (4a), wherein said frame (2) comprises a first bulkhead (20) developed parallel to said main plane (4a) and including at least two second pins (21) developed transversally to said main plane (4a) each movably engaged in a respective said second guide (43), and wherein said equipment (1) is **characterised by** further comprising:

- a side plate (6) constrained to said second pins (21) at the ends of said second pins (21) opposite to said first bulkhead (20) and extending parallel to said main plane (4a) in such a way as to prevent relative displacements between said frame (2) and said support means (4) transversally to said main plane (4a).
- 2. Equipment (1) according to claim 1, wherein said second bulkhead (40) comprises said side plate (6) or said frame (2) comprises said side plate (6) and said second bulkhead (40) is distinct from said side plate (6) and engaged between said first bulkhead (20) and said side plate (6).
- 3. Equipment (1) according to any one of the preceding claims, wherein said side plate (6) is expanded between said second pins (21) at least abutting said rotation axis (3a).
- 4. Equipment (1) according to any one of the preceding claims, wherein side plate (6) defines a substantially L-shape and said second pins (21) are constrained at ends of said side plate (6).
- 5. Equipment (1) according to any one of the preceding claims, wherein said support surface (41) is expanded along a support plane (4c) transverse to said main plane (4a) and parallel to said rotation axis (3a).
- 6. Equipment (1) according to any preceding claim, wherein said first guide (42) is expanded along a circumferential arc with concavity towards said main plane, one of said second guides (43) is expanded along a trajectory parallel to said main plane (4a) and transversal to said support plane (4c) and the other between said second guides (43) defines an

approximately quadrangular manipulating area.

- 7. Equipment (1) according to any preceding claim, wherein each of said guides (42, 43) is made by a through hole.
- 8. Equipment (1) according to any one of the preceding claims, wherein said adjustment means (5) comprise an arm (52) extendable by command and constrained in a compliant way to said frame (2) at a first end (52a) thereof so as to be able to rotate about an axis parallel to said rotation axis (3a) with respect to said frame (2) and a transmission element (51) comprising a triangular connector hinged to said frame (2) at a vertex and constrained in a compliant way at the other vertices respectively to said first pin (50) and to said arm (52) at a second end (52b), opposite to said first end (52a), of said arm (52) so as to be able to rotate about an axis parallel to said rotation axis (3a) with respect to said arm (52) and said support means (4) respectively.
- 9. Equipment (1) according to any one of the preceding claims, wherein said frame (2) comprises a pair of said first bulkheads (20) mutually parallel to each other and arranged at opposite sides of said manipulating means (3) and said support means (4) comprise a pair of said second bulkheads (40) mutually distinct and separate and each arranged between a respective said first bulkhead (20) and a said side plate (6).
- 10. Equipment (1) according to any preceding claim, wherein said adjustment means (5) comprise at least one pair of said first pins (50) each of which is constrained to a respective said second bulkhead (40).
- 11. A self-propelled machine comprising an equipment (1) according to any one of the preceding claims.

Patentansprüche

- 1. Selbstnivellierende Einrichtung (1) zum Handhaben von Festoberflächen, umfassend
 - einen Stützrahmen (2), der konfiguriert ist, operativ mit einer selbstfahrenden Maschine verbunden zu werden,
 - Handhabungsmittel (3), die entsprechend mit dem Rahmen (2) verbunden sind, um in der Lage zu sein, in Bezug auf den Rahmen (2) um eine Drehachse (3a) zu drehen und die konfiguriert sind, die Festoberfläche zu handhaben,
 - Stützmittel (4), die entsprechend an den Rahmen (2) befestigt sind, um in der Lage zu sein, entlang einer Hauptebene (4a) quer zu der Drehachse (3a) in Bezug auf den Rahmen (2)

zu bewegen und die mindestens eine zweite Trennwand (40) umfassen, die sich parallel zu der Hauptebene (4a) erstreckt und die mindestens umfasst

