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(54) **SNOW THROWER AND USE THEREOF**

(57) The present invention relates to a snowplough, adapted to remove snowy material. The snowplough comprises a frame, movement means applied to the frame and configured to allow a movement of the snowplough on a ground and a work tool such as a blade, an auger or a turbine. According to the invention, the snowplough is configurable in a flexible working condition, in which the work tool is in an operating position for removing snowy material from the ground and in which the work tool is simultaneously left free to move along an adjustment direction, the main component of which is orthogonal to the ground.

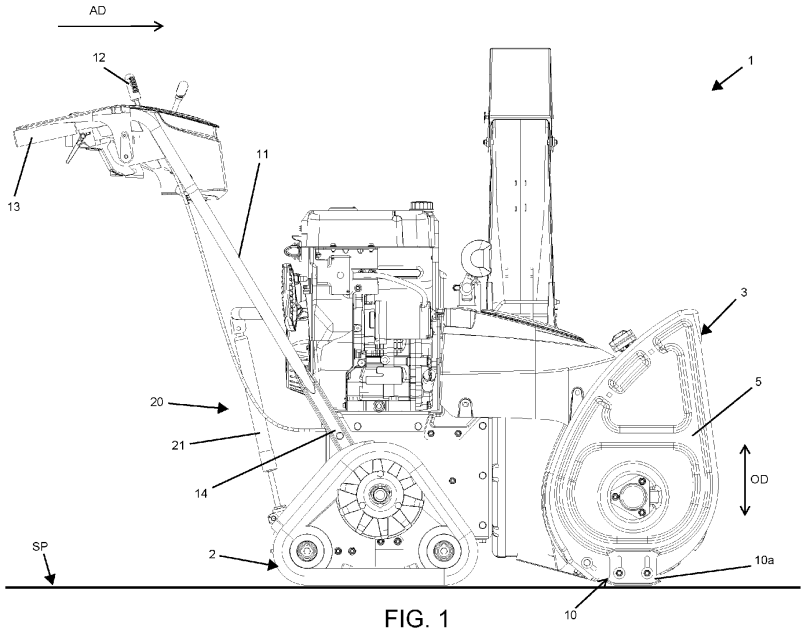

FIG. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a snowplough and a relative use. The snowplough is a machine adapted to remove or move snow and/or ice to facilitate the transit of people and/or vehicles.

STATE OF THE ART

[0002] Snowploughs comprising a work tool placed in the front zone configured to collect snow from the ground so as to facilitate the transit of people and vehicles are known in the field related to the removal and movement of snow and/or ice. Snowploughs exist which are adapted to collect snow from the ground and direct it into a box or laterally, so as to define a passage lane.

[0003] The state of the art comprises snowplough trains, snowplough machines, snowplough tractors, snowplough crawlers. The state of the art further comprises small-sized snowploughs, for example manually pushed and driven, comprising a handlebar to allow an operator to direct the snowplough. The work tool placed in front can be moved between a resting position, in which the work tool is spaced from the ground, and a working position, in which the work tool is adjacent to the ground to collect snow and move it from the advancement direction of the snowplough itself. However, when the work tool is placed in the working position, the disconnections of the terrain, for example holes, dips, bumps, or uneven ice sheets, can create difficulties in proceeding and, at the same time, locally determine a poor effectiveness of the snow and ice removal. For example, a bump can impact the front work tool and consequently cause the snowplough to stop advancing. Alternatively, a dip can cause incomplete snow removal, thus reducing the effectiveness of the snowplough. Due to these problems, the operator must therefore pass over the same point several times to complete the work or change the advancement direction of the snowplough.

Recognition of the prior art underlying the invention

[0004] A known technical solution of snowploughs is described in European patent application EP1067240A2.

[0005] Such a technical solution allows an adjustment of the height of the work tool with respect to the ground. To this end, a manoeuvring lever is provided which, if pulled upwards, determines the opening of a shut-off valve inside a hydraulic cylinder. Consequently, high-pressure gas is transferred from a first chamber to a second chamber of the hydraulic cylinder, resulting in a moment around the motor shaft which allows the work tool to lift with respect to the motor shaft. Once the desired height of the work tool has been reached, the manoeuvring lever is released, causing the shut-off valve to close, so that the work tool stably remains at a fixed height with respect to the ground.

[0006] Further known technical solutions of snowploughs are disclosed in the documents US3,055,127, US2003/0046834A1, US2017/0267297A1, US5,020,250 and JPH11-29914A.

OBJECT OF THE INVENTION

[0007] Therefore, the object of the present invention is to solve at least one of the drawbacks and/or limitations of the previous solutions.

[0008] A first objective is to provide a snowplough capable of facilitating the work of the operator responsible for shovelling snow.

[0009] A further objective is to increase the effectiveness of a snowplough in removing snow.

[0010] A further objective is to provide a snowplough capable of reducing the work time required to remove snow.

[0011] A further objective is to provide a snowplough capable of reducing the stresses transmitted to the operator during operating conditions.

[0012] A further objective is to provide a reliable and durable snowplough.

[0013] A further objective is to provide a snowplough capable of preserving its work tool during operating conditions.

[0014] A further objective is to provide a lightweight snowplough which is easily manoeuvrable for an operator.

[0015] A further objective is to provide a snowplough capable of achieving the aforementioned objectives and at the same time which is sufficiently economical to create.

[0016] These and other objects, which will appear more clearly from the following description, are substantially achieved by a snowplough in accordance with one or more of the appended claims and/or the following aspects.

SUMMARY

[0017] Aspects of the invention are disclosed here below.

[0018] A first aspect of the present invention relates to a snowplough for removing snowy material, said snowplough comprising:

- a frame,
- movement means (2) applied to said frame and configured to allow a movement of the snowplough on a ground, in particular along at least one advancement direction (AD), said movement means (2) defining a support plane (SP) with the ground;
- a work tool (3) configured to remove snowy material at least along the advancement direction (AD) of the snowplough;

said snowplough being configurable according to a flexible working condition in which:

- the work tool (3) is in an operating position for removing snowy material from the ground, said operating position being in particular a lowered position in which the work tool (3) is close to the ground or in contact with the ground, and simultaneously
- the work tool (3) is left free to move with respect to at least one portion of said frame along an adjustment direction, said adjustment direction comprising at least one component orthogonal to the ground.

[0019] A second aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said component orthogonal to the ground is the main component of said adjustment direction.

[0020] A third aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said work tool (3), moving along said adjustment direction, draws a curvilinear trajectory.

[0021] A fourth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said work tool (3), moving along said adjustment direction, draws a trajectory substantially in a circumference arc or in an ellipse arc.

[0022] A fifth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which, in said flexible working condition, the work tool (3) is movable in height to define a stroke greater than 1 cm, in particular comprised between 1 cm and 56 cm, more in particular between 1 cm and 30 cm, optionally between 2 cm and 30 cm. A sixth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which, in said flexible working condition, the work tool (3) is movable in height with respect to the support plane (SP).

[0023] A seventh aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which, in said flexible working condition, the work tool (3) is movable in height to cross said support plane (SP).

[0024] An eighth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which, in said flexible working condition, the work tool (3) is:

- movable in height with respect to the support plane (SP) and
- configured to maintain contact with the ground.

[0025] A ninth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said work tool (3) is housed at a front zone of the snowplough with respect to the advancement direction (AD).

[0026] A tenth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough is further configurable in a resting condition in which the work tool (3) is in an inoperative position, said inoperative position being in particular a raised position with respect to the ground, and in which said snowplough is stably lockable in said resting condition.

[0027] An eleventh aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said resting condition of said work tool (3) corresponds to a condition of relatively easy advancement of said snowplough.

[0028] A twelfth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which, in said inoperative position, said work tool (3) defines with the support plane (SP) a distance comprised between 40 cm and 70 cm, in particular between 50 cm and 65 cm, said distance being a substantially fixed distance.

[0029] A thirteenth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which the work tool (3) is further movable between the inoperative position of the resting condition and the operating position of the flexible working condition and vice versa,

in which the work tool (3), when arranged in the inoperative position of the resting condition, is in a substantially fixed position, in particular with respect to the support plane (SP), and
in which the work tool (3), when arranged in the operating position of the flexible working condition, is in a position variable in height, in particular with respect to the support plane (SP).

[0030] A fourteenth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which the work tool (3) is configured to pass by gravity from the inoperative position of the resting condition to the operating position of the flexible working condition.

[0031] A fifteenth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough comprises a first selective locking arrangement of said work tool (3) in said inoperative position and/or a second selective locking arrangement of said work tool (3) in said operating position.

[0032] A sixteenth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said work tool (3) comprises a snowplough blade configured to contact, during said flexible working condition, the snowy material, in particular in which said snowplough blade comprises a bottom edge facing the support plane (SP) and extending transversely with respect to the advancement direction (AD).

[0033] A seventeenth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said work tool (3) comprises a milling cutter or turbine or auger (4) movable by rotation

around a rotation axis (R) thereof, said rotation axis (R) extending along a width direction of the snowplough, said width direction being transverse, optionally orthogonal, to the advancement direction (AD).

[0034] An eighteenth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said work tool (3) comprises a containment hood (5) carrying a milling cutter or turbine or auger (4) movable by rotation around a rotation axis (R) thereof, said rotation axis (R) extending along a width direction of the snowplough, said width direction being transverse, optionally orthogonal, to the advancement direction (AD).

[0035] A nineteenth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said snowplough comprises said containment hood (5), said containment hood (5) comprising side walls (6, 7) spaced apart from each other and a rear wall (8) interposed in connection between said side walls (6, 7), said containment hood (5) defining an open containment volume (5a) adapted to internally accommodate said milling cutter or turbine or auger (4), and

in which said containment hood (5) has a front frontal opening (9) adapted to receive, during the working condition, the snowy material entering said containment volume (5a),
in particular in which said containment hood (5) has an arcuate shape.

[0036] A twentieth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said containment hood comprises at least one bottom portion (10) facing, at least during said flexible working condition, the ground,

said at least one bottom portion (10) being configured to contact, in particular slide, on the ground during an operating condition of the snowplough, and
in which, in said flexible working condition, the work tool (3) is movable in height with respect to the support plane (SP) as a result of a contact between said bottom portion (10) of the containment hood and an altimetric profile of said ground.

[0037] A twenty-first aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said bottom portion (10) of the containment hood comprises one or more slides (10a) defining a bottom end plane of the containment hood, said slides (10a) being adapted to contact with the ground during the flexible working condition of the snowplough, said one or more slides (10a) being in particular interposed between the bottom portion (10) and said ground.

[0038] A twenty-second aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which the support plane (SP) defines a stable equilibrium support plane of the snowplough, in particular in which said support plane is a two-dimensional plane, and
in which, when the snowplough is in the flexible working condition and optionally in the resting condition, a weight force of the snowplough passing through a centre of gravity of the snowplough transversely intersects said support plane (SP), in particular transversely intersects a support area defined externally by an outline passing through the movement means.

[0039] A twenty-third aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which the movement means (2) define a stable equilibrium of the snowplough,
in which said movement means (2) comprise:

- at least three wheels, in particular at least four wheels, defining said support plane (SP) passing through said wheels,
  in particular in which the movement means (2) comprise:
  - a left rear wheel,
  - a right rear wheel spaced in width from said left rear wheel,
  - a left front wheel,
  - a right front wheel spaced in width from said left front wheel;

  or
- a left track,
- a right track spaced in width from said left track.

[0040] A twenty-fourth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough comprises a suspension system (20) configured to allow the movement of the work tool (3) along the adjustment direction during the flexible working condition.

[0041] In a twenty-fourth bis aspect of the invention according to the preceding aspect, said suspension system (20) comprises at least one hydraulic or pneumatic piston (21) connected to said work tool (3) and movable in extension and compression during said flexible working condition.

