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

(11) Publication number : **0 462 076 A1**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number : **91830246.4**

(51) Int. Cl.^{5} : **E01H 1/05**

(22) Date of filing : **07.06.91**

(30) Priority : **13.06.90 IT 2062890**

(43) Date of publication of application :
18.12.91 Bulletin 91/51

(84) Designated Contracting States :
AT CH DE ES FR GB IT LI NL

(71) Applicant : **PULIMAT S.r.l.**
Località Novella Terza
I-20070 Guardamiglio (Milano) (IT)

(72) Inventor : **Sonzogni, Franco**
Via Trieste 12
I-24040 Canonica D'Adda (Bergamo) (IT)

(74) Representative : **Marietti, Giuseppe**
STUDIO ASSOCIATO MARIETTI &
PIPPARELLI Viale Caldara 38
I-20122 Milano (IT)

(54) **Motorised device for cleaning large surfaces.**

(57) The device comprises at least a central brush (2) having an horizontal axis (1) rotatable at a preset speed, the rotary shaft of said brush (2) is mounted on at least one floating arm (4,5) or lever and is provided with means to control the working position of the brush (2) and the width and frequency of its oscillations during the operation of the device.

EP 0 462 076 A1

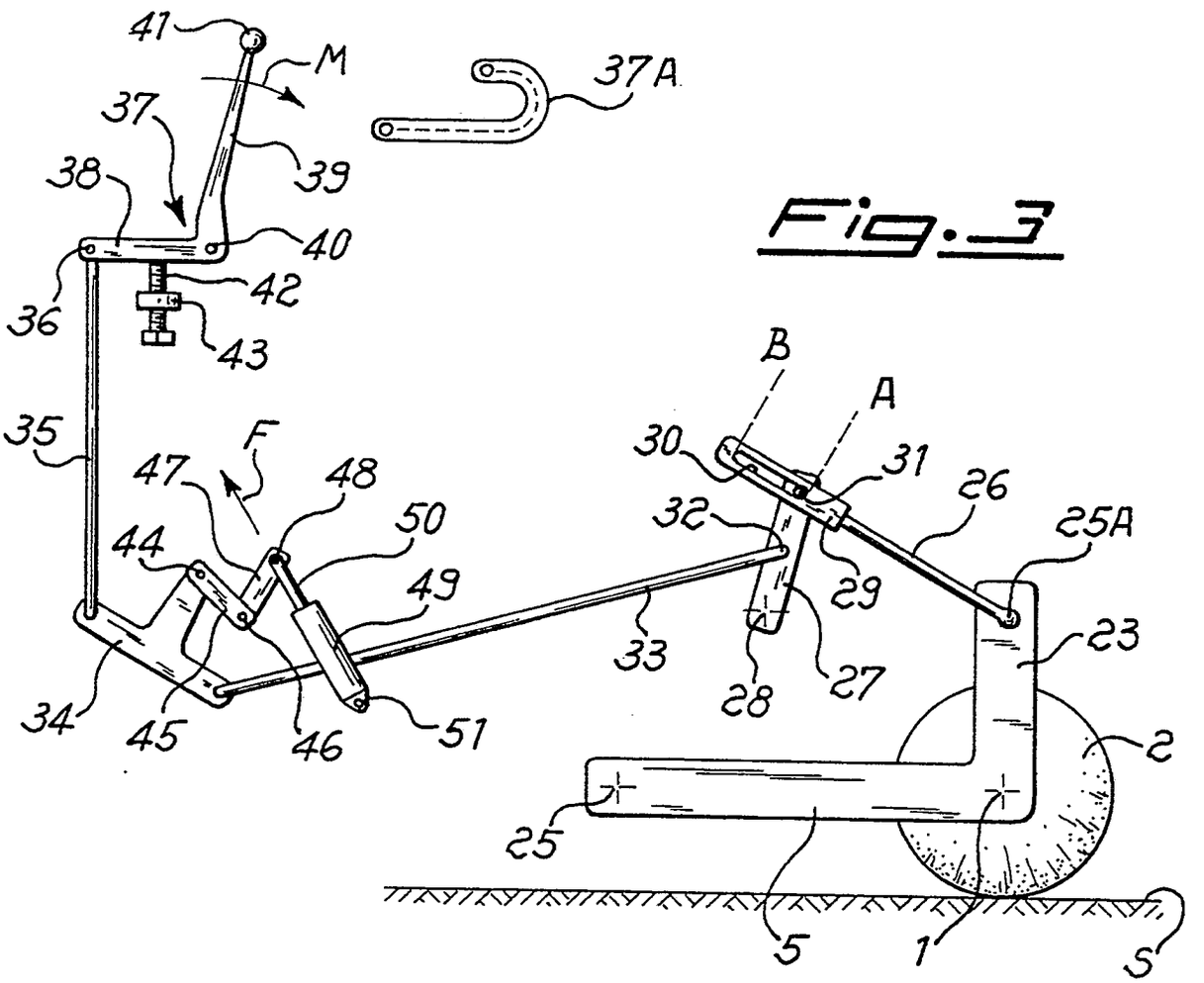

41
M
37A
37
39
38
40
42
36
43
35
F
47
48
50
44
49
34
45
46
51
B
A
30
31
26
25A
32
29
33
28
27
23
2
25
5
1
S

Fig. 3

The present invention relates to a motorised device for cleaning large surfaces, also known as motor-broom, and in particular a self-propelled vehicle provided with two or more side brushes having almost vertical axes and with at least one cylindrical brush having an horizontal axis mounted in the back of the vehicle in a central position to collect wastes pushed towards it by the side brushes and project them towards the inside of the vehicle where they are sucked and deposited into an appropriate collecting box.

The vehicles of this are motorized by an internal-combustion engine or an electric motor, according to the type of use foreseen. Said motor can provide power both for moving the vehicle and for moving the brushes, or alternatively a suitable electric motor can be envisaged for actuating the brushes.

These vehicles are designed for cleaning large asphalted or in any way paved surfaces, which very often present considerable accidents and bumps, typically holes, depressions and small bulges, which cause two kinds of inconveniences.

In fact, on one side, in correspondence with said bumps the regular contact between the horizontal brush and the surface to be cleaned is interrupted and therefore cleaning is no longer effective.

On the other side, the brush and related mechanical members are submitted to abrupt stresses, even of high intensity, which negatively affect the useful life as well as the maintenance cycles of said machines.

No vehicles of this kind have been proposed up to now provided with an effective system capable of allowing a brush self-levelling and an adjustment of the load applied thereto.

