(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 338 649 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.03.2024 Bulletin 2024/12

(21) Application number: **23197096.3**

(22) Date of filing: **13.09.2023**

(51) International Patent Classification (IPC):
A47L 11/30 *(2006.01)* ***A47L 11/08*** *(2006.01)*
A47L 11/162 *(2006.01)* ***A47L 11/293*** *(2006.01)*
A47L 11/40 *(2006.01)* ***A47L 11/16*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A47L 11/08; A47L 11/16; A47L 11/293; A47L 11/4038

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **14.09.2022 GB 202213493**

(71) Applicant: **NUMATIC INTERNATIONAL LIMITED**
Camberley
Surrey GU15 3SY (GB)

(72) Inventor: **BUKOWSKI, Piotr**
Somerset TA20 2GB (GB)

(74) Representative: **CSY London**
Helios Court
1 Bishop Square
Hatfield
Hertfordshire AL10 9NE (GB)

(54) **FLOOR TREATMENT MACHINE**

(57) The present invention concerns the field of floor treatment machines such as scrubbers, finishers or polishers. Floor scrubbers typically have rotating work heads equipped with bristles for working the floor to remove dirt. The invention provides a hand-guided floor treatment machine comprising a handle portion (41) connected to a base portion (11), which base portion is provided with a rotatable generally disc-shaped floor-facing work head (4) having a substantially vertical axis of rotation (V), the machine being provided with drive means (15) for rotatably driving the work head, wherein the rotational axis of the work head is slightly tilted away from the vertical in a direction which has a transverse component and a rearward component so that the work head is biased into contact with the floor in a region rearwardly and to one side of the work head, whereby in use rotation of the work head through the biased region provides propulsion predominantly in a forward direction.

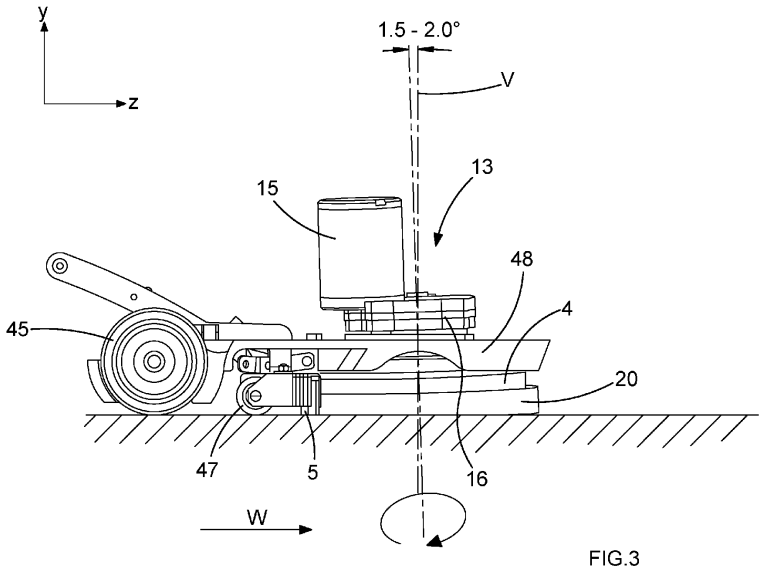

FIG.3

EP 4 338 649 A1

Description

[0001] The present invention concerns the field of floor treatment machines such as scrubbers, finishers or polishers. Floor scrubbers typically have rotating work heads equipped with bristles for working the floor to remove dirt. Finishers may have stiffer bristles with which to pare down a floor surface, such as a wooden surface. Polishers are typically equipped with relatively soft cleaning pads for polishing floor surfaces such as varnished wooden, polymer (e.g. linoleum) or concrete / ceramic surfaces. The treatment process may be assisted by the deposition of liquids, lubricants, pastes or polishes on the floor surface to be treated. A vacuum suction device may be included in the machine and used to entrain and convey used fluid from the floor surface for collection in a waste tank.

[0002] The present invention in particular concerns treatment machines having floor-facing generally disc shaped work heads. These work heads typically have a vertical axis of rotation. Where there are two work heads, they are typically arranged to be counter-rotating so as to balance any tendency for generating torque reaction which results in a net force parallel to the floor, causing unintended travel or drift of the machine during operation. One example of a hand-guided machine having counter-rotating balanced work heads is described in US8887348B2 (2014). This machine is entirely supported by the two work heads and is easy to move over a surface being scrubbed, but is prone to drift or wander if the work head axes are not precisely vertical or if any asymmetries between brushes arise, such as in brush wear or slight variations in the respective axes or rotation. US9826874B2 discloses a similar hand-guided machine having a base portion or deck supported by two counter-rotating work heads. However, in this case the work heads have axes of rotation that are deliberately inclined slightly from the vertical so as to be convergent in a transverse direction. In other words, the two side by side work heads when viewed from the front exhibit a dihedral effect in the rotational planes. So, the work heads have slightly lifted transverse outer edge regions and correspondingly depressed inter transverse inner edge regions (i.e. at the juxtaposed 3 and 9 O'clock regions of the work heads, where 12 O'clock is the working travel direction of the machine). Because the friction of the work head brushes is higher in the depressed inner edge regions, a linear propulsion effect arises in a working direction perpendicular to the transverse direction, when the inner depressed brush regions are both moving backwards when rotating. A problem arises in that while the central adjacent regions of the work heads tend to exhibit enhanced cleaning/brushing due to the increased frictional pressure which arises, whereas the outer regions exert less pressure on the floor and therefore have a reduced cleaning or polishing effect. This affects the cleaning efficiency and increases work time for a cleaning task.

[0003] The twin-work head machines of the type described above are complicated and relatively costly to manufacture. They typically have dual work-heads with two electric motors with reduction gearboxes and large batteries to provide adequate power. The present applicants have noted a desire in the market for cheaper, simpler machines which have a good self-propulsive effect for ease of use, but which have reduced complexity. This applies especially in the scrubber-drier market which is displacing standard floor mopping in commercial cleaning.

[0004] GB1202369 (published 1970) discloses a hand guided floor treatment machine which is provided with a single disc-shaped work head which has a substantially vertical axis of rotation. There is a pivotably mounted rear facing two-part handle portion with a T-bar for a user to grasp. By twisting the T-bar the pressure of respective left and right sides of the work head may be tilted so as to provide a differential contact pressure on the floor brush, which causes a reaction which drives the machine forwards or backwards, depending upon the applied twist direction and work head rotation direction. A problem with this arrangement is that the differential pressure exerted by handle-twisting means that one side of the machine has reduced cleaning effect, which may even cease completely. This can prolong scrubbing tasks, requiring second passes and thus more working time.

[0005] The present invention seeks to ameliorate one or more of the aforementioned problems and provide a cleaning machine which is less complex and provides excellent cleaning, whilst also providing self-propulsion to assist the user.

[0006] According to one aspect of the present invention there is provided a hand-guided floor treatment machine comprising a handle portion connected to a base portion, which base portion is provided with a rotatable generally disc-shaped floor-facing work head having a substantially vertical axis of rotation, the machine being provided with drive means for rotatably driving the work head, wherein the rotational axis of the work head is tilted slightly away from the vertical. The tilt is preferably in a direction which has a transverse component so as to provide a machine forward propulsive effect. There may also be a rearward tilt component so that the work head is biased into enhanced contact with the floor in a region rearwardly and to one side of the work head. In use rotation of the work head through the biased region provides propulsion predominantly in a forward direction. The rearward tilt increases floor contact pressure on a rear end region of the rotating work head (and the associated agitation surface, such as floor-facing bristles). This helps counteract the reduced contact biasing arising from the transverse tilt, so that contact pressure (and cleaning effect) is better maintained across the full span of the work head. Also, any cleaning liquid applied under the work head tends to be retained as the machine moves forwards, rather than being left behind on the path swept by the machine.