[0042] A twenty-fifth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which an extension or compression of said hydraulic or pneumatic piston (21) of the suspension system (20) determines the transition of the snowplough from the resting condition to the flexible working condition and vice versa, and
in which:

- in the resting condition of the snowplough, said hydraulic or pneumatic piston (21) is in a locking condition to maintain the inoperative position of the work tool (3) fixed;
- in the flexible working condition of the snowplough,

said hydraulic or pneumatic piston (21) is in an unlocking condition in which extension and compression of said hydraulic or pneumatic piston (21) is allowed.

[0043] In a twenty-fifth bis aspect of the invention, dependent on any one of the preceding aspects from 24, said suspension system (20) comprises at least one elastic element (22), optionally a traction or compression or torsion spring, kinematically connected to said work tool (3) and movable in extension and compression during said flexible working condition,

optionally in which a movement of the work tool (3) along the adjustment direction determines extension and/or compression of said elastic element (22) of the suspension system (20) and vice versa,
optionally in which the elastic element (22), when the snowplough is in the flexible working condition, is preloaded to define a lifting force of the work tool (3).

[0044] A twenty-sixth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which the snowplough is configurable in a stable working condition in which:

- the work tool (3) is in an operating position for removing snowy material from the ground, the work tool (3) being close to the ground or in contact with the ground in said operating position, and simultaneously
- arranged in a fixed position with respect to said frame.

[0045] A twenty-seventh aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said fixed position is a position which is placed along said adjustment direction.

[0046] A twenty-eighth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which in said stable working condition, the work tool (3) is locked in a height direction in particular with respect to the support plane (SP).

[0047] A twenty-ninth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which in the fixed working condition of the snowplough, said hydraulic or pneumatic piston (21) is in a locking condition to maintain the operating position of the work tool (3).

[0048] A thirtieth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which, in said locking condition, the piston (21) is locked in extension and compression.

[0049] A thirty-first aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said suspension system (20) comprises at least one valve configured to selectively allow and prohibit an extension and compression movement of said hydraulic or pneumatic piston (21) to define the resting condition and the flexible working condition, optionally to also define the stable working condition.

[0050] A thirty-second aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which the work tool (3), when the snowplough is in the flexible working condition, is movable in height to follow an altimetric profile of the ground.

[0051] A thirty-third aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said height direction comprises at least one component transverse, optionally orthogonal, to the support plane (SP), in particular in which said height direction is transverse, optionally substantially orthogonal, to the support plane (SP) and/or in which said height direction comprises at least one component transverse, optionally orthogonal, to the ground.

[0052] A thirty-fourth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough comprises a handle (11) configured to be grasped by an operator to guide said snowplough.

[0053] A thirty-fifth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said handle (11) is positioned at a rear zone of the snowplough with respect to the advancement direction (AD).

[0054] A thirty-sixth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough further comprises at least one selector (12) operatively connected to the work tool and configured to switch the condition of the work tool (3) between resting condition, flexible working condition and optionally stable working condition.

[0055] A thirty-seventh aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said selector (12) comprises a control lever.

[0056] A thirty-eighth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said control lever is movable at least between:

- a first position determining the resting condition;
- a second position determining the flexible working condition;
- optionally a third position determining the fixed working condition.

[0057] A thirty-ninth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said selector (12), in particular a control lever, is applied to said handle (11) or in which said selector (12), in particular a control lever, is applied to a body fixed to said frame.

[0058] A fortieth aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which said control lever is operatively connected to a valve of

the hydraulic or pneumatic piston (21) of the suspension system (20), said valve being movable between an open position and a closed position by driving said control lever.

[0059] A forty-first aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said handle (11) is movable, in particular by rotation, between a first and a second position integrally with the work tool (3), such that a movement of the control handle (11) determines a simultaneous movement of the work tool (3), such that:

- when said control handle (11) is in the first position, the work tool (3) is in the inoperative position,
- when said control handle is in the second position, the work tool (3) is in the operating position.

[0060] A forty-second aspect of the invention, dependent on the preceding aspect, relates to a snowplough, in which a movement of the handle (11) from the first position to the second position causes a movement of the work tool (3) from the inoperative position to the operating position, and
in which a movement of the handle (11) from the second position to the first position causes a movement of the work tool (3) from the operating position to the inoperative position.

[0061] A forty-third aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which:

- said handle (11) extends between:
    - a gripping portion (13), configured to be grasped by an operator, and
    - a bottom portion (14) movable by rotation around a respective rotation axis in particular to allow the movement of the handle (11) between the first position and the second position;
- said hydraulic or pneumatic piston (21) extends between a first attachment portion and a second attachment portion, in which:
    - the first attachment portion is constrained to a respective attachment portion of the handle (11), optionally said attachment portion of the handle (11) being interposed between the gripping portion (13) and the bottom portion (14) of the handle (11);
    - the second attachment portion is constrained to a portion of said frame.

[0062] A forty-fourth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough comprises:

- a hydraulic or pneumatic circuit which is operatively connected to the hydraulic or pneumatic piston (21),
- a hydraulic or pneumatic pump configured to pressurize said hydraulic or pneumatic circuit,
said pressurized hydraulic or pneumatic piston (21) determining the transition of the work tool (3) from the lowered position to the raised position,
and/or
- an electric actuator, optionally operatively connected to the hydraulic or pneumatic piston (21), configured to determine the transition of the work tool (3) from the lowered position to the raised position,
- a mechanical system, optionally operatively connected to the hydraulic or pneumatic piston (21) and configured to vary the length of said piston (21), configured to determine the transition of the work tool (3) from the lowered position to the raised position.

[0063] A forty-fifth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough comprises at least one motor operatively connected to the movable milling cutter or turbine or auger (4) to determine the rotation thereof, said motor being powered by fuel or battery.

[0064] A forty-sixth aspect of the invention, dependent on any one of the preceding aspects, relates to a snowplough, in which said snowplough is a push machine, optionally pulled, manually driven and lacking a driving seat for supporting an operator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0065] Some embodiments and aspects of the invention will be described hereinafter with reference to the accompanying figures, given merely for illustrative, non-limiting purposes in which:

- Figure 1 is side view of a snowplough in a flexible working condition in accordance with the present invention;
- Figure 2 is a side view of a snowplough in a resting condition in accordance with the present invention;
- Figure 3 is a front perspective view of a snowplough in a flexible working condition in accordance with the present invention;
- Figure 4 is a perspective detailed view of the handlebar of a snowplough in accordance with the present invention;
- Figure 5 is a sectional view depicting the transmission system interposed between the selector and the suspension system of the snowplough in accordance with the present invention;
- Figure 6 is a sectional view depicting the stop element of the suspension system of the snowplough in accordance with the present invention.

DEFINITIONS AND CONVENTIONS

[0066] It should be noted that in the present detailed

description, corresponding parts illustrated in the various figures are indicated with the same numerical references. The figures could illustrate the object of the invention through non--scale depictions; therefore, the parts and components illustrated in the figures related to the object of the invention could exclusively relate to schematic depictions.

Control unit

[0067] The snowplough described and claimed herein can comprise a control unit responsible for controlling the operating conditions implemented by the same snowplough.

[0068] The control unit can be a single unit or be formed by a plurality of different control units depending on the design choices and operational needs.

[0069] The term control unit means an electronic type component which can comprise at least one of: a digital processor (CPU), an analogue type circuit, or a combination of one or more digital processors with one or more analogue type circuits. The control unit can be *"configured"* or *"programmed"* to carry out certain steps: in practice, this can be accomplished by any means that allows the control unit to be configured or programmed. For example, in the case of a control unit comprising one or more CPUs and one or more memories, one or more programs can be stored in appropriate memory banks connected to the CPU(s); the program(s) contains instructions which, when executed by the CPU(s), program or configure the control unit to carry out the operations described in relation to the control unit. Alternatively, if the control unit is or comprises analogue circuitry, then the circuitry of the control unit can be designed to include circuitry configured, in use, to process electrical signals so as to carry out the steps related to the control unit.

Actuator

[0070] The term actuator means any device capable of causing a movement on a body, for example upon the command of the control unit (receipt by the actuator of a command sent by the control unit). The actuator can be electrical, pneumatic, mechanical (e.g., spring-loaded), hydraulic or another type of actuator.

Work tool

[0071] The term work tool refers to the payload of the snowplough, i.e., the load by means of which the snowplough performs its function of removing snowy material, in particular during advancement along the ground, the work tool typically being placed at the front region of the snowplough. It should be noted that the present invention has no limitation on the type of work tool installed in the snowplough. By way of non-limiting explanation, the work tool can comprise a snowplough blade or a tool movable by rotation around a rotation axis thereof, such as a milling cutter or a turbine or an auger. In an advantageous configuration, the work tool is housed in a containment hood.

Operating position

[0072] The term operating position (referring to the work tool of the snowplough) means any of the positions of the work tool (taking in particular as reference the support plane of the snowplough or, alternatively, the ground) at which the work tool can fulfil its function of removing snowy material. It should be noted that, in order to be able to consider a certain position of the work tool as an operating position, the height of the work tool with respect to the support plane and/or with respect to the ground assumes a main relevance. In particular, a position in which the work tool is in contact with the ground can suitably be considered an operating position, the work tool being able to process snowy material in such a position in contact with the ground and in particular to remove it. Conversely, a position in which the accumulation of snowy material on the ground is exceeded in height cannot be considered an operating position of the work tool.

Flexible working condition

[0073] The term flexible working condition (referring to the work tool of the snowplough) means a condition according to which the work tool is allowed a freedom of movement between different positions which, in particular as a function of the quantity and/or distribution of the snowy material accumulated on the ground, are all appropriately considered as operating positions of the work tool. The operating positions among which the work tool can move in the flexible working condition have a different height with respect to the support plane and/or with respect to the ground.

[0074] Therefore, the freedom of movement that the work tool has in the flexible working condition relates to a vertical direction or a direction having a vertical component (or rather, a main component). The freedom of movement can indifferently envisage, for the work tool, a straight trajectory or a curved trajectory, for example (in advantageous embodiments of the present invention) a circumferential arc trajectory. In the flexible working condition, the work tool moves continuously between distinct operating positions, in particular between distinct heights with respect to the support plane and/or with respect to the ground.

[0075] Considering a function of the type *y=f(x),* where the variable x is the position of the work tool along the advancement direction and the variable y is the position of the work tool along the advancement direction, in the flexible working condition, the variable y varies continuously as the variable y varies. In other words, in the flexible working condition, the height of the work tool varies continuously during the advancement of the snowplough.

Therefore, in the prior art solution of a snowplough disclosed in European Patent Application EP1067240A2, no flexible working condition of the work tool is envisaged. In fact, in such a prior art solution, once the work tool has been adjusted to the desired height, the position of the work tool is thus fixed, so that the work tool then remains stably at the desired height during the advancement of the snowplough.

[0076] According to the present invention, in the flexible working condition, the work tool of the snowplough follows the altimetric profile of the ground, thus being able to absorb variations in the altimetric profile of the ground, i.e., the dips, the bumps and more in general the irregularities that are traditionally formed in the event of accumulation of snowy material. In the flexible working condition, the work tool of the snowplough could therefore be seen as a floating load that remains in contact with the ground (despite the irregularities thereof), managing to "float" in the snowy material so as not to sink.

[0077] The freedom of movement referred to in the flexible working condition is advantageously obtained by inhibiting a stop or a blockage of the snowplough which would otherwise force the work tool to park in a fixed position, in particular with respect to the support plane and/or with respect to the ground. It is intended, in this regard, to specify that the work tool of the snowplough, in the flexible working condition, is capable of moving with respect to the ground and/or with respect to the support plane of the snowplough even only as a result of its own weight force and/or the thrust received from the snowy material. On the contrary, when the stop or blockage of the snowplough exerts its effectiveness, forcing the work tool to assume a fixed position, neither the weight force of the work tool nor the thrust of the snowy material are capable of moving the work tool with respect to the ground and/or with respect to the support plane of the snowplough.

DETAILED DESCRIPTION

Snowplough 1

[0078] The reference number 1 globally indicates a snowplough, shown in the accompanying figures 1-3, for removing snowy material.