Another inconvenience of the known machines is constituted by the progressive wear of the horizontal brush, which, in a vehicle with a fixed brush, results in an unsatisfactory sweeping action. In particular, in known vechicles, the operator must stop the machine and control through a port the wear level, and then loosen the elements for brush adjustment on both sides.

Therefore an object of the present invention is to overcome the aforestated inconveniences and limitations of the prior technique and in particular to propose a motorised device for cleaning large surfaces wherein the horizontal brush is movable in vertical direction and allows an almost automatic compensation of the ground bumps.

A further object of the invention is to provide a motor-broom provided with means to compensate in an easy and quick way the wear of the central brush.

The system should to be simple, in that obtained by using mechanical pieces (arms and levers), and nevertheless very effective.

These objects are achieved by means of the invention, consisting in a motorised device for cleaning large surfaces comprising at least a cylindrical central brush with horizontal axis, rotatable at a preset speed, characterised in that the rotary shaft of said central brush is mounted on at least one floating arm or lever, said arm or arms being provided with means to control the operative position of said brush and to control the width and frequency of the oscillations of said brush during the device operation.

According to an advantageous feature, the device according to the invention envisages to mount an electric motor for actuating said central brush on one of said floating arms supporting the central brush.

According to a further advantageous feature of the invention, said vehicle is characterised by the fact of providing a device for compensating the brush wear, comprising means to adjust the position of the brush both in horizontal and vertical direction.

The invention will be now described more in detail with reference to preferred embodiments, illustrated in the accompanying drawings, wherin:

- Figure 1 is a schematic and partial view from the top of the floating arrangement of the brush according to the invention;
- Figure 2 shows a preferential configuration of a floating lever;
- Figure 3 is a schematic view of the control linkage of the vehicle according to the invention; and
- Figure 4 is a schematic view illustrating the device for compensating the brush wear.

With reference first of all to Figure 1, the device according to the invention comprises a brush 2, substantially cylindrical and with horizontal axis, rotatably mounted between two floating arms or levers 4, 5. The arms 4, 5 are pivoted in a known way to the body of the machine and are rigidly connected to each other by means of a pivot 3. The brush 2 is mounted, rotatable about its own axis 1, at the free ends of said floating arms in such a way to be able to move in a vertical direction in order to adapt its position to the depressions and bulges of the surface to be cleaned.

In case the brush 2 is actuated by a combustion motor, the movement is transmitted to it in a known way through driving gears as will be evident to those skilled in the art and the floating arms, or levers, do not require particular configurations.