[0007] Instead of rearward tilt the vertical axis of rota-

tion may have a forward tilt, which increases pressure in a front region of the work head, providing enhanced cleaning pressure in that region. The tilt applied may comprise combined transverse and backwards/rearwards components so as to achieve a desired propulsion direction, or to limit or remove net propulsion of the machine, so as to make the machine progress easier to control by reducing or cancelling torque rection to the rotation action of the single work head.

[0008] The combination of applied rear and transverse tilt components makes it possible to provide a good cleaning effect in machines which only have a single-floor facing work head. So, the machine preferably only has a single work head. There may also be only a single drive motor.

[0009] The work head may be carried underneath a deck portion of the base portion. The deck portion comprises a generally planar arrangement in the form of a horizontal tray or framework or tub. The deck portion may support the drive motor of the drive means. An output rotor of the motor may feed into an associated transmission unit. The transmission unit typically has an output shaft which carries a work head hub or chuck. The transmission unit usually provides a rotational speed reduction down to a rotational cycle which is suitable for floor treatment, such as scrubbing in some preferred embodiments. The shaft which drives the hub is typically substantially vertical in orientation so as to take a floor-facing work head with underlying agitation surface (typically an annular scrubbing brush). The tilt is in this case applied to the drive shaft for the hub. The motor can be oriented vertically - in series with the transmission - or transversely, in which case a worm gear may be entered into the transmission unit. The transverse arrangement allows for a low-profile base portion, the better to fit under furniture or other obstructions on the floor surface during cleaning.

[0010] Alternatively, an output rotor of the motor may be directly attached to the work head hub, optionally via a drive shaft, and without an intervening transmission unit. This direct drive configuration is less complex and potentially more reliable and less noisy. The motor rotor does however stand upwards (in the absence of other measures), creating a higher base portion.

[0011] The work head tilt may be achieved in several ways, some of which are described herein. In a preferred arrangement the tilt is achieved by tilting away from the vertical of the motor output rotor (with hub). By 'vertical' we mean a plumb line when the machine is square-on to the floor. In another arrangement the transmission unit output shaft (with hub) is tilted away from the vertical.

[0012] Alternatively, the tilting of the output shaft may be achieved by fixing a transmission unit in a tilted disposition with respect to the deck portion upon which the transmission unit. The transmission unit may be tilted by means of one or more spacer elements disposed between the transmission unit and the deck portion. The spacer may be a washer or a wedge, or a variable thickness gasket. For example, the transmission unit may have four corners, each with a bolt for holding the unit onto the deck. The spacer may be interposed between the transmission unit and the deck portion so as to tilt the transmission unit with respect to the deck unit. Bolt may pass through the spacer to stably locate it in position.

[0013] In another arrangement suitable for direct drive motors, the motor output rotor may be tilted away from the vertical by means of one or more spacer elements. In this case the spacer or spacers may be disposed between a mounting (bracket or flange) for the motor and the deck portion upon which the motor is mounted. As before, a mounting bolt may pass through the spacer.

[0014] The hub unit may be mounted on the output rotor, and a hub is typically attached to the free end of the output rotor. The hub (usually comprising a chuck) has attached thereto a disc-shaped work head.

[0015] In use, the work head faces the floor. The floor-facing surface may be provided with an array of bristles to form a scrubbing brush. Alternatively, the floor facing surface may be provided with a polishing pad, or a more aggressive treatment surface, such as wire bristles. It will be understood that the tilting of the output rotor or shaft also tilts the hub and associated work head. In this way the hub becomes inclined with respect to the underlying floor.

[0016] Another way of induing work head tilt is to have a floating work head and motor / transmission assembly which is suspended from the deck portion. Biasing means may be applied between the floating work head and motor/transmission assembly and the deck portion so that the assembly as a unit tilts to provide a tilted work head.

[0017] The work head is preferably oriented so as to have an axis of rotation that exhibits a transverse tilt of 1 to 3, more preferably 1.5 to 2.0 degrees, from the vertical axis V in the transverse direction (negative X), as shown in figure 4.

[0018] The work head is preferably oriented so as to have an axis of rotation that exhibits a rearwards tilt of 1 to 3, more preferably 1.5 to 2.0 degrees, from the vertical axis V, in the negative Z direction, as shown in figure 3.

[0019] The degree of tilt selected may require a certain amount of experimentation to get optimum performance, and may be tailored to specific work head brush stiffness, rotational speed, floor roughness, or the presence or absence of any cleaning liquid or lubricant applied. Generally speaking, the backwards tilt provides more uniform cleaning/scrubbing/polishing effect, whereas the transverse tilt provides a propulsive effect. The amount of transverse tilt should be sufficient to produce the desired propulsive effect or assistance to the user. The amount of rearwards tilt should be consistent with an effective cleaning performance. Alternatively, forwards tilt may be applied, if an enhanced front region cleaning effect is required.

[0020] The work head may be oriented so as to have an axis of rotation that exhibits a forwards tilt of 1 to 3, more preferably 1.5 to 2.0 degrees, from the vertical axis V, in the positive Z direction.

[0021] The rearward tilt is especially useful where the machine is a scrubber-drier and includes a cleaning liquid deposition device. The compressed rear bristles of the work head prevent the liquid from immediately passing out from under the machine, as serve to keep a volume of liquid constrained ahead of the rear bristles.

[0022] The base portion is preferably provided with wheel means to enable translational motion of the machine over the floor surface during operation. The wheels means may comprise or more wheels or rollers, but could include caterpillar tracks, or skids. In some embodiments there is one wheel or roller, but preferably there is a pair of transversely spaced apart wheels. The wheel means helps the user guide the machine in a preferred direction (usually the working direction), especially when the wheel or wheels rotate around a fixed transverse axis of rotation, so as to provide directional stability. As such the wheel(s) may be termed guide wheel or wheels. The tilt of the work head tends to induce a curved forward drive direction, as shown in figure 6, so the wheels help the user to counter-act this by yaw steering in the opposite direction. The wheels also share the machine weight, which makes the machine easier to manipulate and steer during use.

[0023] The wheel means may comprise a single central wheel or roller, or two transversely spaced apart wheels or rollers. Other configurations are possible.

[0024] In a use configuration, the weight of the machine is preferably shared by the wheel means and the work head. The wheels means are preferably disposed at a rear region of the base portion, and the work head is preferably disposed at a front region of the base portion.

[0025] The machine may be configured as a wet scrubber with scrubbing brush attachments provided on an underside of each work head, a cleaning liquid reservoir, a cleaning liquid dispenser provided in advance of, or under, the work head. In this way a cleaning liquid may be applied to the floor to assist in the scrubbing action by dissolving or entreating dirt.

[0026] The machine may further comprise a suction squeegee device for collecting liquid-entrained dirt and configured to be trailed behind the work head. This is used to lift used cleaning liquid and dirt from the floor. A waste liquid tank may be provided within the machine, or remotely (in either case connected by a suction conduit). Preferably the waste tank is adjacent the cleaning liquid reservoir.