[0079] The snowplough 1 comprises movement means 2 configured to allow a movement of the snowplough on a ground along an advancement direction AD. The movement means 2 define a support plane SP with the ground. It should be noted that the support plane SP can be distinguished from the ground plane, as the latter can have dips or bumps. In particular, the support plane SP defines a support area delimited externally by an outline passing through the contact points between the movement means and the ground.

[0080] The snowplough is thus configured to move and remove the snowy material along a trajectory coinciding with the advancement direction AD thereof. The snowplough can be configured to collect the snowy material from the ground and direct it towards a containment box: alternatively, the snowplough can be configured to collect the snowy material from the ground and unload it to the side of the advancement direction.

[0081] In an embodiment, the movement means can comprise tracks, for example a left track and a right track, spaced from each other in width between a left side and a right side of the snowplough 1. Each track can be wound to a front wheel and a rear wheel, to define a ground footprint of the track extending in length along a longitudinal direction of the snowplough, the front wheel and the rear wheel being movable by rotation around respective rotation axes parallel to each other. The front wheel and the rear wheel can be placed substantially at the same height with respect to the support plane SP, so that the contact portion of each track with the ground is interposed between the wheels and the support plane SP itself.

[0082] Each track can also be wound around at least one auxiliary wheel, such that each track is wound around the front wheel, the rear wheel and the auxiliary wheel. The front wheel, the rear wheel and the auxiliary wheel can be movable by rotation around rotation axes parallel to each other. For example, the front wheel, the rear wheel, and the auxiliary wheel can be arranged at the vertices of a triangle, such that one side of the triangle defines the ground footprint of the track.

[0083] The longitudinal direction of the snowplough can be directed starting from a rear portion to a front portion of the snowplough, such a longitudinal direction being able to be coincident, at least during a straight movement of the snowplough, with the advancement direction AD.

[0084] In an embodiment, the tracks can be idle, such that the operator must push the snowplough in advancement.

[0085] Alternatively, the tracks can be driving, in which at least one wheel is driving to transmit motion to the respective track. In a preferential embodiment, the left track and the right track are both driving and optionally rotatable independently of each other. In particular, the operator can control the traction of the snowplough by driving the left track only, or the right track only, or by driving both tracks simultaneously. To determine a straight motion of the snowplough, the tracks are commanded to rotate at the same speed. Conversely, to determine a curvilinear trajectory of the snowplough, the operator can independently control the rotation of the left track and the right track, a difference in rotation speed between the left track and the right track determining a curvilinear trajectory.

[0086] It should be noted that the movement means comprising tracks define a stable support plane, i.e., a support plane that ensures the snowplough remain in a position resting on the ground without the aid of an operator. The support plane SP is stable when the movement means define a two-dimensional surface and a

weight force of the snowplough passing through its centre of gravity transversely intersects the support plane SP, in particular when it transversely intersects the support area defined externally by an outline passing through the movement means. If the weight force intersects such a support area, the snowplough enjoys a stable support (conversely, if the weight force falls outside such a support area, the snowplough would be unstable and would not be capable of maintaining the support position thereof independently).

[0087] In an alternative embodiment not shown in the accompanying figures, the movement means of the snowplough do not comprise tracks but, on the contrary, wheels. The points of contact of such wheels with the ground defines the support plane SP. The wheels can comprise rubber tyres, optionally knobby or studded tyres, to increase grip during operating conditions in which the ground is covered by snowy material. As previously disclosed, the movement means like the wheels can be driving to determine the advancement of the snowplough.

[0088] In particular, the movement means can comprise at least two or three wheels, in particular at least four wheels, to define the stable support plane SP previously disclosed. In particular, the movement means 2 can comprise a left rear wheel, a right rear wheel spaced in width from the left rear wheel, a left front wheel and a right front wheel spaced in width from the left front wheel.

[0089] The snowplough further comprises at least one motor, electric or combustion, operatively connected to the movement means to determine the rotation thereof, and thus to determine the advancement of the snowplough.

[0090] The snowplough further comprises a work tool 3 configured to remove snowy material at least along the advancement direction AD of the snowplough 1. The work tool 3 is housed at a front zone of the snowplough 1 with respect to the advancement direction AD.

[0091] The work tool can comprise a snowplough blade configured to contact the snowy material. In particular, the snowplough blade can comprise a bottom edge facing the support plane SP and extending transversely with respect to the advancement direction AD.

[0092] Alternatively, the work tool 3 can comprise a milling cutter or a turbine or an auger 4 which is movable by rotation around a respective rotation axis R, the rotation of the milling cutter or turbine or auger during an operating condition of the snowplough determining the collection and subsequent unloading of the snowy material externally with respect to the advancement direction. The rotation axis R of the milling cutter or turbine or auger extends along a width direction of the snowplough, in which the width direction is transverse, optionally orthogonal, to the advancement direction AD. It should be noted that the milling cutter or turbine or auger, during an operating condition of the snowplough, rotates around the rotation axis R thereof by means of an operatively connected motor, for example an electric motor or a combustion engine.

[0093] Alternatively, the work tool 3 can comprise a containment hood 5 carrying a milling cutter or turbine or auger 4 of the type previously disclosed, as shown in figures 1-3. The containment hood 5 can comprise side walls 6, 7 spaced from each other and a rear wall 8 interposed in connection between the side walls 6, 7. The containment hood 5 defines an open containment volume 5a adapted to internally house the milling cutter or turbine or auger 4, as shown in figure 3. Optionally, the containment hood 5 and the rear wall 8 have an arcuate shape.

[0094] The containment hood 5 further has a front frontal opening 9 adapted to receive, during a working condition, the snowy material entering the containment volume 5a.

[0095] The containment hood 5 comprises at least one bottom portion 10 facing, at least during a working condition, the ground, the bottom portion 10 being in fact configured to contact, in particular slide, on the ground during an operating condition of the snowplough.

[0096] The bottom portion 10 of the containment hood can comprise one or more slides 10a defining a bottom end plane of the containment hood 5. The slides 10a are adapted to contact the ground during the working condition of the snowplough. The slides can be made of metallic material, for example steel, or of plastic material, for example polytetrafluoroethylene (PTFE).

[0097] The containment hood 5 extends in width, between a left side and a right side, transversely to the longitudinal direction of the snowplough: in particular such an extension in width is comprised between 60 cm and 100 cm, in particular between 70 cm and 90 cm.

[0098] The snowplough further comprises at least one motor, electric or combustion, operatively connected to the milling cutter or turbine or auger 4 to determine the rotation thereof during an operating condition. Furthermore, in the case in which the snowplough is driven, the snowplough comprises at least one motor, electric or combustion, operatively connected to the movement means 2. In an embodiment, the snowplough comprises a same motor connected to both the milling cutter or turbine or auger 4, and to the movement means.

[0099] The work tool 3 is movable in height with respect to the support plane along an adjustment direction, the adjustment direction comprising at least one component orthogonal OD to the support plane or to the ground. In particular, the component orthogonal OD to the ground is the main component of the adjustment direction.

[0100] The work tool 3, moving along the adjustment direction, can draw a curvilinear trajectory, for example around a rotation axis of the work tool 3. In particular, the work tool 3, moving along the adjustment direction, can draw a trajectory substantially in a circumference arc or an ellipse arc.

[0101] The containment hood 5 is preferably made of metallic material, for example steel or aluminium, or alternatively of plastic or composite material.

[0102] The snowplough can comprise a handlebar 11,

as shown in figures 1 and 2, positioned at a rear zone of the snowplough with respect to the advancement direction AD. The handlebar 11 of the snowplough is configured to be grasped by an operator to guide and/or push the snowplough 1.

[0103] The handlebar 11 extends between a gripping portion 13, configured to be grasped by an operator, and a bottom portion 14 movable by rotation around a respective rotation axis to allow the movement of the handlebar 11 between a first position and a second position and vice versa.

[0104] The handlebar 11 can be made of metallic material, for example steel, alternatively of polymeric material.

[0105] The handlebar 11 can be movable, for example by rotation, between the first position and the second position in a manner integral with the work tool 3, such that a movement of the control handlebar 11 determines a simultaneous movement of the work tool 3. In particular, a movement of the handlebar 11 determines the movement of the work tool in height.

[0106] In an alternative embodiment, not shown in the accompanying figures, the handlebar 11 can be fixed, for example fixed with respect to a frame of the snowplough or with respect to the support plane SP, in such an embodiment the work tool 3 still remaining movable in height during at least one operating condition of the snowplough.

[0107] The snowplough 1 can comprise a suspension system 20 configured to allow the movement of the work tool 3 along the adjustment direction during the flexible working condition.

[0108] In an embodiment shown in the accompanying figures 1-2, the suspension system 20 can comprise at least one hydraulic or pneumatic piston 21 kinematically connected to the work tool 3 and movable in extension and compression during a movement of the work tool along the adjustment direction thereof. In other words, the work tool 3 and the piston 21 are linked to each other by means of a kinematic chain such that a movement in height of the work tool 3 determines a simultaneous movement in extension or compression of the piston 21.

[0109] As shown in figures 1 and 2, the piston 21 can be interposed between the handlebar 11 and a frame portion of the snowplough 1, in which such a frame portion is substantially fixed with respect to the support plane SP.

[0110] The piston 21 extends between a first attachment portion and a second attachment portion. The first attachment portion can be constrained to a respective attachment portion of the handlebar 11, while the second attachment portion is constrained to the frame portion of the snowplough. The attachment portion of the handlebar 11 can be interposed between the gripping portion 13 and the bottom portion 14 of the handlebar 11.

[0111] Alternatively, the suspension system 20 comprises at least one elastic element 22, optionally a traction or compression or torsion spring, kinematically connected to the work tool 3. In particular, the work tool 3 and the elastic element 22 are linked to each other by means of a kinematic chain such that a movement in height of the work tool 3 along the adjustment direction thereof determines a simultaneous movement of the elastic element 22, for example an extension and compression of the elastic element or a torsion of the elastic element.

[0112] It should be noted that the elastic element 22, when the snowplough 1 is in the flexible working condition, can be in a preload condition so as to define a lifting force of the work tool 3.

[0113] Like the piston 21, the elastic element can be interposed between the handlebar 11 and the fixed frame portion with respect to the support plane. Thereby, a movement of the work tool 3 determines a consequent movement of the handlebar 11, in which the latter determines a consequent movement of the elastic element 22.

[0114] The snowplough 1, according to the invention, is configurable according to a flexible working condition, shown in figure 1, in which:

- the work tool 3 is in an operating position for removing snowy material from the ground, and simultaneously
- the work tool 3 is left free to move along an adjustment direction having the orthogonal component OD with respect to the ground.

[0115] The operating position of the work tool 3 is a lowered position, in which the work tool 3 is close to the ground or is in contact with the ground. In particular, the work tool 3, when arranged in the operating position, is configured to perform the snowy material removal operations, whereby the work tool 3 is sufficiently close to the ground to contact and collect the snowy material.

[0116] In other words, the work tool 3, when the snowplough 1 is in the flexible working condition, is movable in height to follow an altimetric profile of the ground.

[0117] Optionally, in the flexible working condition, the work tool 3 is movable in height to cross the support plane SP. In other words, the work tool can move in height above and below the support plane SP, so as to follow the altimetry of the ground. In particular, the blade or the housing hood 5 are configured, when the snowplough 1 is in the flexible working condition, to move in height, for example above and below the support plane SP, so as to follow the variable altimetry of the ground.

[0118] In greater detail, in the flexible working condition, the work tool 3 is movable in height with respect to the support plane SP and, at the same time, configured to maintain contact with the ground.

[0119] In the flexible working condition, the work tool 3 is movable in height to define a stroke greater than 1 cm, in particular comprised between 1 cm and 56 cm, optionally between 1 cm and 30 cm, more in particular between 2 cm and 20 cm, optionally between 5 cm and 15 cm. Accordingly, the work tool 3, when in the flexible working condition, is capable of absorbing corresponding

variations of the altimetric profile of the ground.