Figure 1 shows an embodiment wherein the brush actuating motor is an electric motor. In this case, as better shown in figure 2, at least one of the levers (lever 5 in fig. 1) is L-shaped and comprises an arm on which said electric motor M is mounted. The transmission of the movement to the brush is thus simplified, the shaft of the motor M bears a pulley PM around which a driving belt 8 is wound and, throug a pulley PS integral to the brush axis, directly transfers the movement of rotation to the brush 2, which movement results in the same direction as that of the vehicle on the surface to be cleaned.

As it can be noticed, the floating arms 4 and 5 are

placed in front of the brush 2 considering the direction of movement, and this fact, together with the direction of rotation of the brush, might lead to a crawling of same. In order to ensure optimal conditions of operation, at least one of the arms is provided with means to control the working position of the brush as well as the width and frequency of the oscillations of said arm during the operation of the device.

As schematically shown in figure 3, said means to control the working position of the brush comprise a rigid linkage (26, 27, 33, 34, 35) which connects the floating arm 5 with an operating lever 37 which is operable by the operator; an adjusting screw 42, 43, or similar means engageable by the lever 37 to limit its downward run; and a spring or similar elastic means which engages said linkage to push the floating arm 5 and therefore the brush 2 towards the ground.

The means to control the width and frequency of the oscillations of brush 2 comprise a damper in engagement with the rigid linkage to control the width and frequency of the oscillations when the brush 2 (and the arm 5) is pushed upwards. The control of the width of the oscillations, or better of the translations that take place when the brush is stressed upwards, is ensured by a pivot-slot connection between two elements of said linkage, preferably between the two elements immediately upstream the arm 5.

In the preferred embodiment as shown in figure 3, the funtion of spring and damper is performed by a single element, consisting of a pneumatic spring 49 which acts on a three-armed lever 34 present in said rigid linkage. Analysing the linkage more in detail, the sequence of its elements is as follows: the brush 2 is rotatably mounted in 1 on an end of the horizontal portion of the arm 5, the other end of which is pivoted or articulated in 25 to the frame of the vehicle. The arm 5 is pivoted in 25A to an end of a rod or rigid tie rod 26, the other end of which is fastened by means of said pivot-slot connection to a vertical lever 27, floating with respect to the frame of the vehicle thanks to a pivot 28 present on the lower end of said lever. As it can be noticed, the slot 30 is provided in one head 29 integral to the rigid tie rod 26, and is slidingly engaged with a pivot 31 integral to the floating lever 27 in the vicinity of its upper end. The length of the slot is approximately of 20-30 mm.

Moreover the floating lever 27 is articulated in 32 to a second driving rod 33, hinged to a first arm of a three-armed lever 34 pivoted in 44 to the frame of the vehicle. The second arm of the lever 34 is hinged to a control rod 35 which is pivoted in 36 to the lower end of the operating lever 37 having an L-configuration and comprising an upper section 39 ending with a knob 41 to be actuated by the operator, and a shorter lower section 38. The operating lever 37 is furthermore pivoted in 40 to the frame of the vehicle and its upper end is movable in an elbow guide 37A between an operative position when the brush is lowered and a rest position with lifted brush.

Under the operating lever 37 an adjusting screw 42 is provided, which is screwed in a seat or nut screw 43 integral with the frame, in a way to limit the maximum downward displacement of the lower section of the operating lever 37.

The third arm integral to the lever 34, as indicated by reference 45, is connected through a movable stem 50 to said pneumatic spring or gas spring 49 which is pivoted at its other end, in 51, to the frame of the vehicle.

Preferably, as shown in Fig. 3, the articulation of lever 34 is of the so-called shackle type, with the lever 47 rigidly fastened in 46 to the arm 45 of the lever 34 by means of a screw and with its free end pivoted in 48 to the stem of the gas spring 49. By loosening the screw 46 and rotating the section 47, it is possible to change the length of the lever arm, and therefore to vary the load of the gas spring 49.

As previously mentioned, the gas spring 49 performs a double function in that it acts as a damper and moreover applies a load to the brush in such a way to provide the necessary strength to avoid the brush jumping. The use of separate damper and spring is thus avoided.

When the vehicle is transferred and in general when a cleaning action is not required, the brush 20 is kept raised from the ground S, and this is obtained by the operator engaging the operating lever 37 in the non operative position of the elbow guide.