[0027] Suitable treatment surfaces include scrubbing brushes, typically comprising bristles arranged in an annular array around a central drive shaft chuck engagement. In this case the pressure applied to the rear of the work heads acts to retain cleaning liquid introduced into the work head within the annular brush rather than allowing it to escape immediately via the bristles. This reduces the amount of cleaning liquid required during a cleaning task. This is especially useful in wet scrubber driers such as described hereinafter.

[0028] Although scrubbing is a preferred treatment, polishing pads may be used, or more aggressive surfaces treatments such as wire or stiff brushes or grinding or sanding surfaces.

[0029] In a preferred aspect of the invention the work head is carried underneath a deck portion of the machine. The deck portion may be used to support various other components of the machine, such as motors, transmissions, batteries, suction turbines.

[0030] Following is a description by way of example only and with reference to the figures of the drawings of one mode for putting the present invention into effect.

[0031] In the drawings:

Figure 1 is a three quarter perspective view of a floor scrubber-dryer machine in accordance with the present invention.

Figure 2 is a side view of the configuration of the machine of figure 1 shown on a floor surface.

Figure 3 is a side view of the base portion of the machine, with housing removed to show internal components, with defined Y and Z spatial directions, and a work head axis of rotation which is tilted from the vertical in the -Z direction.

Figure 4 is a front view of the base portion of figure 3, with defined X and Y directions, the and a work head tilted from the vertical in the -X direction.

Figure 5 is a three quarter perspective view from above of the base portion of the machine, with defined X, Y and Z directions.

Figure 6 is an underside plan view of the base portion of the machine.

Figure 7 is a side view of the scrubber drying machine, tilted back so as to lift the work head and base portion away from the floor, rotated about the rear wheels of the machine.

Figure 8 shows an alternative embodiment of the machine in which the squeegee suction collection is disposed so as to trail behind the rear of the machine.

[0032] The scrubber-dryer machine in accordance with the invention is shown in figure 1 as 10. The machine includes a base portion 11, comprising a motor housing 2, a disc-shaped work head 4 (best seen in figure 6) and a squeegee suction collector 5 which has leading and trailing curved squeegee blades 43, 44 which together define a suction chamber therebetween. The squeegee is collector is disposed immediately behind the work head and has a span which equals or exceeds the diameter of the work head. The squeegee collector is supported by two transversely spaced apart trailing rollers 47 (see fig. 6), which prevent the squeegee blades from collaps-

ing under the weight of the collector. An upper portion of the squeegee collector is formed with a suction orifice 6 in fluid communication with a suction turbine (not shown) and a waste liquid collection tank (not visible). The work head has a lower side provided with an annular detachable brush unit 20 made up of a multitude of floor-facing bristles for agitating the floor surface.

[0033] In an alternative embodiment the squeegee collector is disposed behind the machine base portion, and specifically behind the rear wheels 45, as shown on figure 8.

[0034] There is an upstanding elongate handle portion 41 (see fig. 6) with a cross bar 42 at an upper end region thereof, and the usual controls such as on/off and any work head speed control. A mid-region of the handle portion carries superstructure 7 within which is provided a cleaning liquid reservoir (not visible) and the waste liquid collection tank. The superstructure also carries at a lower end region thereof a re-chargeable battery which serves as a power supply.

[0035] A lower end region of the handle portion is attached to the base portion via a universal joint 30. The universal joint comprises an upper handle pivot P-P' which permits side-to-side pivoting of the handle portion, and a lower, transverse pivot A-A' which permits up and down pivoting of the handle. The user twisting the cross bar in a clockwise or counter-clockwise direction steers the base portion as it travels over a floor surface in a working direction W. Rotation of the work head causes the brushes 20 to scrub the floor. Cleaning liquid delivered to the floor in advance of the work head, or through a hub of the work head, assists in the cleaning effect. The dirty cleaning fluid is then collected behind work heads by the squeegee collector and discharged into the waste tank in the handle super structure (for subsequent disposal).

[0036] A rear end region of the base portion is provided with two co-axially mounted wheels 45 which support the weight of the handle portion, and the rear region of the base portion 11. The wheels have a fixed axis of rotation, so provide directional stability in the working direction of use W during use, whilst permitting steering by yawing of the base portion about the rear wheels 45.

[0037] In figure 3 the interior or the base portion 11 and associated components are shown. There is a substantially horizontal deck portion 48. The deck carries a motor drive unit 13. The motor drive unit comprises a generally cylindrical upright electric motor 15. The motor rotor is mated to a transmission unit (gearbox assembly) 16. A driven hub 14 (figure 6) depends from an underside of the gearbox assembly for driving the work head 4. The gearbox has an output shaft from which the hub depends. This output shaft is oriented so as to exhibit the rearwards tilt of 1.5 to 2.0 degrees from the vertical axis V, in the negative Z direction, as shown in figure 3. The output shaft is also oriented to give a tilt of 1.5 to 2.0 degrees from the vertical axis V in the transverse direction negative X, as shown in figure 4. The tilting can be conveniently achieved by the use of spacers, washers or wedges (not shown in the figures) disposed under one or more of the corners 50 of the gearbox assembly housing, above the associated deck upon which the gearbox assembly is mounted. In this way the whole gearbox assembly is tilted from the horizontal, producing a corresponding shift from the vertical of the output shaft which carries the hub and work head.

[0038] The combination of transverse tilt and backwards tilt of the work head produces increased pressure on the floor surface due to the biasing of the brush bristles in the bottom left region of the work head (as viewed in figure 6). The cross-hatched region indicates increased pressure due to tilting. The backwards and transverse tilts of the brushes produces increased pressure around the 10 o'clock to 4 o'clock positions of the work head. The work head rotation direction (counter-clockwise in figure 6) means that there is increased traction in the biased region, and this produces a propulsive reaction. The rearward tilt helps correct the propulsive thrust so as to be substantially forwards in the working direction, albeit with a small amount of curve which would tend to produce a tendency to steer to the right, but which can be easily correct by the user/operator.

[0039] The rearward biasing of the work head also compresses the brush bristles and helps retain cleaning liquid within the confines of the annular work head brushes. The biasing of course improves the agitation effect and aids cleaning. The rearward biasing improves the agitation effect across almost the entire span of the work head/brush.

[0040] The handle portion is preferably connected to the base portion by a universal joint. The universal joint may comprise two orthogonal pivots which permit up-down pivoting and side-to-side pivoting of the handle portion. The universal joint connection is preferably disposed at a rear end region of the base portion. This facilitates walk-behind guiding of the machine by a user holding the handle portion distal end region. Steering involves twisting the handle portion clockwise or anti-clockwise. The universal joint connection may be adjacent the wheel means (when present) so that the weight of the handle portion and any associated components is mostly taken by the wheel means, whereas the work head takes the weight of the motor/transmission.

[0041] In summary, the invention provides a hand-guided floor treatment machine comprising a handle portion connected to a base portion, which base portion is provided with a rotatable generally disc-shaped floor-facing work head having a substantially vertical axis of rotation, the machine being provided with drive means for rotatably driving the work head, wherein the rotational axis of the work head is slightly tilted away from the vertical in a direction which has a transverse component and a rearward component so that the work head is biased into contact with the floor in a region rearwardly and to one side of the work head, whereby in use rotation of the work head through the biased region provides propulsion

predominantly in a forward direction.