[0120] It should be noted that the handlebar 11, when the snowplough 1 is in the flexible working condition, is movable in rotation at the same time as a movement in height of the work tool 3.

[0121] To summarize, the work tool 3, when in the flexible working condition, can move in height while remaining in the operating position, i.e., in a position adapted to remove the snowy material.

[0122] It should be noted that the piston 21, as shown in figures 1 and 2, is free to move in extension and compression during the flexible working condition. In particular, the piston 21, when the snowplough 1 is in the flexible working condition, is in an unlocking condition in which extension and compression of the hydraulic or pneumatic piston 21 is allowed. In other words, the piston 21, when the snowplough 1 is in the flexible working condition, is free to extend and compress so as to allow the work tool 3 to move in height to follow the altimetric profile of the ground.

[0123] If the suspension system comprises the elastic element 22, for example a traction or compression or torsion spring, such an elastic element 22 is free to move during the flexible working condition, so as to allow the movement in height of the work tool 3.

[0124] It should be noted that the elastic element 22, at least when the snowplough 1 is in the flexible working condition, can be in a preload condition so as to define a lifting force of the work tool 3.

[0125] The snowplough 1 can be further configurable in a resting condition, shown in figure 2, in which the work tool 3 is in an inoperative position. The resting condition is defined as a condition in which the snowplough does not and cannot perform snowy material removal operations. In fact, in the inoperative position, corresponding to the resting condition of the snowplough 1, the work tool is in a raised position with respect to the ground. In particular, the work tool, when arranged in the inoperative position, can define with the ground, in particular with the support plane SP, a distance greater than 30 cm, optionally comprised between 30 cm and 70 cm, in particular between 40 cm and 60 cm.

[0126] It should be noted that the work tool 3, when arranged in the inoperative position of the resting condition, is in a substantially fixed position with respect to the support plane SP. In other words, in the resting condition, the work tool 3 is not movable in height.

[0127] The snowplough 1 is stably lockable in the resting condition, so that the possibility that the work tool 3 can move from the inoperative position to the working position is inhibited.

[0128] In the resting condition, the auger or turbine or milling cutter of the work tool 3 is preferably stationary. In particular, a control unit of the snowplough 1 can be configured to inhibit a rotation of the auger or turbine or milling cutter when the snowplough 1 is in the resting condition.

[0129] However, the movement means of the snowplough 1 can be configured to move the snowplough 1 even in the resting condition.

[0130] The work tool 3 is movable between the inoperative position of the resting condition and the operating position of the flexible working condition and vice versa. In particular, the work tool 3 is configured to pass by gravity from the inoperative position of the resting condition to the operating position of the flexible working condition. In other words, the weight of the work tool contributes to determining the transition of the work tool 3 from the inoperative position to the operating position.

[0131] An extension or compression of the piston 21 of the suspension system 20 determines the transition of the snowplough 1 from the resting condition to the flexible working condition and vice versa. For example, the piston 21 can be adapted to determine the transition of the snowplough from the resting condition to the flexible working condition and vice versa. A pressurized circuit, for example a pneumatic or fluid circuit, operatively connected to the piston 21 can be adapted to provide sufficient energy to determine such movement of the work tool 3.

[0132] If the snowplough 1 comprises the elastic element 22, the latter can be configured to generate a thrust on the work tool 3 from the operating position towards the inoperative position. Such a thrust is thus preferably directed in the opposite direction with respect to the direction of the weight force of the work tool 3.

[0133] In the resting condition of the snowplough 1, the piston 21 can be configurable in a locking condition to maintain the inoperative position of the work tool 3 fixed by means of a stop element 15. Such a stop element can also be deactivated on command of the operator to allow the work tool to move from the inoperative position to the operating position.

[0134] In particular, the stop element can comprise a deactivatable mechanical system configured to maintain the work tool in the inoperative position. Alternatively, the stop element can comprise a valve element, in particular a valve, configured to selectively allow and prohibit an extension and compression movement of the piston 21 to define the resting condition and the flexible working condition.

[0135] The snowplough can also be configurable in a stable working condition in which the work tool 3 is in the operating position for the removal of snowy material from the ground, and is simultaneously arranged in a fixed position with respect to the support plane SP. In other words, if in the flexible working condition the work tool 3 is movable in height to follow an altimetric profile of the ground, in the stable working condition the work tool 3 is in a fixed position with respect to the support plane SP, i.e., the work tool 3 is not movable in height with respect to the support plane SP. The fixed position is a position which is located along the height adjustment direction of the work tool 3.

[0136] In this regard, the stop element 15 is configured to maintain the stable working condition, i.e., configured

to lock the work tool 3 in a height direction with respect to the support plane SP.

[0137] For example, in the stable working condition of the snowplough 1, the piston 21 is in a locking condition to maintain the operating position of the work tool 3, such a locking condition being in particular distinct with respect to that which maintains the work tool 3 in the resting position. In the locking condition, the piston 21 is locked in extension and compression.

[0138] Alternatively, the locking element 15 can comprise the deactivatable mechanical system configured to maintain the work tool 3 in the operating position.

[0139] It should be noted that the stop element can be configured to define a first arrangement for selectively locking the work tool 3 in the inoperative position and/or a second arrangement for selectively locking the work tool 3 in the operating position of the stable working condition.

[0140] As previously disclosed, the control handlebar 11 is movable between the first and the second position to determine the height movement of the work tool 3. In particular, when the handlebar 11 is in the first position, the work tool 3 is in the inoperative position, while when the handlebar 11 is in the second position, the work tool 3 is in the operating position. The movement of the handlebar 11 from the first position to the second position thus causes a movement of the work tool 3 from the inoperative position to the operating position. Conversely, a movement of the handlebar 11 from the second position to the first position causes a movement of the work tool 3 from the operating position to the inoperative position.

[0141] Optionally, when the work tool 3 is in the operating position, the piston is in an extended condition, while when the work tool 3 is in the inoperative position the piston is in a retracted condition.

[0142] The snowplough 1 can further comprise at least one selector 12 operatively connected to the work tool 3 and configured to switch the condition of the work tool 3 between resting condition, flexible working condition and optionally stable working condition.

[0143] In an embodiment of the present invention, the selector 12 is present in the snowplough 1 in the form of a control lever movable at least between a first position which determines the resting condition and a second position which determines the flexible working condition.

[0144] Furthermore, the control lever (or, more generally, the selector 12) can be movable in a third position which determines the stable working condition.

[0145] The control lever, by way of non-limiting example, extends in length from a dashboard of the snowplough 1 and is in particular positioned on the handlebar 11 of the snowplough, preferably near or at the gripping portion 13 of the handlebar 11. It should be underlined that the positioning of the control lever (or, more generally, of the selector 12) at the handlebar 11 provides an undoubted benefit in terms of ergonomics. However, the present invention is not to be understood as being limited in this sense, since the control lever (or, more generally, the selector 12) can alternatively be arranged on a body applied to the frame of the snowplough 1.

[0146] As shown in figure 6, the control lever can be operatively connected to a valve of the piston 21 of the suspension system 20. An opening and closing of the valve can selectively determine the locking position and the unlocking position of the piston. For example, the selector 12 (e.g., the control lever) in the first position can determine the locking position of the piston, while the selector 12 (e.g., the control lever) in the second position can determine the unlocking position of the piston. The selector 12 (e.g., the control lever) in the third position can still determine the locking position, but in conjunction with a different position of the work tool 3.

[0147] In a particularly advantageous embodiment of the present invention, the first position of the selector 12, in particular of the control lever, is a locking position, in which the operator driving the snowplough 1 is inhibited from varying the position and/or the orientation of the work tool 3 and/or of the front part of the snowplough 1. The operator can therefore arrange the selector 12 in the first position, having to drive the snowplough 1 along a ground which is generally uniform or when the snowplough is at rest.

[0148] Again, in such a particularly advantageous embodiment of the present invention, the second position of the selector 12, in particular of the control lever, is a temporary unlocking position, in which the operator driving the snowplough 1 is allowed to temporarily and/or provisionally vary the position and/or the orientation of the work tool 3 and/or of the front part of the snowplough 1. In order to make the unlocking associated with the second position of the selector 12 temporary, the selector 12 can be configured such that the second position of the selector 12 appears as an unstable position, persisting as long as it is manually maintained by the operator. Therefore, once released by the operator, the selector 12 automatically returns from the second position to the first position. The operator can arrange the selector 12 in the second position when, advancing the snowplough 1 along a generally uniform ground, an isolated irregularity, for example a step, arises.

[0149] Again, in this particularly advantageous embodiment of the present invention, the third position of the selector 12, in particular of the control lever, is a permanent unlocking position, in which the operator driving the snowplough 1 is allowed to continuously vary the position and/or the orientation of the work tool 3 and/or of the front part of the snowplough 1. The operator can arrange the selector 12 in the third position, having to advance the snowplough 1 along uneven ground, with continuous dips and bumps, so as to allow a dynamic adaptation of the snowplough 1 to the ground conditions.

[0150] The second position of the selector 12 can be an intermediate position between the first position of the selector 12 and the third position of the selector 12. However, it must be specified how the present invention is independent of the order in which the three positions of

the selector 12 follow one another.

[0151] In an embodiment not shown in the accompanying figures, the control lever (or more generally the selector 12) can be operatively connected to the mechanical locking system and configured to activate and deactivate the mechanical locking system, so that, during the flexible operating condition, the mechanical locking system is deactivated.

[0152] In a preferred embodiment, the snowplough has a weight comprised between 80 kg and 200 kg, in particular between 120 kg and 180 kg, more in particular between 140 kg and 160 kg, even more in particular of about 150 kg.

[0153] The snowplough has an extension in length, between the rear portion and the front portion, comprised between 70 cm and 180 cm, in particular between 90 cm and 150 cm, a width, between the left side and the right side, comprised between 60 cm and 100 cm, in particular between 70 cm and 85 cm, and a height starting from the support plane SP comprised between 80 cm and 150 cm, in particular between 100 cm and 110 cm.

[0154] It should be noted that the snowplough of the present invention typically does not comprise a driving seat adapted to accommodate the operator. Conversely, during an operating condition, the operator grasps the handlebar 11 at the gripping portion 13 and walks to set the advancement direction AD of the snowplough 1.

[0155] It should also be noted that in the embodiment of the present invention referred to in the figures accompanying the present disclosure, the frame, the motor assembly and the work tool move integrally with each other, so as to achieve the switches between the envisaged conditions of the work tool. In a variant of the present invention, the snowplough is configured such that the work tool is instead left free to move with respect to at least one portion of the frame of the snowplough. Therefore, in such a variant, the switches between the envisaged conditions of the work tool (in particular resting condition, flexible working condition, stable working condition) are achieved by means of a variation of the position and/or the orientation of the work tool with respect to the fixed frame portion.

Use of the snowplough 1

[0156] The inventive features of the snowplough 1 as described above, as well as depicted in the accompanying figures, are such that the use of the same snowplough 1 must also be seen as an invention. Such use will be described below, specifying that what is disclosed in the preceding paragraph regarding the snowplough 1 also applies to the related use. Therefore, any features described above which also affect the use of the snowplough 1 and which are not expressly repeated herein must in any case be considered as integral parts of the present paragraph.

[0157] A peculiar feature of the use of the snowplough 1 according to the present invention is to implement a flexible working condition (as defined in the dedicated paragraph of the above section called "Definitions and Conventions").

[0158] To this end, the use according to the present invention envisages performing a step of moving the work tool 3 in height with respect to the support plane SP and/or with respect to the ground, the movement of the work tool 3 in height occurring in particular along an adjustment direction which is orthogonal with respect to the ground (i.e., along a vertical direction) or comprising, preferably as a main component, a component which is orthogonal with respect to the ground. The movement of the work tool 3 in height can occur following a straight trajectory or following a curvilinear trajectory, for example a circumferential arc trajectory. Preferably, the work tool 3 is moved or can be moved in height to define a stroke comprised between 1 cm and 56 cm, in particular between 1 cm and 30 cm, more in particular between 1 cm and 15 cm.