- eine Stützfläche (41), die konfiguriert ist, sich bei Verwendung der Einrichtung (1) als Stütze für die Festoberfläche zu bewegen,
- eine erste Führung (42), die auf einer Seite der Stützmittel (4) gegenüber der Stützfläche (41) angeordnet ist,
- zwei zweite Führungen (43), die getrennt sind und die an gegenüberliegenden Seiten der Stützmittel (4) in Bezug auf einen Zwischenweg (4b) angeordnet sind, der sich bei Verwendung der Einrichtung (1) senkrecht zur der Festoberfläche erstreckt und die Drehachse (3a) durchquert,

- Einstellmittel (5), die konfiguriert sind, die relative Position zwischen dem Rahmen (2) und den Stützmitteln (4) einzustellen und umfassend einen ersten Bolzen (50), der sich quer zu der Hauptebene (4a) erstreckt, der beweglich in die erste Führung (42) eingreift und entsprechend an dem Rahmen (2) befestigt ist, um in der Lage zu sein, auf Befehl, in Bezug auf den Rahmen (2), um eine von dem ersten Bolzen (50) beabstandete Achse und parallel zu der Drehachse (3a) zu drehen, um die Stützmittel (4), im Verhältnis zu der Drehung, relativ zu dem Rahmen (2) entlang einer Richtung parallel zu der Hauptebene (4a) zu bewegen,

wobei der Rahmen (2) eine erste Trennwand (20) umfasst, die sich parallel zu der Hauptebene (4a) erstreckt und die mindestens zwei zweite Bolzen (21) umfasst, die sich quer zu der Hauptebene (4a) erstrecken und jeweils beweglich in eine jeweilige zweite Führung (43) eingreift, und wobei die Einrichtung (1) ferner **dadurch gekennzeichnet ist, dass** sie Folgendes umfasst:

- eine Seitenplatte (6), die an den Enden der zweiten Bolzen (21) gegenüber der ersten Trennwand (20) an den zweiten Bolzen (21) befestigt ist und sich parallel zu der Hauptebene (4a) erstreckt, sodass relative Verschiebungen zwischen dem Rahmen (2) und den Stützmitteln (4) quer zu der Hauptebene (4a) verhindert werden.

2. Einrichtung (1) nach Anspruch 1, wobei die zweite Trennwand (40) die Seitenplatte (6) umfasst oder der Rahmen (2) die Seitenplatte (6) umfasst und die

zweite Trennwand (40) von der Seitenplatte (6) getrennt ist und zwischen der ersten Trennwand (20) und der Seitenplatte (6) eingreift.

3. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Seitenplatte (6) sich zwischen den zweiten Bolzen (21) erstreckt, indem sie zumindest an der Drehachse (3a) anliegt.
4. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Seitenplatte (6) eine im Wesentlichen L-förmige Gestalt definiert und die zweiten Bolzen (21) an den Enden der Seitenplatte (6) befestigt sind.
5. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Stützfläche (41) sich entlang einer Stützebene (4c) quer zu der Hauptebene (4a) und parallel zur der Drehachse (3a) erstreckt.
6. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die erste Führung (42) sich entlang eines Umfangsbogens mit Konkavität zu der Hauptebene erstreckt, wobei eine der zweiten Führungen (43) sich entlang eines Wegs parallel zu der Hauptebene (4a) und quer zu der Stützebene (4c) erstreckt und die andere der zweiten Führungen (43) einen annähernd viereckigen Handhabungsbereich definiert.
7. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei jede der Führungen (42, 43) durch ein Durchgangsloch ausgebildet wird.
8. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Einstellmittel (5) einen Arm (52), der auf Befehl dehnbar ist und entsprechend an dem Rahmen (2) an einem ersten Ende (52a) desselben befestigt ist, um in der Lage zu sein, relativ zu dem Rahmen (2) um eine Achse parallel zu der Drehachse (3a) zu drehen, und ein Übertragungselement (51) umfassen, das einen dreieckigen Stecker umfasst, der an einer Spitze an dem Rahmen (2) scharniert ist und entsprechend an den anderen Spitzen jeweils an dem ersten Bolzen (50) und an dem Arm (52) an einem zweiten Ende (52b) gegenüber dem ersten Ende (52a) befestigt ist, um in der Lage zu sein, um eine Achse parallel zu der Drehachse (3a) jeweils relativ zu dem Arm (52) und zu den Stützmitteln zu drehen.
9. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei der Rahmen (2) ein Paar der ersten Trennwände (20) umfasst, die zueinander parallel liegen und an gegenüberliegenden Seiten der Handhabungsmittel (3) angeordnet sind, und wobei die Stützmittel (4) ein Paar der zweiten Trennwände (40) umfassen, die voneinander getrennt und separat