Claims

1. A hand-guided floor treatment machine comprising a handle portion connected to a base portion, which base portion is provided with a rotatable generally disc-shaped floor-facing work head having a substantially vertical axis of rotation, the machine being provided with drive means for rotatably driving the work head, wherein the rotational axis of the work head is slightly tilted away from the vertical in a direction which has a transverse component so that a work head side region is biased into enhanced contact with the floor so as to provide machine propulsion predominantly in a forward working direction,

   wherein the tilt has a rearward component so that the work head is biased into contact with the floor in a region rearwardly and to the side region of the work head, whereby in use rotation of the work head through the biased region provides propulsion predominantly in a forward direction, along with enhanced contact of the rearward region, or
   wherein the tilt has a forward component so that the work head is biased into contact with the floor in a region forwardly and to the side region of the work head, whereby in use rotation of the work head through the biased region provides propulsion predominantly in a forward direction, along with enhanced contact of the forward region.

2. A machine as claimed in claim 1 wherein the work head is carried underneath a deck portion of the base portion, wherein the deck portion supports one or more drive motors.

3. A machine as claimed in claim 1 or 2 wherein an output rotor of the motor feeds into an associated transmission unit and an output shaft of the transmission unit carries a work head hub, or wherein an output rotor of the motor is directly attached to the work head hub, optionally via a drive shaft, and without an intervening transmission unit.

4. A machine as claimed in claim 3 wherein the work head tilt is achieved by tilting away from the vertical of the motor output rotor with hub, and/or the transmission unit output shaft with hub.

5. A machine as claimed in claim 4 wherein tilting of the output shaft is achieved by fixing a transmission unit in a tilted disposition with respect to the deck portion upon which the transmission unit is mounted.

6. A machine as claimed in claim 5 wherein the transmission unit is tilted by means of one or more spacer elements disposed between the transmission unit and the deck portion.

7. A machine as claimed in claim 3 wherein the motor output rotor is tilted away from the vertical by means of one or more spacer elements disposed between a mounting for the motor and the deck portion upon which the motor is mounted.

8. A machine as claimed in any of the preceding claims wherein the work head is provided in a floating work head assembly comprising the work head and motor as a unit, the assembly being suspended from the deck portion.

9. A machine as claimed in claim 8 wherein biasing means are operative between the deck and the assembly so that the assembly tilts and the work head is biased into enhanced contact with the floor.

10. A machine as claimed in any of the preceding claims wherein the base portion is provided with wheel means to enable translational motion of the machine over the floor surface, which wheel means may comprise a single central wheel or roller, or two transversely spaced apart wheels or rollers.

11. A machine as claimed in claim 10 wherein, in a use configuration, the weight of the machine is shared by the wheel means and the work head or heads.

12. A machine as claimed in claim 10 or 11 wherein the wheels means are disposed at a rear region of the base portion, and the work head is disposed at a front region of the base portion.

13. A machine as claimed in any preceding claims which is configured as a scrubber drier with scrubbing brush attachments provided on an underside of each work head, a cleaning liquid reservoir, a cleaning liquid dispenser provided in advance of, or under, the work head, optionally further comprising a suction squeegee device for collecting liquid-entrained dirt and configured to be trailed behind the work head.

14. A machine as claimed in any of the preceding claims wherein the transverse tilt is in an amount of 1 to 3 degrees, preferably 1.5 to 2.5 degrees away from the vertical and/or the backwards/forwards tilt is in an amount of 1 to 3 degrees, preferably 1.5 to 2.5 degrees.

15. A machine as claimed in any of the preceding claims wherein the handle portion is connected to the base portion by a universal joint, wherein the universal

joint may comprise two orthogonal pivots which permit up-down pivoting and side-to-side pivoting of the handle portion.

16. A machine as claimed in claim 15 wherein the universal joint connection is disposed at a rear end region of the base portion so as to facilitate walk-behind guiding of the machine by a user holding the handle portion distal end region.

17. A machine as claimed in claim 16 wherein the universal joint connection is adjacent the wheel means or incorporates the wheel means so that the weight of the handle portion and any associated components is mostly taken by the wheel means.