[0159] Still in order to implement the flexible working condition, the use according to the present invention envisages performing a step of maintaining the work tool 3 in an operating position (as defined in the dedicated paragraph of the above section called "Definitions and Conventions"), so that the work tool 3 can effectively exercise the function thereof of removing snowy material from the ground. In particular, the maintenance of the work tool 3 in the operating position envisages that the work tool 3 remains in contact with the ground during the advancement of the snowplough 1, where a minimum deviation with respect to the ground (e.g., a deviation less than 1 cm) is assimilated to a ground contact condition.

[0160] The steps disclosed above of moving the work tool 3 and maintaining the work tool 3 in an operating position are performed simultaneously, so that it is possible for the work tool 3 of the snowplough 1 to follow an altimetric profile of the ground, absorbing the variations of such an altimetric profile generated by the irregularities (such as bumps and dips) typical of the accumulation of snowy material. Advantageously, the simultaneous execution of the steps of moving the work tool 3 and maintaining the work tool 3 in an operating position causes the work tool 3, during the advancement of the snowplough 1, to automatically be able to adjust and/or adapt the position thereof with respect to the ground and/or with respect to the support plane SP, as a function of the precise extent of the accumulation of snowy material. In the embodiment of the snowplough 1 depicted in the accompanying figures, such automation in adjusting and/or adapting the position of the work tool is made possible by the ability of the piston 21, when in the unlocking condition, to be movable in extension and compression.

[0161] According to what is disclosed above, the snowplough 1 advantageously includes a suspension system 20, comprising in particular a hydraulic or pneumatic piston 21 kinematically connected to the work tool 3. Since such a piston 21, when in an unlocking condition, is movable in extension and compression during the flexible

working condition, the above-disclosed steps of moving the work tool 3 and maintaining the work tool 3 in an operating position envisage arranging the piston 21 in an unlocking condition, so as to allow the work tool 3 to move along the adjustment direction and/or in height with respect to the support plane SP, during the advancement of the snowplough 1.

[0162] The use of the snowplough 1 according to the present invention envisages establishing the flexible working condition of the snowplough 1 by means of switching starting from a different condition of the same snowplough 1, where such a different condition can be a resting condition or a stable working condition.

[0163] It should be recalled that the resting condition of the snowplough 1 is the condition (suitable in particular to allow an easier advancement of the snowplough 1) in which the work tool 3 is in an inoperative position, in which the work tool 3 cannot remove snowy material from the ground, being arranged in a raised position with respect to the ground (for example at a distance, with respect to the support plane SP, comprised between 30 cm and 70 cm, in particular between 40 cm and 60 cm, more in particular between 50 cm and 60 cm) and being constantly maintained in such a fixed raised position with respect to the ground.

[0164] It should further be recalled that the stable working condition of the snowplough 1 is the condition in which the work tool 3 is in an operating position, in which the work tool 3 (contacting the ground or being close to the ground) is capable of removing snowy material from the ground, as well as in the flexible working condition. However, unlike the flexible working condition, in the stable working condition the work tool 3 is constantly maintained in a fixed position with respect to the ground, whereby it is not capable of following the altimetric profile of the ground, nor of adapting the position thereof to variations of such an altimetric profile, such as the typical variations of irregularities in the accumulation of snowy material.

[0165] Switching from the resting condition to the flexible working condition and switching from the stable working condition to the flexible working condition can be achieved by inhibiting and/or disabling a locking condition having effectiveness on the work tool 3, in particular a locking condition which forces the work tool 3 to assume a fixed position. In the embodiment of the snowplough 1 depicted in the accompanying figures, this means that the piston 21, in order to operate the switching from the resting condition to the flexible working condition, as well as the switching from the stable working condition to the flexible working condition, is driven in an unlocking condition, in which the piston 21 is movable in extension and compression.

[0166] In the embodiment of the snowplough 1 comprising the piston 21, in order to operate the switching from the resting condition to the flexible working condition, as well as the switching from the stable working condition to the flexible working condition, a disabling of the stop element 15 associated with the piston 21 and depicted in particular in figure 6 can be envisaged. More generally, the switching from the resting condition to the flexible working condition and the switching from the stable working condition to the flexible working condition can both presuppose a prior variation of the condition of a mechanical stop element associated with the work tool 3 from a locking condition in which the movement of the work tool 3 along the adjustment direction and/or in height with respect to the support plane SP is inhibited to an unlocking condition in which the movement of the work tool 3 along the adjustment direction and/or in height with respect to the support plane SP is allowed.

[0167] In the use of the snowplough 1 according to the present invention, switching from the flexible working condition to a different condition of the snowplough 1 is also possible, in particular switching from the flexible working condition to the resting condition or switching from the flexible working condition to the stable working condition. Such switching adapted to establish the resting condition or the stable working condition of the work tool 3 obviously presuppose actions carried borne for example by the piston 21 and/or the mechanical stop element which are inverse to those previously disclosed, or actions intended to establish a locking condition starting from an unlocking condition.

[0168] The switching in the condition of the work tool 3 just described can all be operated manually, by means of the special selector 12 envisaged in the snowplough 1 (in particular the control lever positioned at the handlebar 11 and depicted in figure 5). In fact, since there is an operating connection between the selector 12, in particular the control lever, and the mechanical stop element, in particular the stop element 15 associated with the piston 21, an action exerted on the selector 12 produces effects on the mechanical stop element, so that the condition of the mechanical stop element can be switched from the locking condition to the unlocking condition (and vice versa), manually operating the special selector 12 of the snowplough 1. Consequently, by manually operating the selector 12, the condition of the work tool 3 can be switched between the flexible working condition, the resting condition, and the stable working condition. In particular, the flexible working condition of the work tool 3 can be established by arranging the selector 12 in an unlocking condition, while the resting condition and the stable working condition can be established by placing the selector 12 in a locking condition (in conjunction with different positions of the work tool 3, i.e., respectively in conjunction with an inoperative position and an operating position of the work tool).

[0169] The configuration of the selector 12, in particular of the control lever, is suitable to allow to manually perform, by means of the selector 12, a switching such as to stably establish the flexible working condition of the snowplough 1, this occurring by arranging the selector 12, in particular the control lever, in a permanent unlocking position. In the permanent unlocking position of the selector 12, continuous variations of the position of the

work tool 3 (in particular of the height of the work tool 3 with respect to the ground and/or with respect to the support plane SP of the snowplough) are allowed, as long as the selector 12 remains in such a permanent unlocking position. Therefore, the use according to the present invention can advantageously comprise the step of arranging the selector 12, in particular the control lever, in a permanent unlocking position, in order to stably establish the flexible working condition of the snowplough 1.

[0170] Advantageously, the configuration of the selector 12, in particular of the control lever, further allows to manually perform, by means of the selector 12, a switching such as to unstably establish the flexible working condition of the snowplough 1, this occurring by arranging the selector 12, in particular the control lever, in a temporary unlocking position, in which variations of the position of the work tool 3 (in particular of the height of the work tool 3 with respect to the ground and/or with respect to the support plane SP of the snowplough 1) are allowed, as long as the selector 12 is manually retained in the temporary unlocking position. In fact, a release of the selector 12, in particular of the control lever, when in the temporary unlocking position, determines an automatic switching, depending on the configuration of the snowplough 1 (in particular of the selector 12), from the flexible working condition of the snowplough 1 to the resting condition or to the stable working condition. Therefore, the use according to the present invention can advantageously comprise the step of arranging the selector 12 in a temporary unlocking position, so as to only temporarily establish the flexible working condition of the snowplough 1. Furthermore, the use according to the present invention can comprise the step of releasing the selector 12 from the temporary unlocking position, so as to stably establish the stable working condition or the resting condition starting from the flexible working condition of the snowplough 1.

ADVANTAGES OF THE INVENTION

[0171] The present invention allows to obtain important advantages. In particular, the freedom of movement in height of the work tool during the operating conditions of the snowplough allows the snowplough to advance easily even in the presence of uneven terrain, i.e., in the presence of holes, dips, snow piles or bumps. For example, if the ground has a dip, the work tool is free to lower to follow the ground, effectively completing the snow removal. Conversely, in the event of a significant bump or snow pile, the work tool (3) is free to rise in height so as to avoid stopping the advancement.

[0172] Furthermore, the freedom of movement of the work tool during the operating conditions of the snowplough allows to reduce the stresses, for example vibrations or kickbacks, transmitted to the operator through the control handlebar. Furthermore, the freedom of movement of the work tool during the operating conditions of the snowplough allows to limit the wear of the work tool, as the latter, in the event of contact with the ground, can freely rise.

[0173] In summary, the present invention, if compared with what is known in the state of the art in the field, achieves a considerable improvement in the driving of the snowplough by the operator, making it significantly easier and more comfortable. Given that snowy ground is characterised by the formation of dips and bumps which can make surfaces extremely irregular (so that snowploughs according to the state of the art, especially when manually driven and moved by means of tracks, are subject to continuous stops during their advancement), the present invention ensures an optimal adaptation of the snowplough to such irregularities (and in general to the altimetric profile of the ground), thus minimising the difficulties of advancing the snowplough. Furthermore, the provision of the selector disclosed above allows the operator to have the possibility of varying, at will, the configuration of the snowplough as a function of the conditions of the ground. It is therefore intended that a further effect of the present invention is a greater effectiveness of snow removal operations.

Claims

1. Snowplough (1) for removing snowy material, comprising:

   - movement means (2) configured to allow a movement of the snowplough on a ground, in particular along at least one advancement direction (AD), said movement means (2) defining a support plane (SP) with the ground;
   - a work tool (3) configured to remove snowy material at least along the advancement direction (AD) of the snowplough (1);

   characterized in that it is configurable according to a flexible working condition in which:

   - the work tool (3) is movable in height with respect to the support plane (SP);
   - the work tool (3) maintains contact with the ground or is configured to maintain contact with the ground;
   - the work tool (3) is movable to follow an altimetric profile of the ground and/or the work tool (3) absorbs or is capable of absorbing variations in the altimetric profile of the ground.

2. Snowplough (1) according to claim 1, wherein in said flexible working condition:

   - the work tool (3) is in an operating position for removing snowy material from the ground, said operating position being in particular a lowered position in which the work tool (3) is close to the

ground or in contact with the ground, and simultaneously
- the work tool (3) moves along an adjustment direction or is left free to move along an adjustment direction, said adjustment direction comprising at least one orthogonal component (OD) with respect to the support plane (SP) or with respect to the ground.

3. Snowplough (1) according to claim 1 or claim 2, wherein said snowplough (1) is further configurable in a resting condition in which the work tool (3) is in an inoperative position, said inoperative position being in particular a raised position with respect to the ground.

4. Snowplough (1) according to claim 3, wherein:

i) said snowplough (1) is stably lockable in said resting condition or said work tool (3) is stably lockable in said resting condition and/or
ii) said resting condition of said work tool (3) corresponds to a condition of relatively easy advancement of said snowplough (1) and/or
iii) in said inoperative position, said work tool (3) defines with the support plane (SP) a distance comprised between 50 cm and 60 cm, said distance being a substantially fixed distance, and/or
iv) the work tool (3) is further movable between the inoperative position of the resting condition and the operating position of the flexible working condition and vice versa, the work tool (3), when arranged in the inoperative position of the resting condition, being in a substantially fixed position, in particular with respect to the support plane (SP), the work tool (3), when arranged in the operating position of the flexible working condition, being in a variable position in height, in particular with respect to the support plane (SP), and/or
v) the work tool (3) is configured to pass by gravity from the inoperative position of the resting condition to the operating position of the flexible working condition.