To lower the brush to its working position as shown in Fig. 3, the operating lever 37 is released and brought to said working position of the guide 37A and the linkage, which constitutes a rigid mechanically connected group, lowers. When the brush reaches the ground, it stops, but however the gas spring 49 continues to exert a thrust F directed according to its own axis, which determines a couple with respect to the fulcrum 44 of the rigid lever system represented by the linkage group.

As a result of this action, the floating lever 27 rotates around the fulcrum 28 driving in the movement the pivot 31 which moves inside the slot as fas as to reach the position A shown in Fig. 3. By means of the pivot 31 which is now in its end stroke position, the thrust supplied by the gas spring 49 is now applied to the brush 2.

In order to adjust the working position of the brush, the adjusting screw 42 is screwed and the lever 37 is released allowing the gas spring 49 to push the brush 20 against the ground, then the adjusting screw 42 is moved again until its end is in contact with the portion 38 of the lever 37.

During operation, when the brush finds a bulge and the arm 5 is stressed upwards, the pivot 31 acts on the linkage loading the gas spring 49; on the contrary, in case of downward movement of the brush, caused by a hole, the linkage cannot move back-

wards, however the downward movement is made possible by the idle run of the pivot 31 within the slot 30 up to position B.

According to a further aspect of the invention, the motorised device is provided with means to adjust in horizontal direction the position of the brush to compensate its wear during its useful life, keeping it at the proper distance from the front wall of the brush box. As illustrated in fig. 4, the free end of the floating ¡ever is preferable mounted on an arm 11, turnable around the fulcrum 10 to position at least in horizontal direction the brush 2 with respect to the frame of the vehicle. The position of the free end 25 of the arm 11, where the floating lever 5 is pivoted, can be controlled in any known way, for instance by means of a cam.

However, in the preferred embodiment as shown, said position is controlled by an arm 11 pivoted in 10 and kept in position by a locking system 12.

By loosening the locking system 12, the lever 11 pivoted in 10 moves according to a circumference arc displacing the end 25 ahead and downwards, carrying the worn brush to gently rest on the front wall of the brush box and simultaneously on the ground, as indicated by dashed lines in figure 4.

The movement of lever 11 is caused by the weight of the elements hanging thereto (namely the brush 2 and the arm 5) and can be possibly helped by an elastic member (not shown).

Claims

1. A motorised movable device for cleaning large surfaces, comprising at least a central cylindrical brush having an horizontal axis, rotatable at a preset speed, characterised in that the rotary shaft of said central brush is mounted on at least one floating arm or lever, said arm or arms being provided with means to control the working position of said brush and to control the width and frequency ot the oscillations of said brush during the device operation.

2. A device according to claim 1, characterised in that said means to control the working position of the brush consist of: a rigid linkage which connects at least one floating arm with an operating lever to be actuated by an operator; an adjusting screw or similar means engageable with said operating lever to limit the run thereof in one direction; and a spring or similar elastic means engaged with said linkage to stress said floating arm towards the ground.

3. A device according to claim 2, characterised in that said means controlling the width and frequency of the oscillations of the brush comprise a damper in engagement with said linkage to control the width and frequency of the oscillations when the brush is stressed upwards, and a pivot-slot connection inserted in said linkage to control the width of the oscillations due to a downward stress of the brush.

4. A device according to claim 2 or 3, characterised in that said spring and said damper are constituted by a single pneumatic spring.

5. A device according to claim 4, characterised in that said pneumatic spring engages a three-armed lever included in said linkage, said lever being connected upstream with a control rod fastened to said operating lever, and downstream with a second driving rod, connected on its turn, through a floating lever and a rigid tie rod with one of said floating arms.

6. A device according to one of claims 3 to 5, characterised in that said pivot-slot connection is positioned between said floating lever and said rigid tie rod, the pivot of said connection being integral to said lever and the slot being provided in a head integral to said rigid tie rod.

7. A device according to one of the preceding claims, characterised in that said floating lever or levers of the brush are mounted on the free end of at least one arm, rotatable in a controlled way within a preset angle to adjust at least in the horizontal direction the position of the brush and therefore compensate its wear.

8. A device according to claim 7, characterised in that the end of said rotatable arm, on which said floating lever of the brush is mounted, is movable according to a circumference arc directed towards the ground and towards the front portion of the device, in order to simultaneously adjust the brush position with respect to the ground and to the wall of the brush box.

9. A device according to claims 7 or 8, characterised in that the movement of the turnable arm is caused by an elastic element and/or by the load of group of elements hanging on said arm.

10. A device according to one of the preceding claims, wherein said brush is actuated by an electric motor, characterised in that said floating lever or levers are L-shaped and in that on the vertical arm of said L-shaped lever said driving motor of the brush is mounted.