sind und jeweils zwischen einer der ersten Trennwände (20) und einer Seitenplatte (6) angeordnet sind.

10. Einrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Einstellmittel (5) mindestens ein Paar der ersten Bolzen (50) umfassen, von denen jeder an eine der zweiten Trennwände (40) befestigt ist.
11. Selbstfahrende Maschine umfassend eine Einrichtung (1) nach einem der vorhergehenden Ansprüche.

Revendications

1. Équipement autonivelant (1) pour la manipulation de surfaces solides comprenant

- un châssis de support (2) conçu pour être connecté de manière opérationnelle à une machine autopropulsée,
- des moyens de manipulation (3) connectés de manière flexible audit châssis (2) afin de pouvoir tourner, par rapport audit châssis (2), autour d'un axe de rotation (3a) et conçus pour manipuler ladite surface solide,
- des moyens de support (4) contraints de manière flexible audit châssis (2) de manière à pouvoir se déplacer, par rapport audit châssis (2), le long d'un plan principal (4a) transversal à cet axe de rotation (3a) et comprenant au moins une seconde cloison (40) s'étendant parallèlement audit plan principal (4a) et comprenant au moins

- une surface de support (41) conçue pour se déplacer, lorsque ledit équipement (1) est en usage, en support de ladite surface solide,
- un premier guide (42) disposé sur un côté desdits moyens de support (4), opposé à ladite surface de support (41),
- deux seconds guides (43) séparés et positionnés de part et d'autre desdits moyens de support (4) par rapport à une trajectoire intermédiaire (4b) perpendiculaire à ladite surface solide, lorsque ledit équipement (1) est en usage, et passant par ledit axe de rotation (3a),
- des moyens de réglage (5) conçus pour ajuster la position relative entre ledit châssis (2) et lesdits moyens de support (4) et comprenant un premier axe (50) s'étendant transversalement audit plan principal (4a), engagé de manière mobile dans ledit premier guide (42) et contraint de manière flexible audit châssis (2) afin de pouvoir

tourner sur commande, par rapport audit châssis (2), autour d'un axe espacé dudit premier axe (50) et parallèle audit axe de rotation (3a) afin de déplacer, proportionnellement à ladite rotation, lesdits moyens de support (4) par rapport audit châssis (2) le long d'au moins une direction parallèle audit plan principal (4a), dans lequel ledit châssis (2) comprend une première cloison (20) développée parallèlement audit plan principal (4a) et comprenant au moins deux seconds axes (21) développés transversalement audit plan principal (4a) chacun étant engagé de manière mobile dans un desdits seconds guides (43),

et dans lequel ledit équipement (1) est **caractérisé par le fait** de comprendre en outre:

- une plaque latérale (6) contrainte auxdits seconds axes (21) aux extrémités desdits seconds axes (21) opposées à ladite première cloison (20) et s'étendant parallèlement audit plan principal (4a) de manière à empêcher des déplacements relatifs entre ledit châssis (2) et lesdits moyens de support (4) transversalement audit plan principal (4a).