5. Snowplough (1) according to any one of the preceding claims, wherein said snowplough (1), in particular said work tool (3), comprises a containment hood (5) carrying a milling cutter or turbine or auger (4) movable by rotation around a rotation axis (R) thereof, said rotation axis (R) extending along a direction in width of the snowplough (1), said direction in width being transverse, optionally orthogonal, to the advancement direction (AD), said containment hood (5) comprising side walls (6, 7) spaced apart from each other and a rear wall (8) interposed in connection between said side walls (6, 7), said containment hood (5) defining an open containment volume (5a) adapted to house internally accommodate said milling cutter or turbine or auger (4),
optionally wherein:

i) said containment hood (5) has a front frontal opening (9) adapted to receive, during the working condition, the snowy material entering said containment volume (5a) and/or
ii) said containment hood (5) has an arcuate shape, and/or
iii) said containment hood (5) comprises at least one bottom portion (10) facing, at least during said flexible working condition, the ground, said at least one bottom portion (10) being configured to contact, in particular slide, on the ground during an operating condition of the snowplough, and in said flexible working condition, the work tool (3) is movable in height with respect to the support plane (SP) as a result of a contact between said bottom portion (10) of the containment hood (5) and an altimetric profile of said ground and/or
iv) said bottom portion (10) of the containment hood (5) comprises one or more slides (10a) defining a bottom end plane of the containment hood (5), said slides (10a) being adapted to contact the ground during the flexible working condition of the snowplough (1), said one or more slides (10a) being in particular interposed between the bottom portion (10) and said ground.

6. Snowplough (1) according to any one of the preceding claims, further comprising at least one selector (12) operatively connected to the work tool (3) and configured to determine a switching in the condition of the work tool (3), said selector (12) in particular comprising a control lever, wherein:

- a first position of the selector (12) is a locking position, adapted to inhibit variations in the position and/or orientation of the work tool (3) and/or of a front part of the snowplough (1),
- a second position of the selector (12) is a temporary unlocking position, adapted to allow provisional variations in the position and/or orientation of the work tool (3) and/or of a front part of the snowplough (1),
- a third position of the selector (12) is a permanent unlocking position, adapted to allow continuous variations in the position and/or orientation of the work tool (3) and/or of a front part of the snowplough (1),

optionally wherein said second position is an unstable position requiring in particular the selector (12) to be retained in said second position, in particular the selector (12) moving automatically from the sec-

ond position to the first position upon the release of the selector (12).

7. Snowplough (1) according to any one of the preceding claims, wherein said snowplough (1) comprises a suspension system (20) configured to allow the movement of the work tool (3) along the adjustment direction during the flexible working condition,
wherein said suspension system (20) comprises at least one hydraulic or pneumatic piston (21) kinematically connected to said work tool (3) and movable in extension and compression during said flexible working condition, optionally wherein an extension or compression of said hydraulic or pneumatic piston (21) of the suspension system (20) determines the transition of the snowplough (1) from the resting condition to the flexible working condition and vice versa, and wherein:

- in the resting condition of the snowplough (1), said hydraulic or pneumatic piston (21) is in a locking condition to maintain the inoperative position of the work tool (3) fixed;
- in the flexible working condition of the snowplough (1), said hydraulic or pneumatic piston (21) is in an unlocking condition in which extension and compression of said hydraulic or pneumatic piston (21) is allowed, or wherein said suspension system (20) comprises at least one elastic element (22), optionally a traction or compression or torsion spring, kinematically connected to said work tool (3) and movable in extension and compression during said flexible working condition,
- optionally wherein: a movement of the work tool (3) along the adjustment direction determines extension and/or compression of said elastic element (22) of the suspension system (20) and vice versa, and/or
- the elastic element (22), when the snowplough (1) is in the flexible working condition, is preloaded to define a lifting force of the work tool (3).

8. Snowplough (1) according to any one of the preceding claims, wherein the snowplough (1) comprises a mechanical stop element such that:

- in the resting condition of the snowplough (1), said mechanical stop element is in a locking condition to maintain the inoperative position of the work tool (3) fixed;
- in the flexible working condition of the snowplough (1), said mechanical stop element is in an unlocking condition in which the movement of the work tool (3) along the adjustment direction is allowed.

9. Snowplough (1) according to any one of the preceding claims, wherein the snowplough (1) is configurable in a stable working condition in which:

- the work tool (3) is in an operating position for removing snowy material from the ground, the work tool (3) being close to the ground or in contact with the ground in said operating position, and simultaneously
- the work tool (3) is arranged in a fixed position with respect to the ground, in particular in a fixed position with respect to the support plane (SP),

optionally wherein:

i) said fixed position is a position which is located along said adjustment direction and/or
ii) in said stable working condition, the work tool (3) is locked in a height direction, in particular with respect to the support plane (SP), and/or
iii) in the stable working condition of the snowplough (1), said hydraulic or pneumatic piston (21) is in a locking condition to maintain the operating position of the work tool (3) and/or
iv) in said locking condition, the piston (21) is locked in extension and compression.

10. Snowplough (1) according to any one of the preceding claims, wherein said suspension system (20) comprises at least one stop element configured to selectively allow and prohibit an extension and compression movement of said hydraulic or pneumatic piston (21) to define the resting condition and the flexible working condition, optionally to also define the stable working condition, said element optionally being a valve of said piston.

11. Snowplough (1) according to any one of the preceding claims, wherein:

i) said component orthogonal (OD) to the ground is the main component of said adjustment direction and/or
ii) said work tool (3), moving along said adjustment direction, draws a curvilinear trajectory, in particular in which said work tool (3), moving along said adjustment direction, draws a trajectory substantially in a circumference arc or in an ellipse arc and/or
iii) said snowplough (1) further comprises a frame and said movement means (2) are applied to said frame, optionally wherein the work tool (3), in particular in said flexible working condition, moves with respect to at least one portion of said frame or is left free to move with respect to at least a portion of said frame, and/or
iv) in said flexible working condition, the work tool (3) is movable in height to define a stroke greater than 1 cm, in particular comprised be-

tween 1 cm and 56 cm, optionally between 1 cm and 30 cm, more in particular between 1 cm and 15 cm, and/or

v) in said flexible working condition, the work tool (3) is movable in height to cross said support plane (SP) and/or

vi) said work tool (3) is housed at a front zone of the snowplough (1) with respect to the advancement direction (AD) and/or

vii) said work tool (3) comprises at least one among:

- a snowplough blade configured to contact, during said flexible working condition, the snowy material, in particular wherein said snowplough blade comprises a bottom edge facing the support plane (SP) and extending transversely with respect to the advancement direction (AD), or
- a milling cutter or turbine or auger (4) movable by rotation around a rotation axis (R) thereof, said rotation axis (R) extending along a width direction of the snowplough, said width direction being transverse, optionally orthogonal, to the advancement direction (AD)

viii) said height direction comprises at least one transverse component, optionally orthogonal, to the support plane (SP), in particular wherein said height direction is transverse, optionally substantially orthogonal, to the support plane (SP) and/or wherein said height direction comprises at least one transverse component, optionally orthogonal, to the ground and/or

ix) said snowplough (1) comprises a handlebar (11) configured to be grasped by an operator to guide said snowplough (1) and/or

x) said handlebar (11) is positioned at a rear zone of the snowplough with respect to the advancement direction (AD) and/or

xi) said snowplough (1) comprises:

- a hydraulic or pneumatic circuit which is operatively connected to the hydraulic or pneumatic piston (21),
- a hydraulic or pneumatic pump configured to pressurize said hydraulic or pneumatic circuit, said pressurized hydraulic or pneumatic piston (21) determining the transition of the work tool (3) from the lowered position to the raised position and/or

xii) said snowplough (1) comprises at least one motor operatively connected to the milling cutter or turbine or auger (4) movable to determine the rotation thereof, said motor being powered by fuel or battery and/or

xiii) said snowplough (1) is a push machine and/or a traction machine, manually driven and without a driving seat to support an operator and/or

xiv) the snowplough (1) comprises a first arrangement for selectively locking said work tool (3) in said inoperative position and/or a second arrangement for selectively locking said work tool (3) in said operating position and/or

xv) the support plane (SP) defines a stable equilibrium support plane of the snowplough (1), in particular wherein said support plane (SP) is a two-dimensional plane, and when the snowplough (1) is in the flexible working condition and optionally in the resting condition, a weight force of the snowplough (1) passing through a centre of gravity of the snowplough (1) transversely intersects said support plane (SP), in particular transversely intersects a support area defined externally by an outline passing through the movement means (2), and/or

xvi) the movement means (2) define a stable equilibrium of the snowplough (1) and said movement means (2) comprise at least two wheels, in particular at least three or four wheels to define said support plane (SP) passing through said wheels, or a left track and a right track spaced in width from said left track, in particular wherein the movement means (2) comprise:

- a left rear wheel,
- a right rear wheel spaced in width from said left rear wheel,
- a left front wheel,
- a right front wheel spaced in width from said left front wheel and/or

xvii) the snowplough (1) is configured so that the work tool (3) moves or is left free to move with respect to at least one portion of the frame of the snowplough (1), so that the switching between conditions of the work tool (3) is achieved by means of a variation of the position and/or of the orientation of the work tool (3) with respect to the fixed frame portion and/or

xviii) the snowplough (1) has an optimal adaptation to the altimetric profile of the ground, in particular to irregularities in the ground.

12. Snowplough (1) according to any one of the preceding claims, further comprising at least one selector (12) operatively connected to the work tool (3) and configured to switch the condition of the work tool (3) between resting condition, flexible working condition and optionally stable working condition, optionally wherein:

i) said selector (12) comprises a control lever and/or
ii) said selector (12), in particular said control lever, is movable at least between:

- a first position determining the resting condition;
- a second position determining the flexible working condition;
- preferably a third position determining the stable working condition, and/or

iii) said selector (12), in particular said control lever, is applied to said handlebar (11) or wherein said selector (12), in particular control lever, is applied to a body fixed to said frame and/or
iv) said selector (1) is operatively connected to a valve of the hydraulic or pneumatic piston (21) of the suspension system (20), in particular said control lever is operatively connected to a valve of the hydraulic or pneumatic piston (21) of the suspension system (20), said valve being movable between an open position and a closed position by driving said control lever.

13. Snowplough (1) according to claim 11 or claim 12, wherein said handlebar (11) is movable, in particular by rotation, between a first and a second position integrally with the work tool (3), such that a movement of the handlebar (11) determines a simultaneous movement of the work tool (3), such that:

- when said handlebar (11) is in the first position, the work tool (3) is in the inoperative position,
- when said handlebar (11) is in the second position, the work tool (3) is in the operating position,

optionally wherein:

i) a movement of the handlebar (11) from the first position to the second position causes a movement of the work tool (3) from the inoperative position to the operating position, and wherein a movement of the handlebar (11) from the second position to the first position causes a movement of the work tool (3) from the operating position to the inoperative position, and/or
ii) said handlebar (11) extends between:

- a gripping portion (13), configured to be grasped by an operator, and
- a bottom portion (14) movable by rotation around a respective rotation axis in particular to allow the movement of the handlebar (11) between the first position and the second position; and/or

iii) said hydraulic or pneumatic piston (21) extends between a first attachment portion and a second attachment portion, wherein:

- the first attachment portion is constrained to a respective attachment portion of the handlebar (11), optionally said attachment portion of the handlebar (11) being interposed between the gripping portion (13) and the bottom portion (14) of the handlebar (11);
- the second attachment portion is constrained to a portion of said frame.

14. Use of a snowplough (1) for removing snowy material, said snowplough (1) being in particular according to any one of claims 1 to 13, said snowplough (1) comprising:

- movement means (2) configured to allow a movement of the snowplough on a ground, in particular along at least one advancement direction (AD), said movement means (2) defining a support plane (SP) with the ground;
- a work tool (3) configured to remove snowy material at least along the advancement direction (AD) of the snowplough (1),

said use comprising, in particular in a flexible working condition of said snowplough (1), the steps of:

A) moving the work tool (3) in height with respect to the support plane (SP) and/or along an adjustment direction comprising at least one orthogonal component (OD) with respect to the ground, in particular wherein in said step A) the work tool (3) is moved or can be moved in height to define a stroke comprised between 1 cm and 56 cm, in particular between 1 cm and 30 cm, more in particular between 1 cm and 15 cm, and
B) maintaining the work tool (3) in contact with the ground and/or in an operating position for removing snowy material from the ground;

said steps A) and B) being performed simultaneously, in particular being performed simultaneously in said flexible working condition of said snowplough (1), so as to allow the work tool (3) to follow an altimetric profile of the ground and/or to absorb variations in the altimetric profile of the ground.