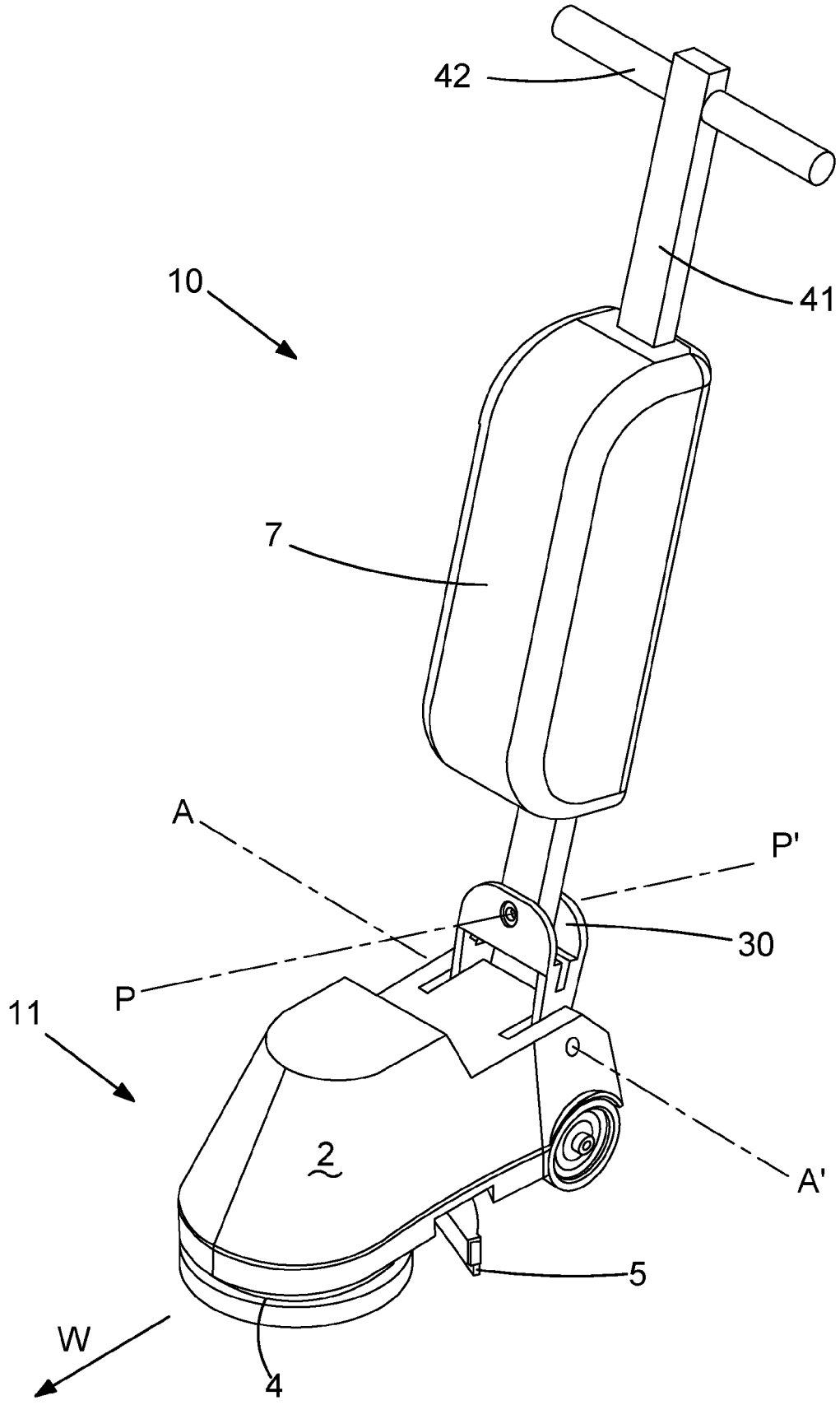

FIG.1

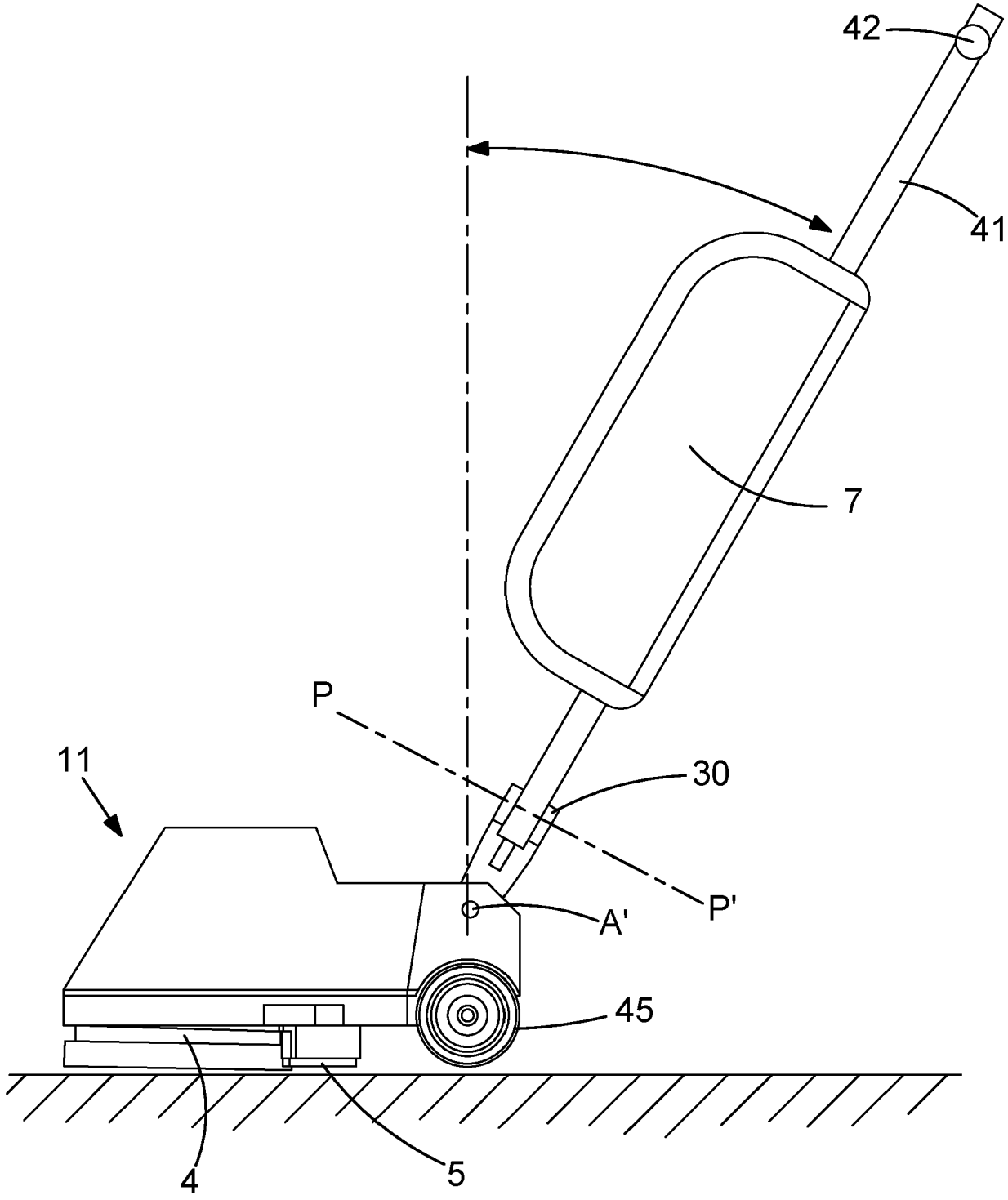

FIG.2

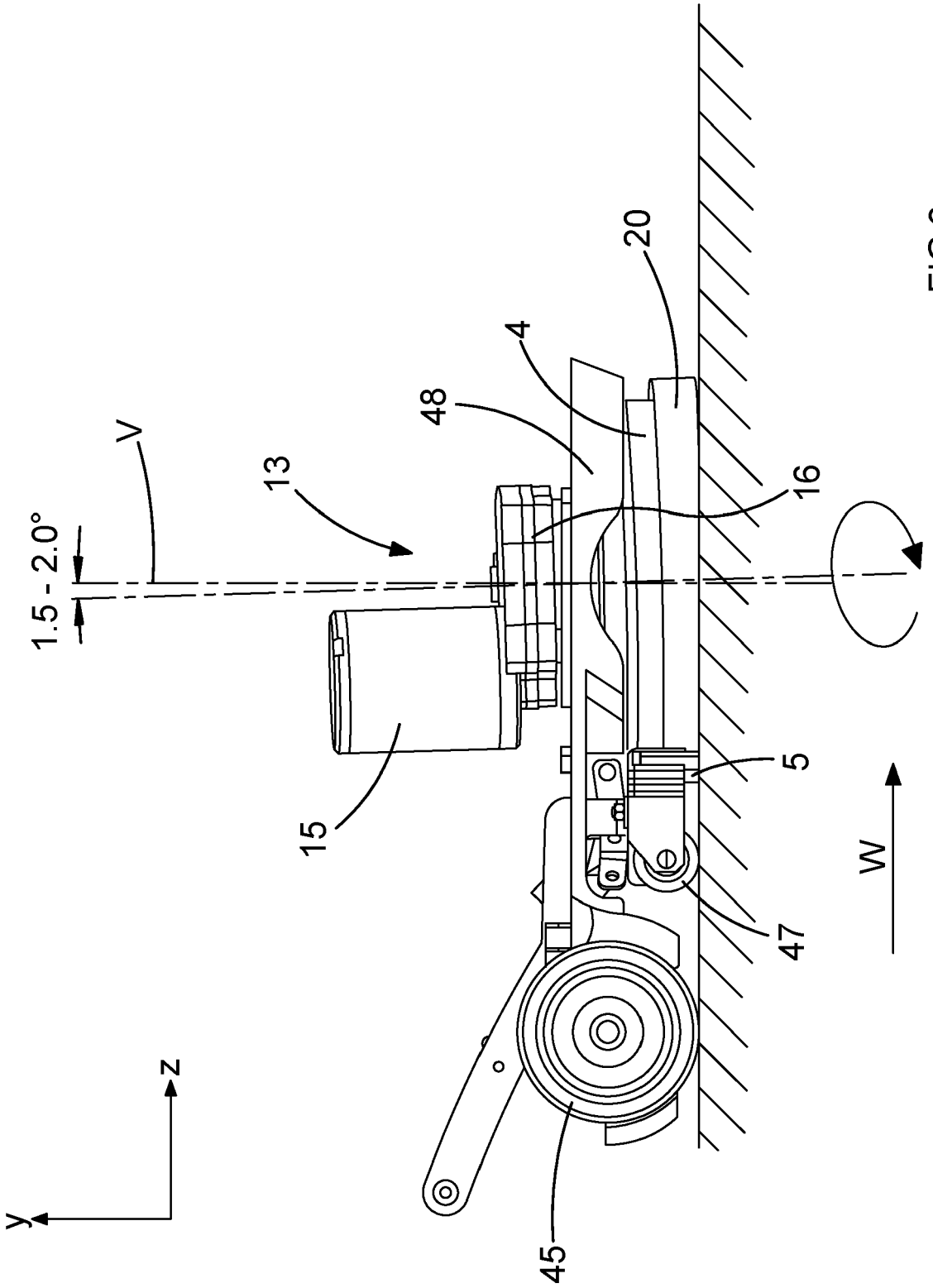

FIG.3

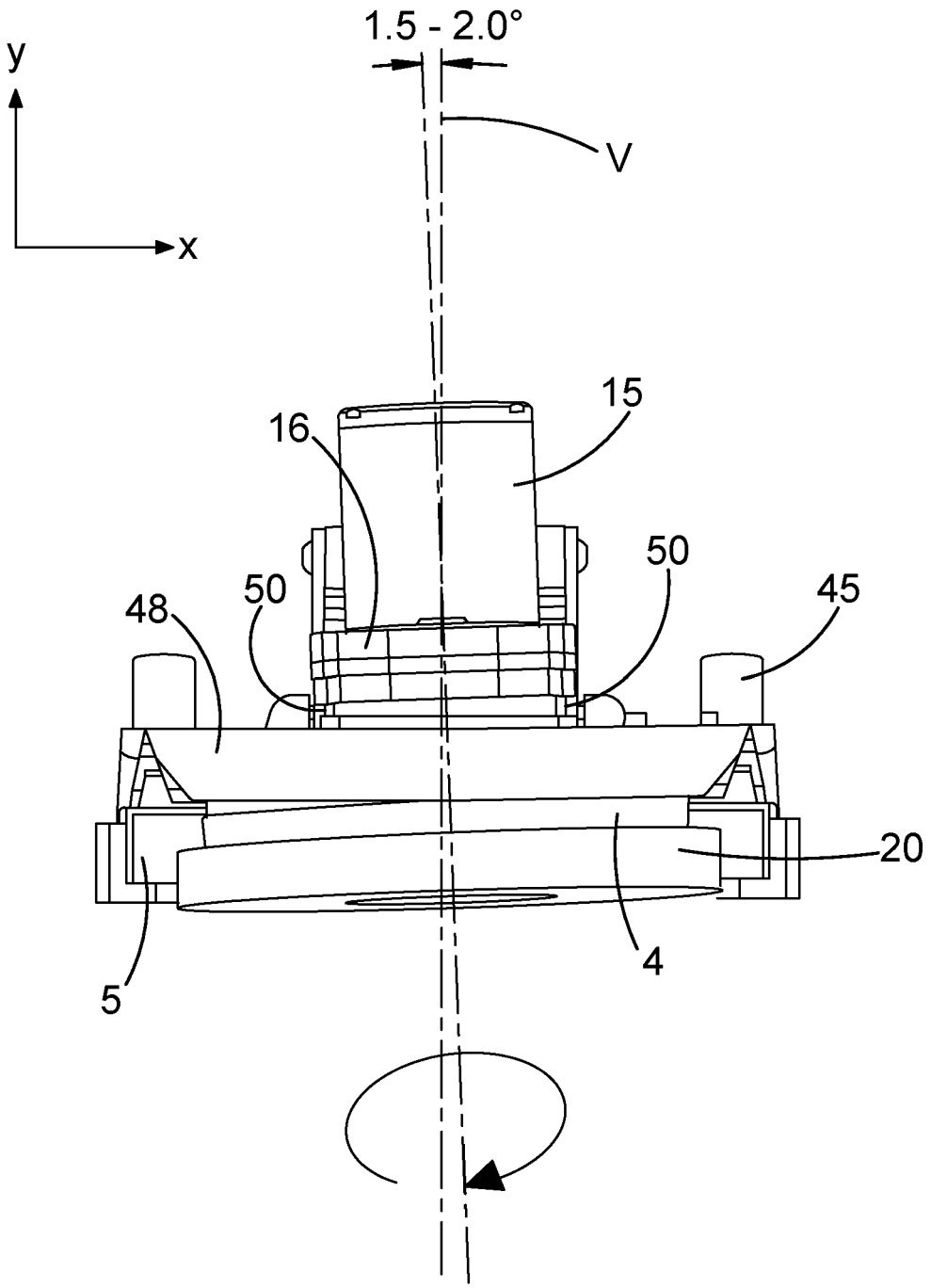

FIG.4

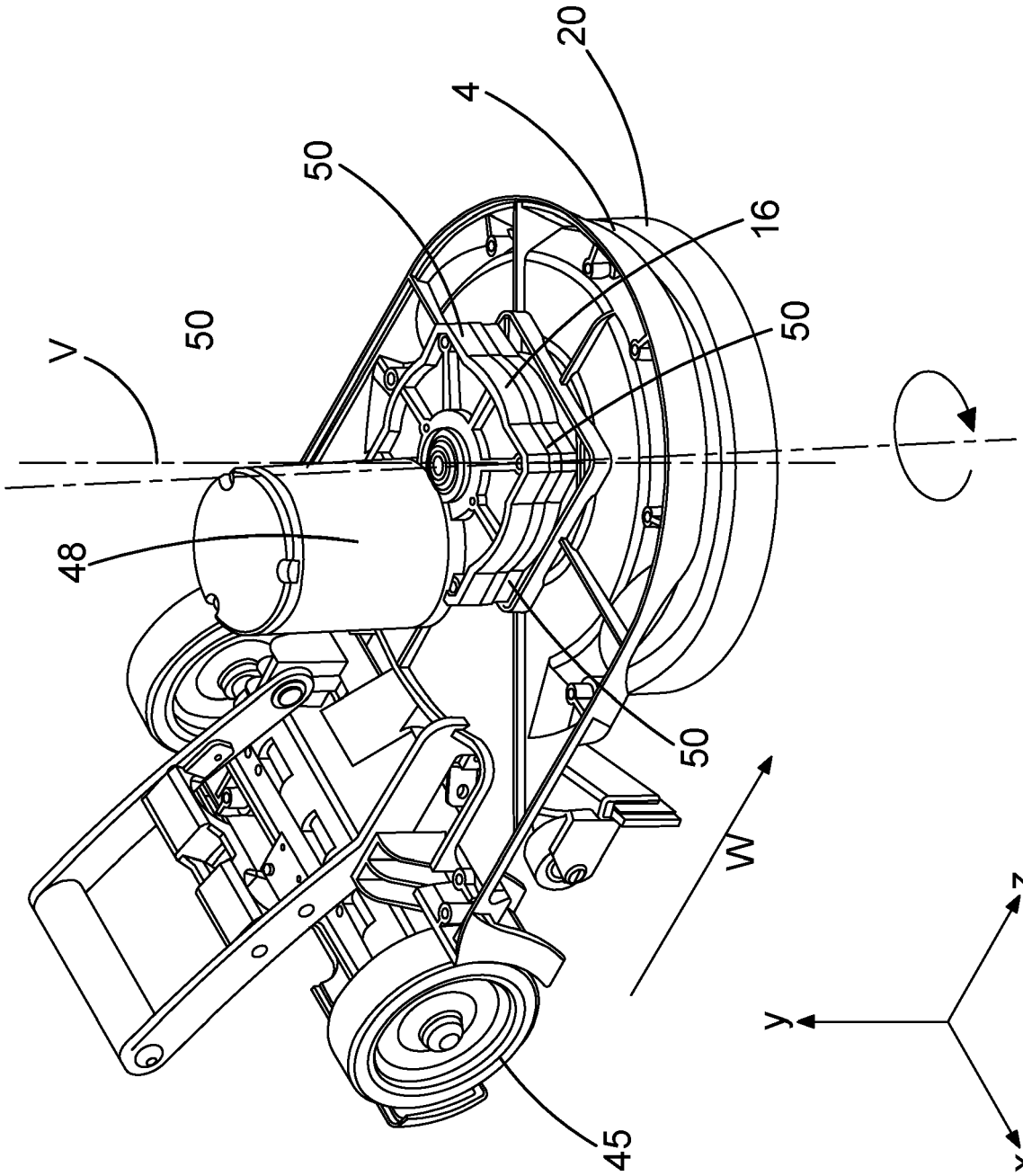

FIG.5

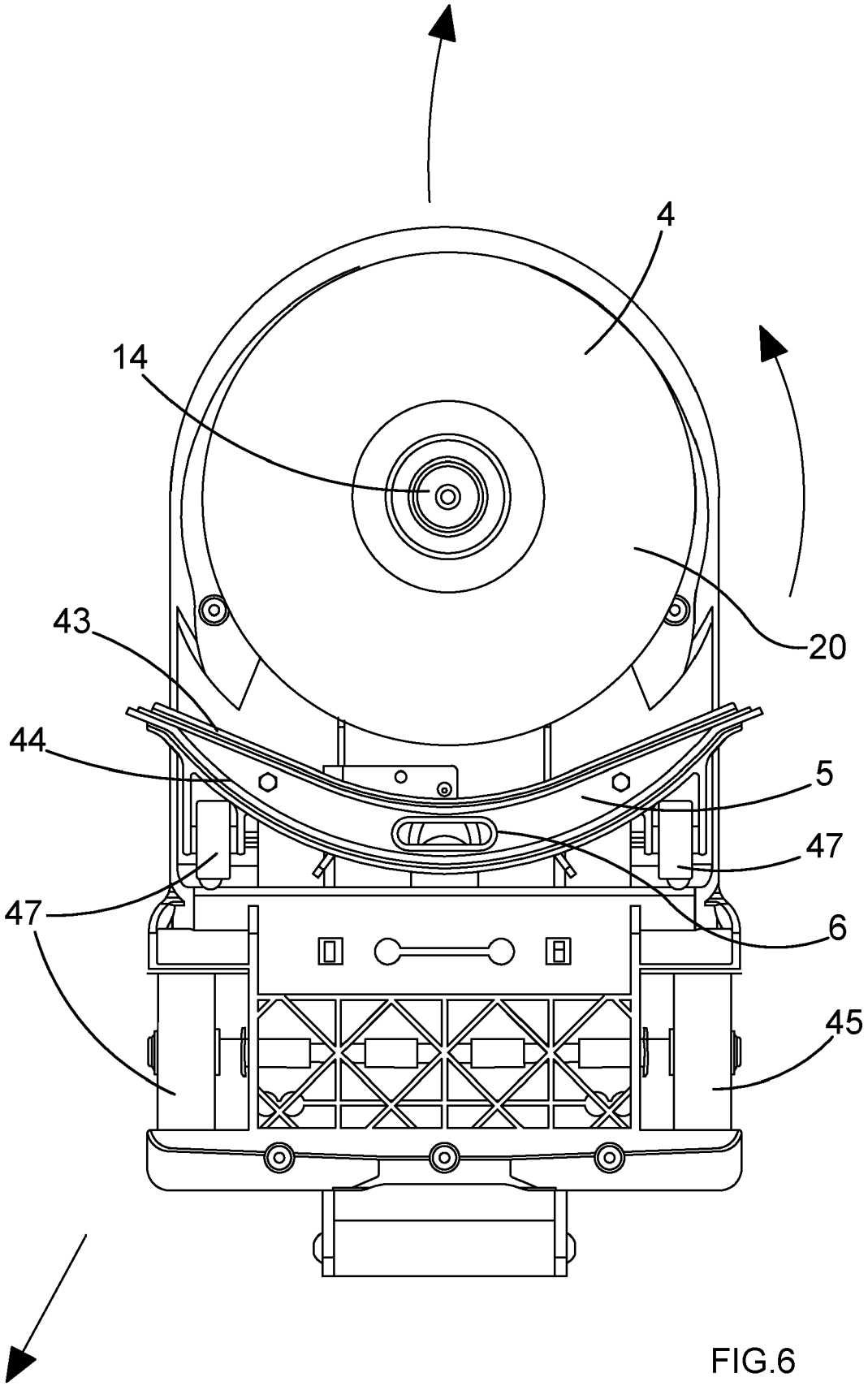

FIG.6

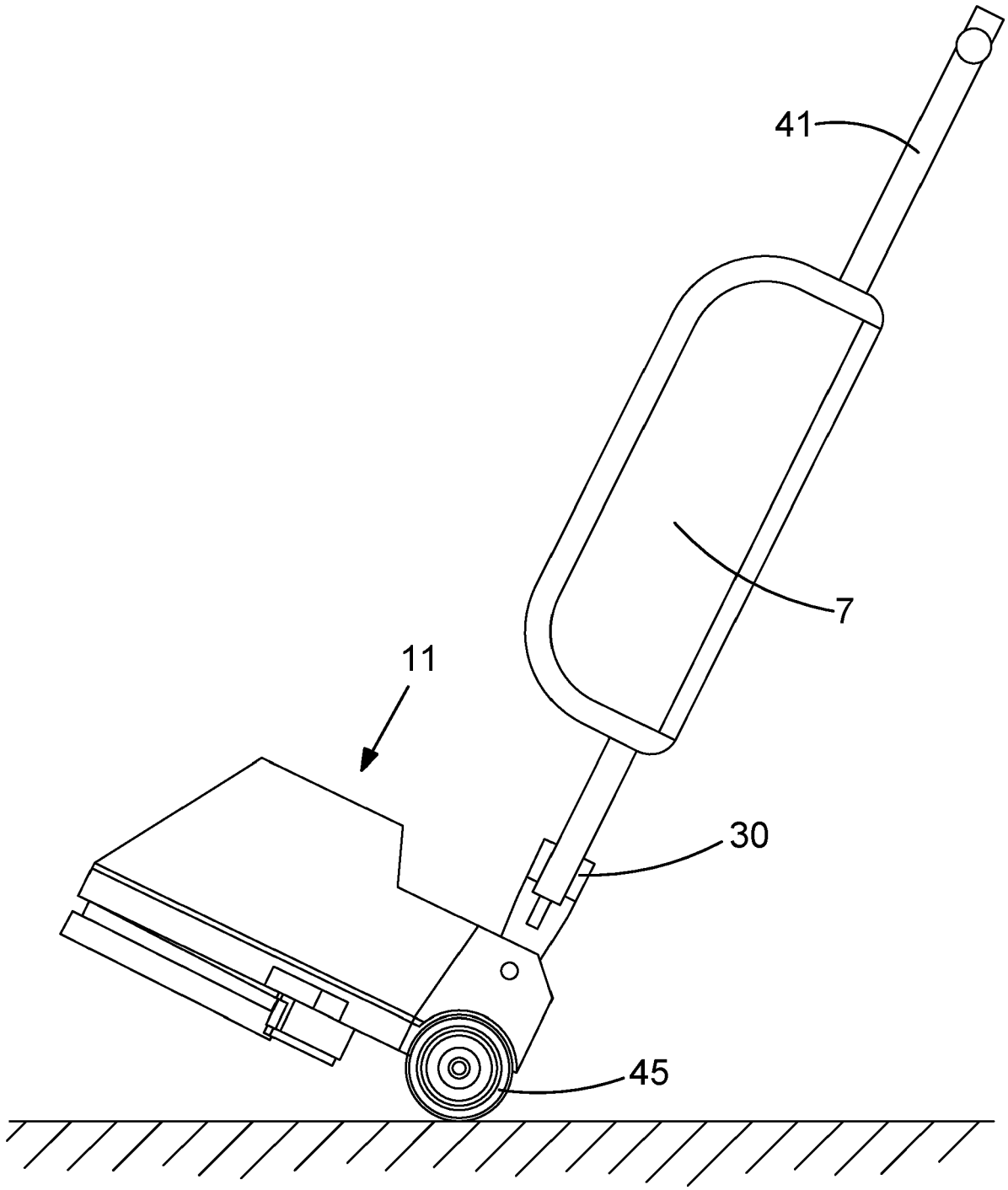

FIG.7

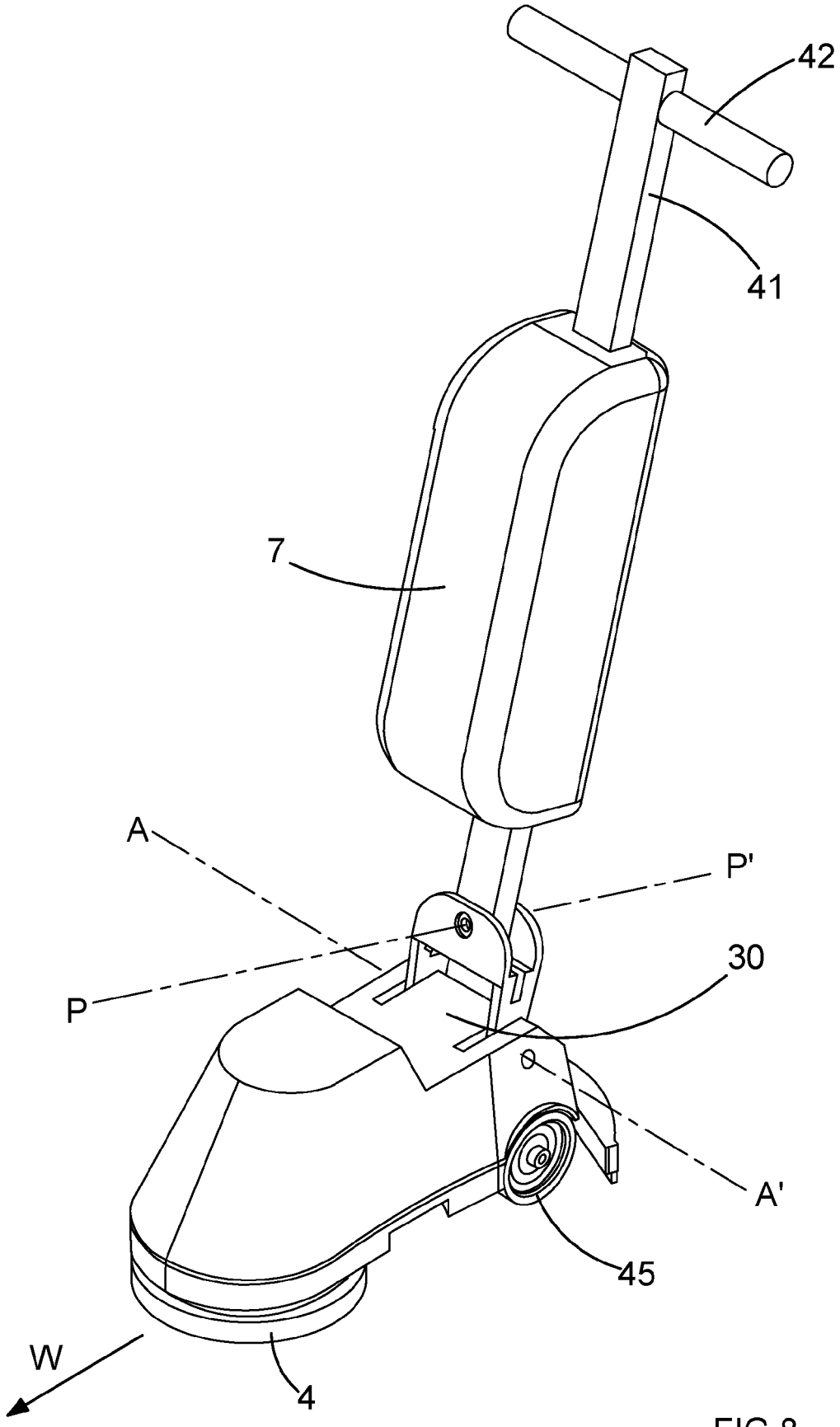

FIG.8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 19 7096

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 5 849 097 A (WINDMEISSER DIETER [CH]) 15 December 1998 (1998-12-15)	1-3, 10-13,17	INV. A47L11/30