2. Équipement (1) selon la revendication 1, dans lequel ladite seconde cloison (40) comprend ladite plaque latérale (6) ou ledit châssis (2) comprend ladite plaque latérale (6) et ladite seconde cloison (40) est distincte de ladite plaque latérale (6) et engagée entre ladite première cloison (20) et ladite plaque latérale (6).

3. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel ladite plaque latérale (6) est étendue entre lesdits seconds axes (21) au moins en butée contre ledit axe de rotation (3a).

4. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel ladite plaque latérale (6) définit une forme sensiblement en L et lesdits seconds axes (21) sont contraints aux extrémités de ladite plaque latérale (6).

5. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel ladite surface de support (41) est étendue le long d'un plan de support (4c) transversal audit plan principal (4a) et parallèle audit axe de rotation (3a).

6. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel ledit premier guide (42) est étendu le long d'un arc circonférentiel avec concavité vers ledit plan principal, l'un desdits seconds guides (43) est étendu le long d'une trajectoire parallèle audit plan principal (4a) et transversal

audit plan de support (4c) et l'autre parmi lesdits seconds guides (43) définit une zone de manipulation approximativement quadrangulaire.

7. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel chacun desdits guides (42, 43) est réalisé par un trou traversant. 5

8. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens de réglage (5) comprennent un bras (52) extensible sur commande et contraint de manière flexible audit châssis (2) à une première extrémité (52a) de celui-ci de manière à pouvoir tourner autour d'un axe parallèle audit axe de rotation (3a) par rapport audit châssis (2) et un élément de transmission (51) comprenant un connecteur triangulaire articulé audit châssis (2) à un sommet et contraint de manière flexible aux autres sommets respectivement audit premier axe (50) et audit bras (52) à une seconde extrémité (52b), opposée à ladite première extrémité (52a), dudit bras (52) de manière à pouvoir tourner autour d'un axe parallèle audit axe de rotation (3a) par rapport audit bras (52) et auxdits moyens de support (4) respectivement. 10
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9. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel ledit châssis (2) comprend une paire desdites premières cloisons (20) mutuellement parallèles entre elles et disposées de part et d'autre desdits moyens de manipulation (3) et lesdits moyens de support (4) comprennent une paire desdites secondes cloisons (40) mutuellement distinctes et séparées et chacune disposée entre une desdites premières cloisons (20) et une dite plaque latérale (6). 30
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10. Équipement (1) selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens de réglage (5) comprennent au moins une paire desdits premiers axes (50) dont chacun est contraint à une desdites secondes cloisons (40). 40