15. Use according to claim 14, wherein:

i) said use comprises, in particular in a resting condition of said snowplough (1), the further

steps of:

C) arranging the work tool (3) in an inoperative position for removing snowy material from the ground, said inoperative position being a raised position with respect to the ground, in particular wherein the work tool (3), when arranged in the inoperative position, defines with the support plane (SP) a distance comprised between 30 cm and 70 cm, optionally between 40 cm and 60 cm, more in particular between 50 cm and 60 cm, and

D) maintaining said inoperative position of the work tool (3) fixed,

said steps C) and D) being able to be performed before said steps A) and B) and/or after said steps A) and B), and/or

ii) said use comprises, in particular in a stable working condition of said snowplough (1), the further steps of:

E) arranging the work tool (3) in an operating position for removing snowy material from the ground, said operating position being a position in which the work tool (3) is close to the ground or in contact with the ground, and

F) maintaining said operating position of the work tool (3) fixed,

said steps E) and F) being able to be performed before said steps A) and B) and/or after said steps A) and B), and/or

iii) the snowplough (1) further comprises a suspension system (20) configured to allow the work tool (3) to move in height with respect to the support plane (SP) and/or along the adjustment direction, said suspension system (20) comprising at least one hydraulic or pneumatic piston (21) kinematically connected to said work tool (3) and movable in extension and compression in particular during said flexible working condition, and said use comprises, before said steps A) and B), the further step of:

G) bringing said hydraulic or pneumatic piston (21) into an unlocking condition in which extension and compression of said hydraulic or pneumatic piston (21) is allowed and/or

iv) the snowplough (1) further comprises a mechanical stop element and said use comprises, before said steps A) and B), the further step of:

H) bringing said mechanical stop element into an unlocking condition in which the movement of the work tool (3) along the adjustment direction is allowed and/or

v) the snowplough (1) further comprises at least one selector (12) operatively connected to the work tool (3) and in particular configured to switch the condition of the work tool (3) between resting condition, flexible working condition and optionally stable working condition, said selector (12) being in particular in the form of a control lever in particular positioned on a handlebar (11) of the snowplough (1), and said use comprises, before said steps A) and B), a step between:

I) arranging said selector (12) in a temporary unlocking position, in which the operator driving the snowplough (1) is allowed to temporarily and/or provisionally vary the position and/or orientation of the work tool (3), in particular wherein said temporary unlocking position is an unstable position, lasting as long as it is manually maintained by the operator and

J) arranging said selector (12) in a permanent unlocking position, in which the operator driving the snowplough (1) is allowed to continuously vary the position and/or orientation of the work tool (3).