A	* the whole document *	4-9	A47L11/08 A47L11/162
X	US 2019/038101 A1 (JANG JAEWON [KR] ET AL) 7 February 2019 (2019-02-07)	1-3,14	A47L11/293 A47L11/40
A	* the whole document *	4-13, 15-17	A47L11/16
A	GB 2 573 134 A (NUMATIC INT LTD [GB]) 30 October 2019 (2019-10-30) * the whole document *	1-17	
A	EP 3 011 884 A1 (HAAGA KEHRSYSTEME GMBH [DE]) 27 April 2016 (2016-04-27) * paragraph [0021] - paragraph [0025] *	1-17	
A	EP 3 574 816 A2 (BLACK & DECKER INC [US]) 4 December 2019 (2019-12-04) * paragraph [0021] - paragraph [0028] * * paragraph [0035] - paragraph [0044] *	1-17	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 January 2024	Jezierski, Krzysztof

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 19 7096

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-01-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5849097 A	15-12-1998	CA 2194949 A1	10-08-1997
		DE 69608408 T2	21-09-2000
		ES 2147896 T3	01-10-2000
		US 5849097 A	15-12-1998
US 2019038101 A1	07-02-2019	AU 2018313599 A1	26-03-2020
		CN 111182825 A	19-05-2020
		EP 3666151 A1	17-06-2020
		JP 6935576 B2	15-09-2021
		JP 2020530342 A	22-10-2020
		KR 20190015932 A	15-02-2019
		TW 201909827 A	16-03-2019
		US 2019038101 A1	07-02-2019
		WO 2019031798 A1	14-02-2019
GB 2573134 A	30-10-2019	CN 112739246 A	30-04-2021
		DK 3784103 T3	20-03-2023
		EP 3784103 A2	03-03-2021
		ES 2940329 T3	05-05-2023
		GB 2573134 A	30-10-2019
		PL 3784103 T3	08-05-2023
		US 2021267427 A1	02-09-2021
		WO 2019207290 A2	31-10-2019
EP 3011884 A1	27-04-2016	DE 202014008544 U1	13-11-2014
		EP 3011884 A1	27-04-2016
		PL 3011884 T3	29-11-2019
EP 3574816 A2	04-12-2019	EP 3574816 A2	04-12-2019
		GB 2573753 A	20-11-2019
		US 2019343351 A1	14-11-2019

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 8887348 B2 **[0002]**
- US 9826874 B2 **[0002]**
- GB 1202369 A **[0004]**