11. Une machine autopropulsée comprenant un équipement (1) selon l'une quelconque des revendications précédentes. 45

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Fig. 1

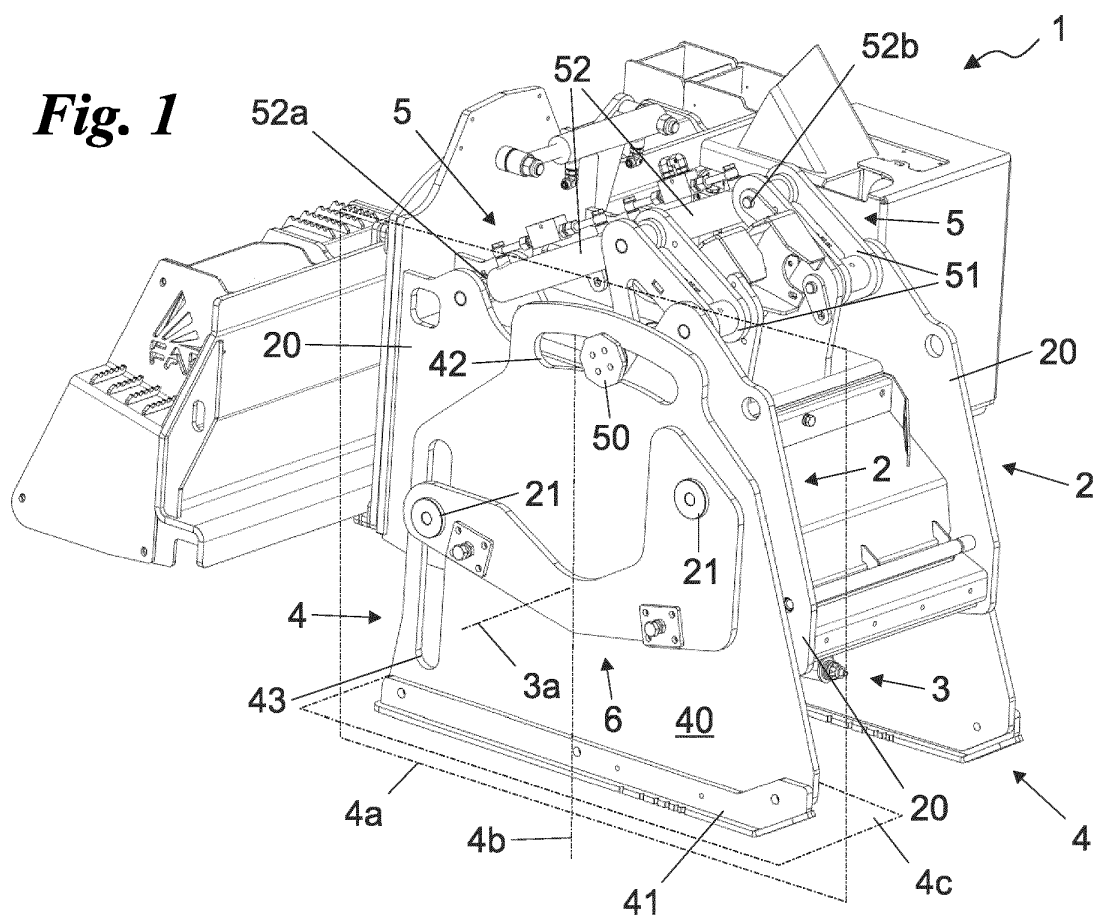
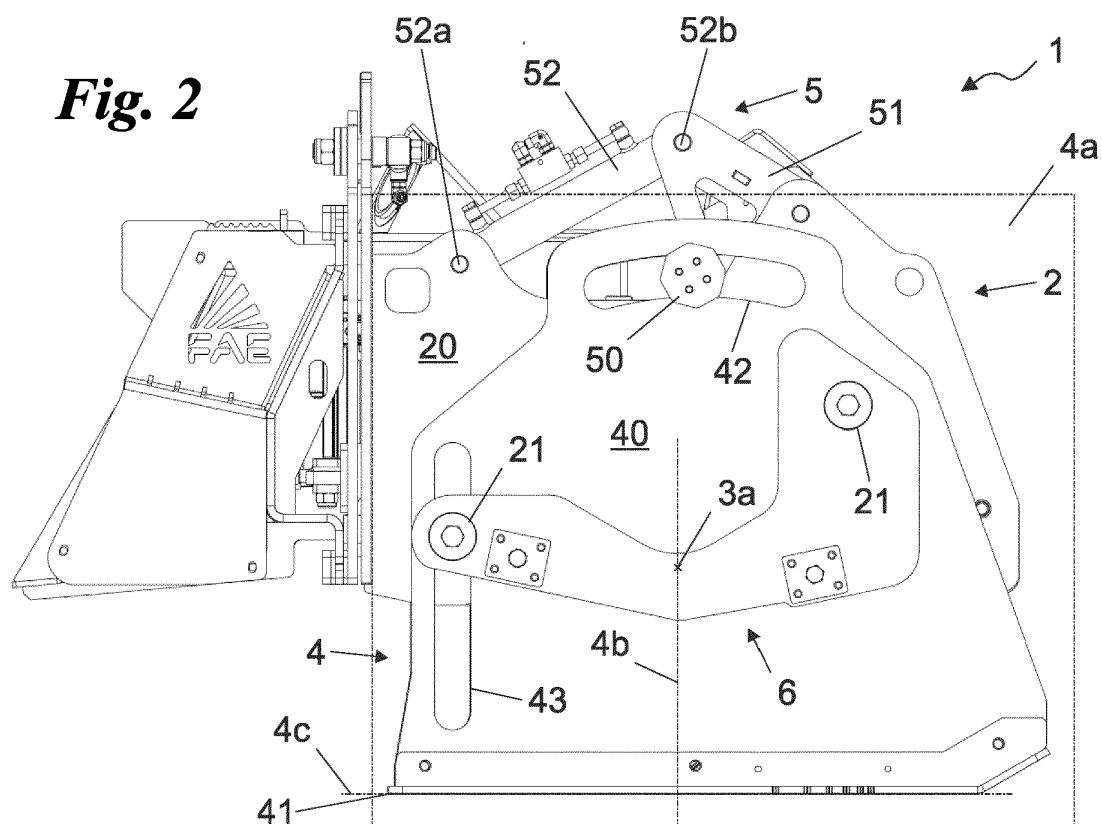