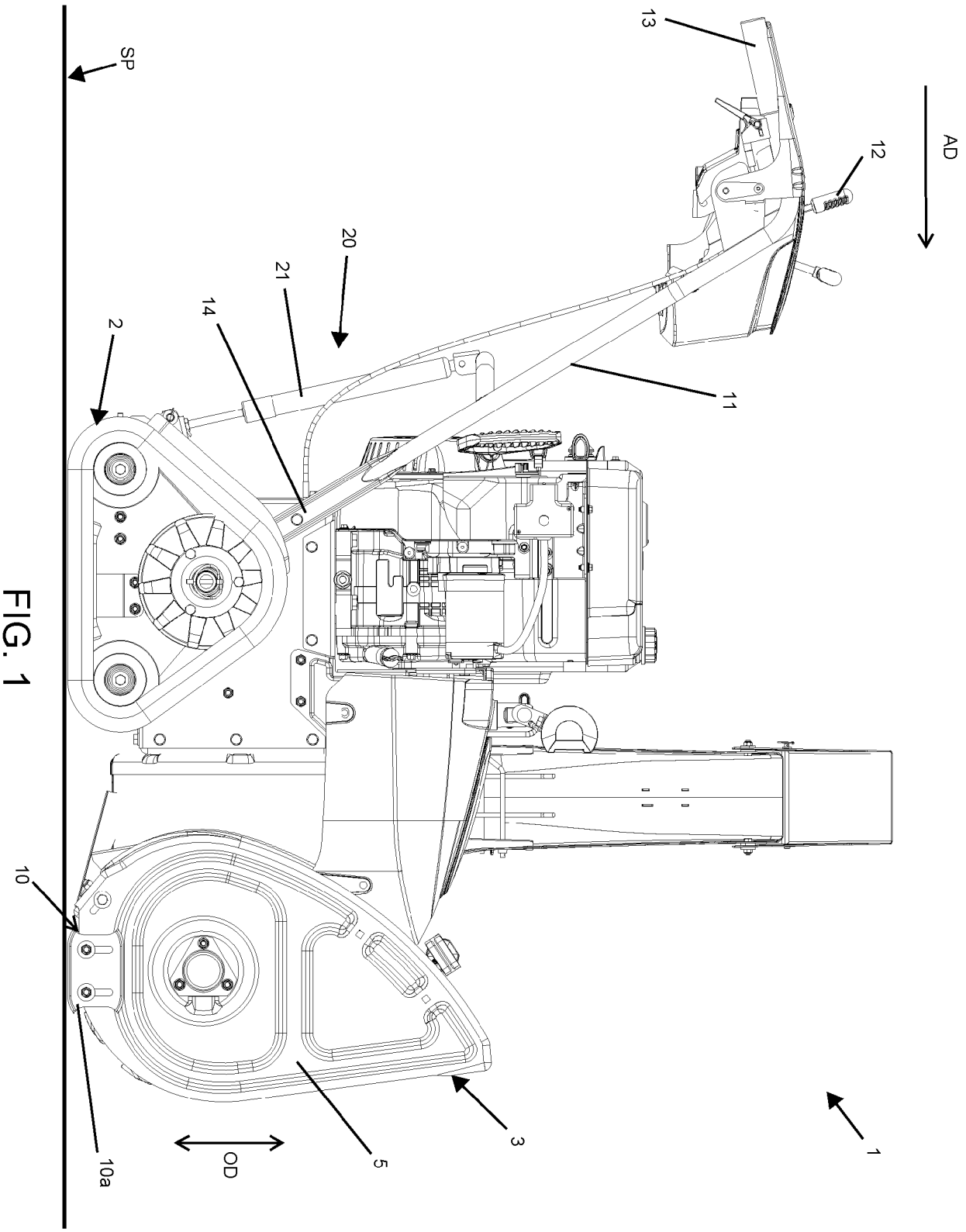


FIG. 1

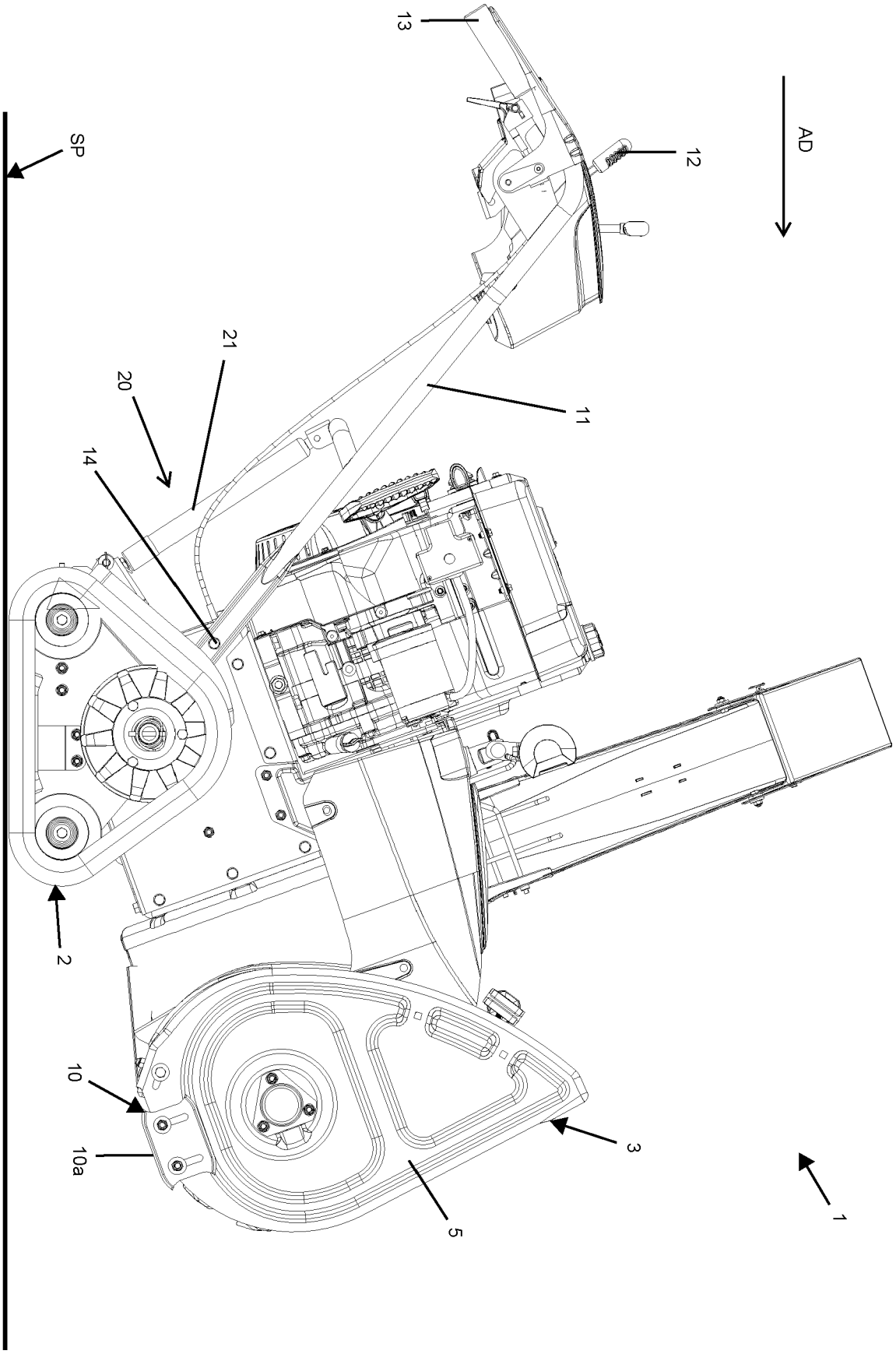


FIG. 2

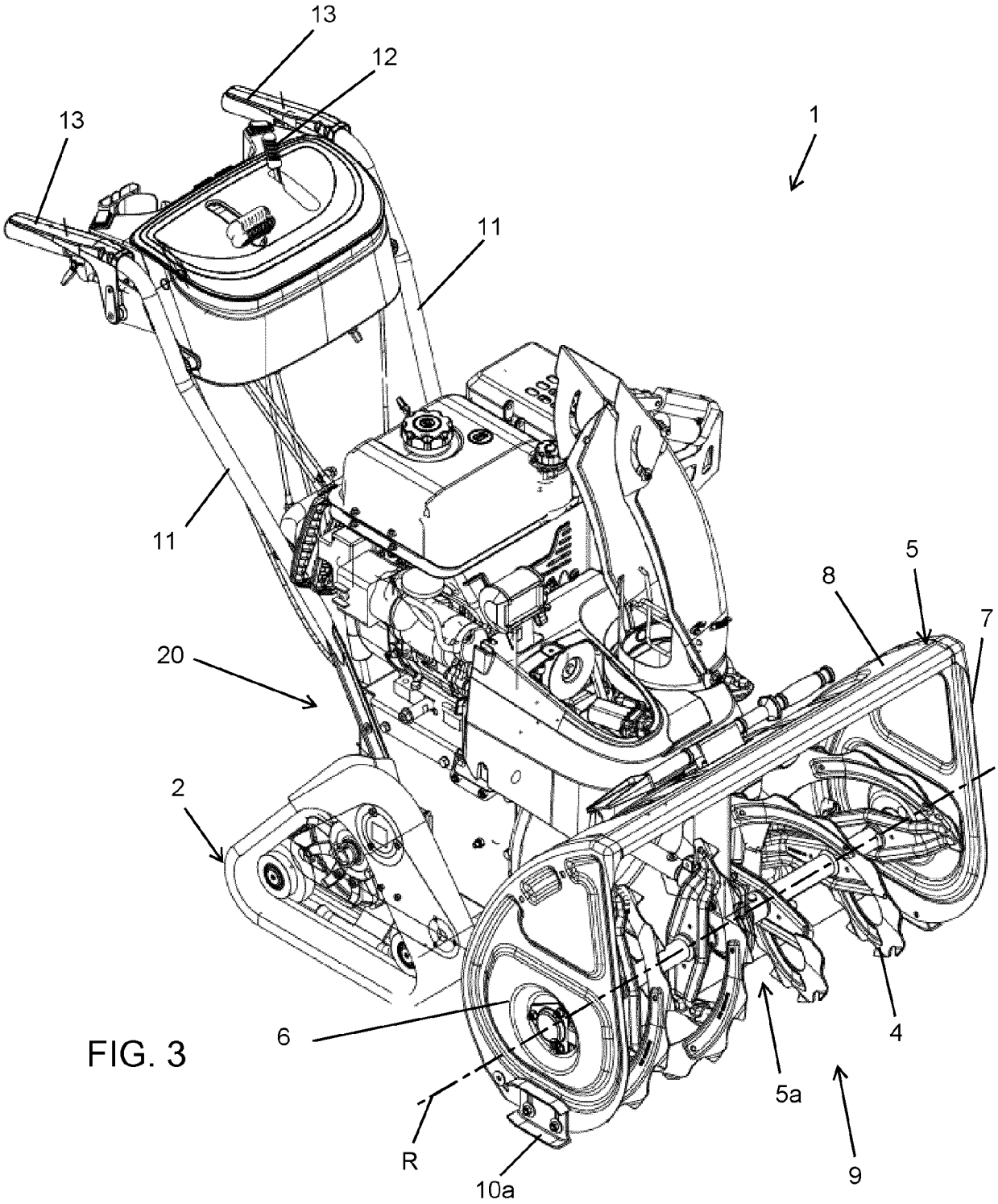
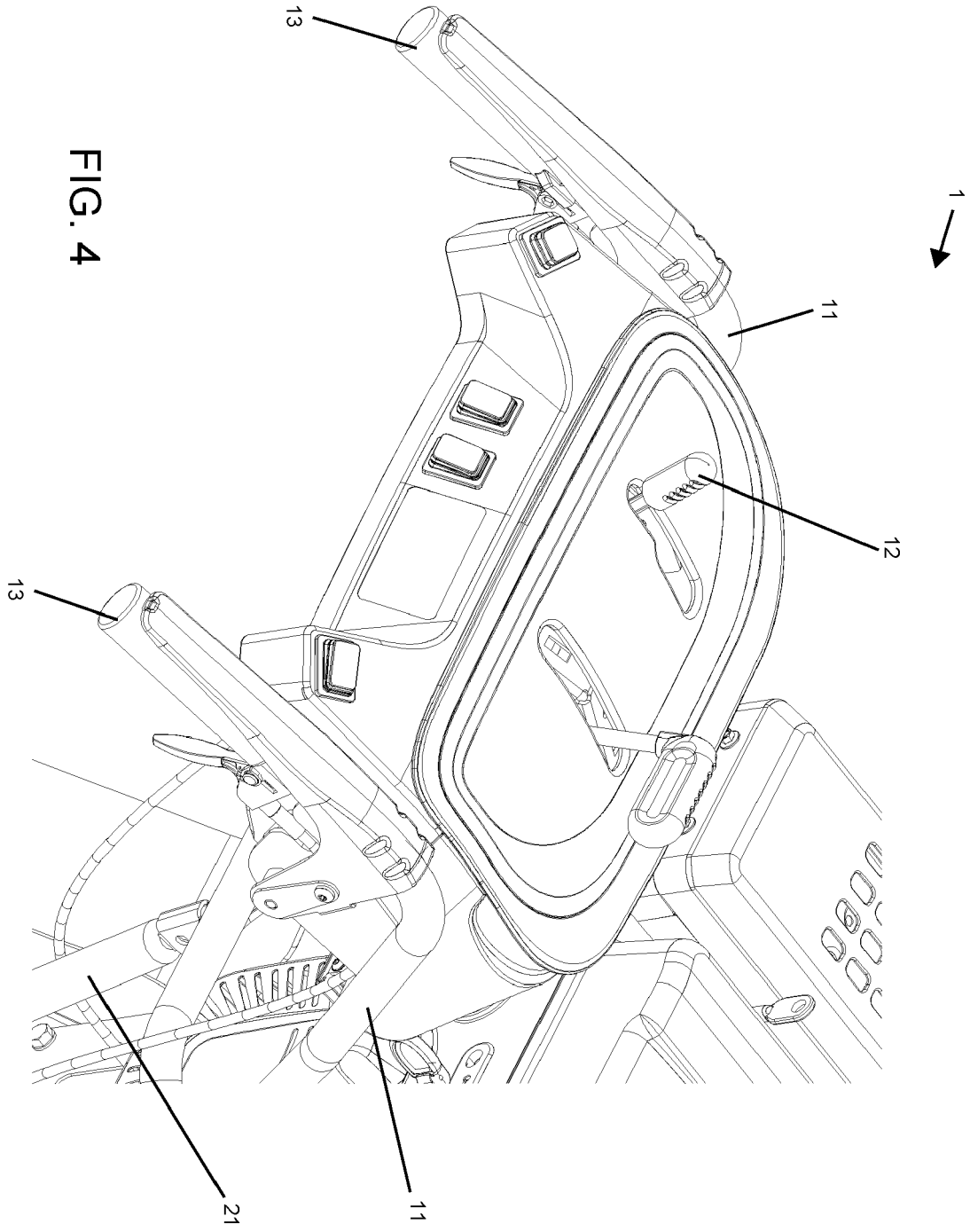


FIG. 3

FIG. 4



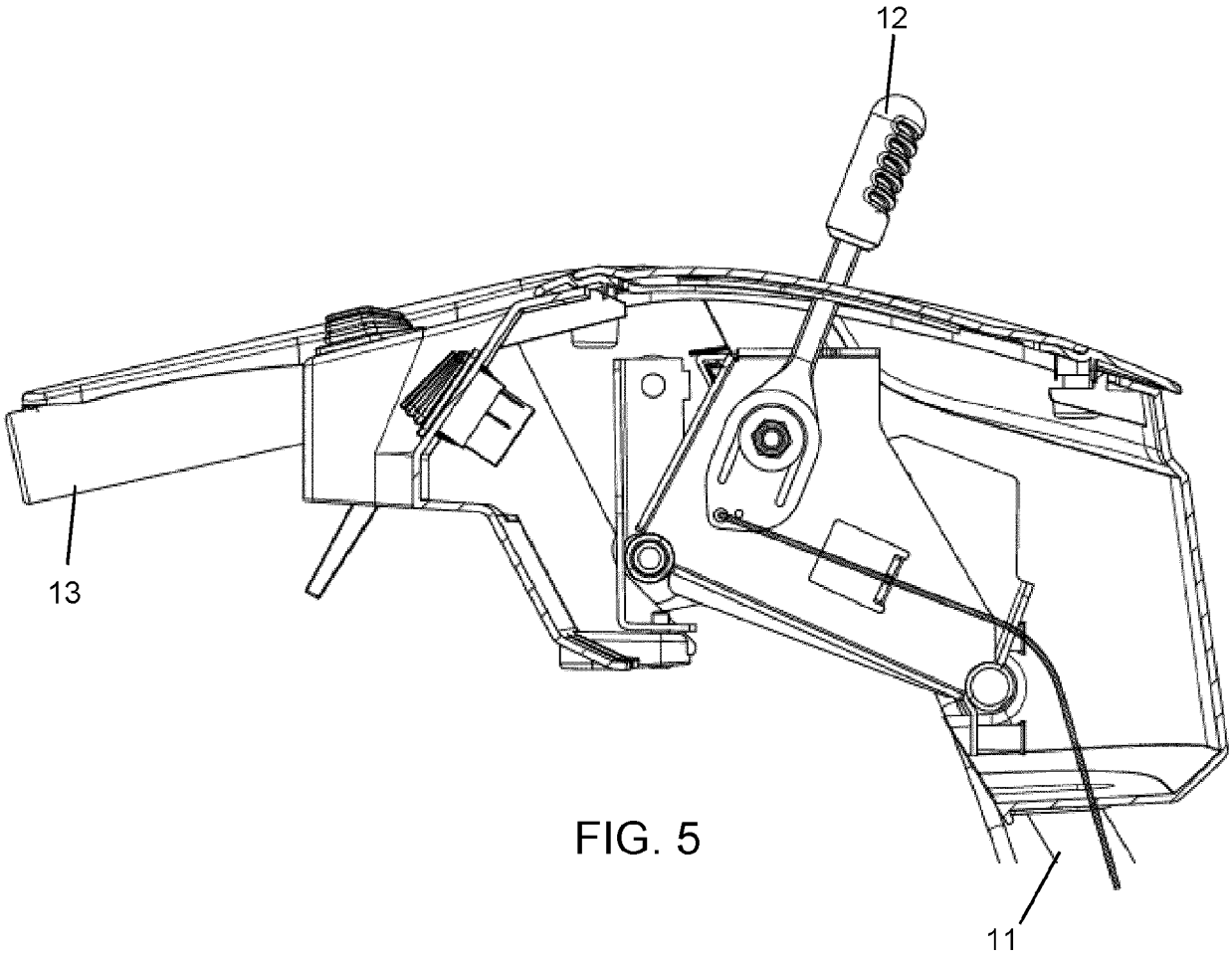


FIG. 5

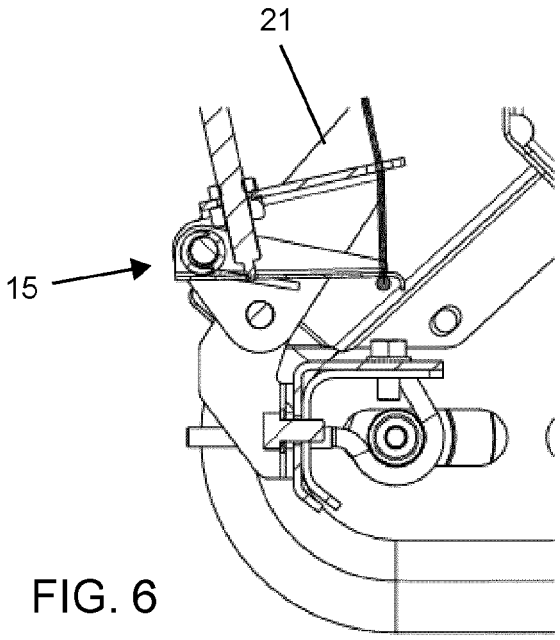


FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 6246

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 055 127 A (WILLIAMSON JAMES W) 25 September 1962 (1962-09-25) * column 3 *	1-15	INV. E01H5/09 E01H5/04
X	US 3 640 005 A (CHIAROLANZA GENEROSO ET AL) 8 February 1972 (1972-02-08) * column 2, line 52 - column 3, line 2 *	1-15	
X	US 2007/214683 A1 (ALMADANI MAZEN W [US]) 20 September 2007 (2007-09-20) * paragraphs [0036] - [0041] *	1-15	
X	US 4 266 617 A (MULLET DAVID L ET AL) 12 May 1981 (1981-05-12) * column 4, lines 53-66 *	1-15	
X	US 6 581 306 B1 (DICLEMENTI JAMES ANTHONY [US] ET AL) 24 June 2003 (2003-06-24) * column 6 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 January 2024	Saretta, Guido

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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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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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 19 6246

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09-01-2024

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