Fig. 2



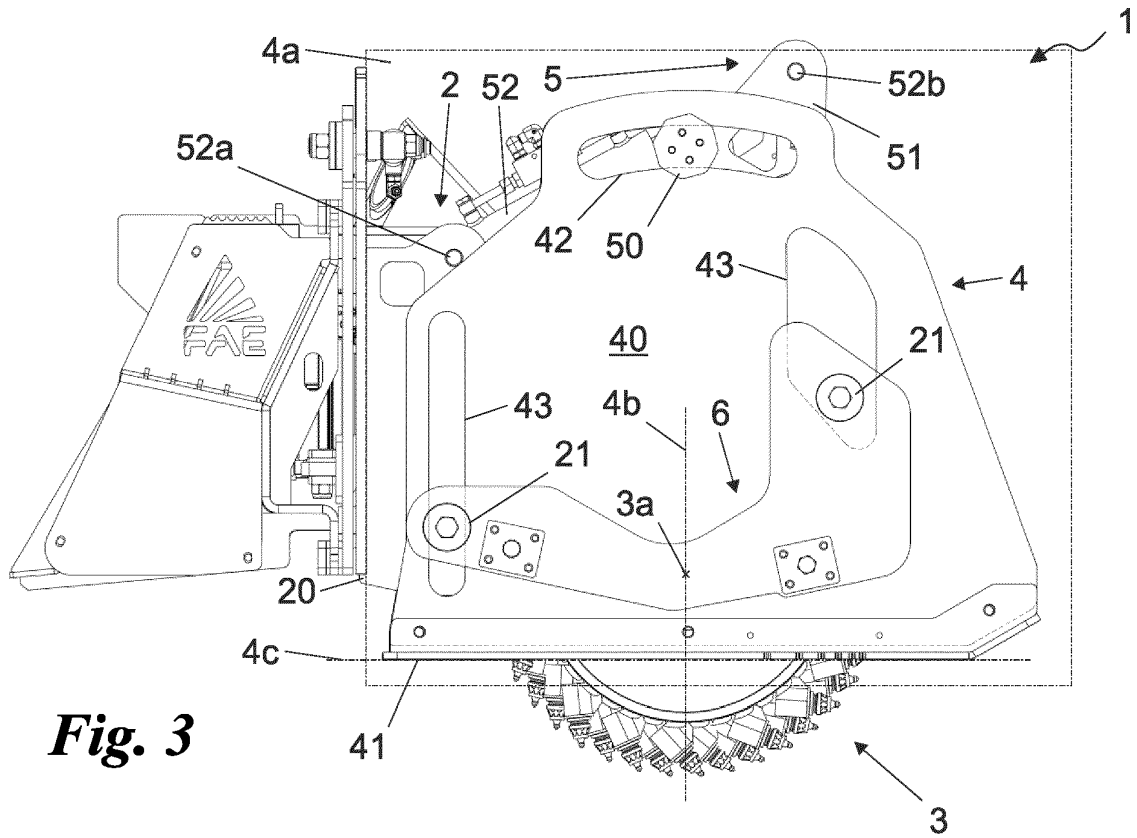


Fig. 3

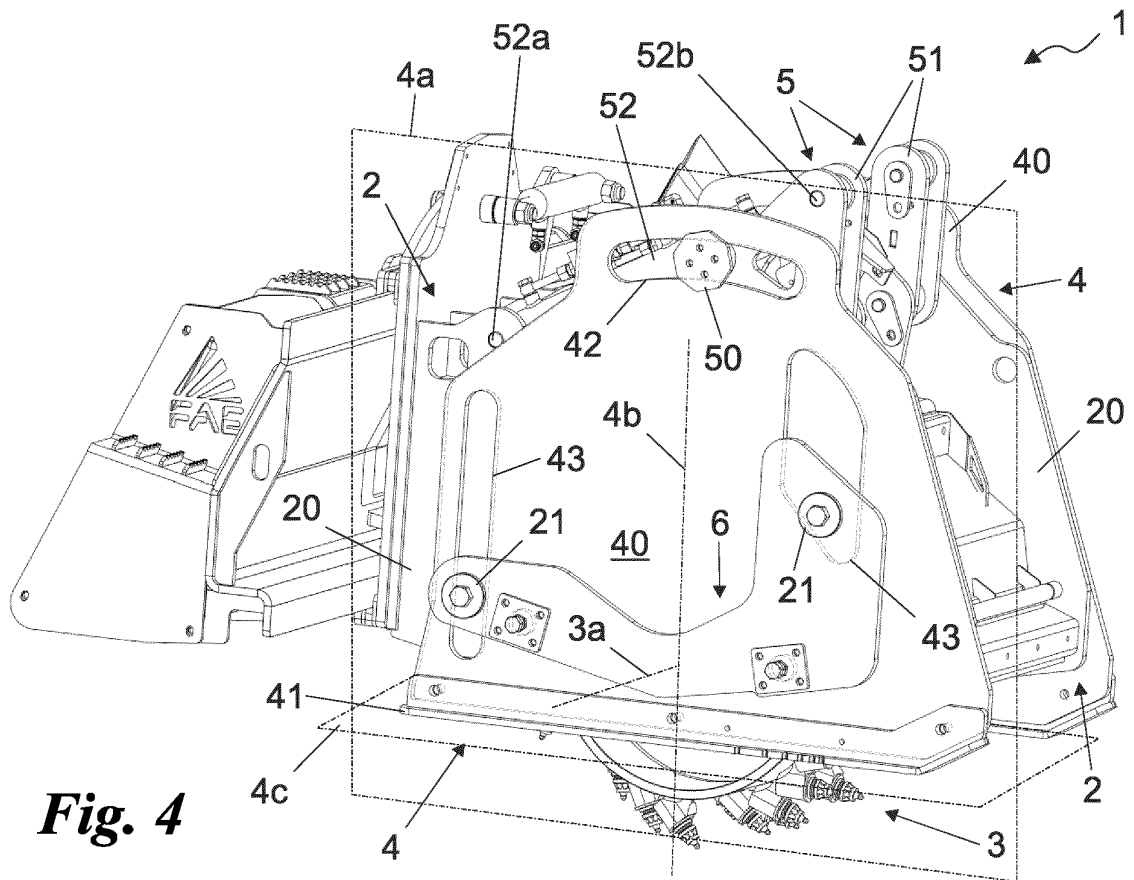


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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