Fig.1

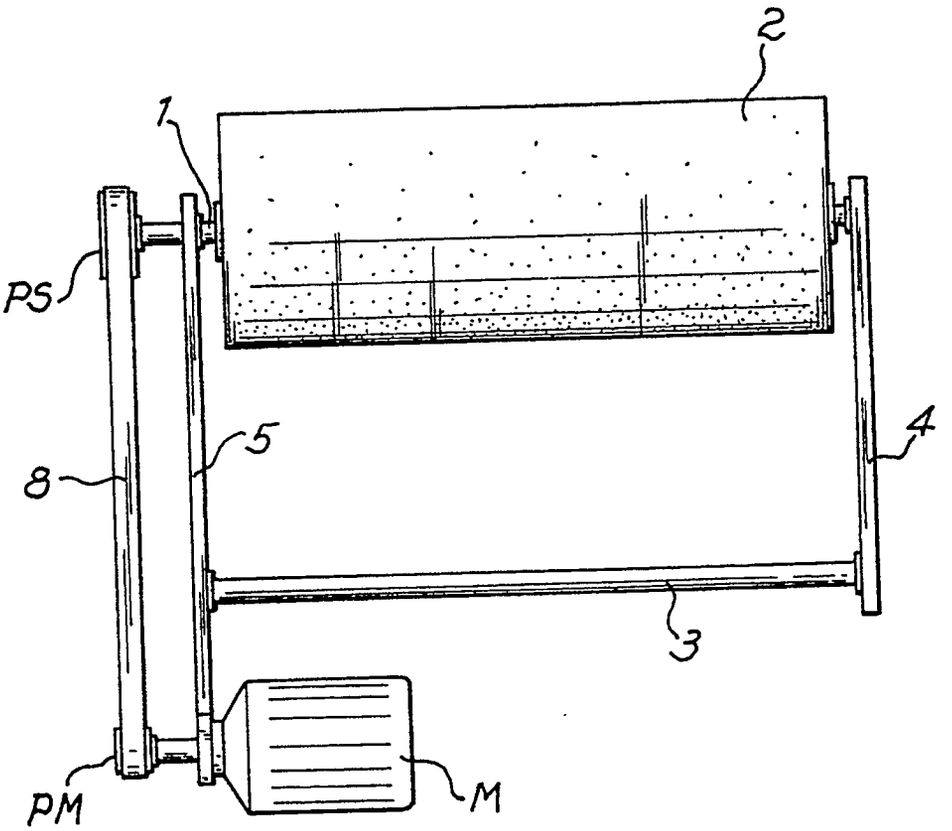
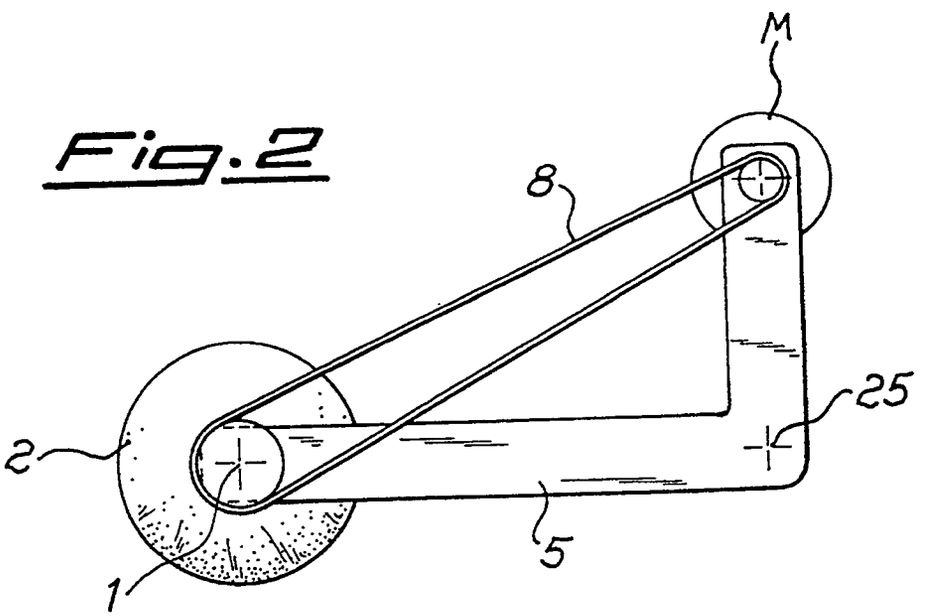


Fig.2



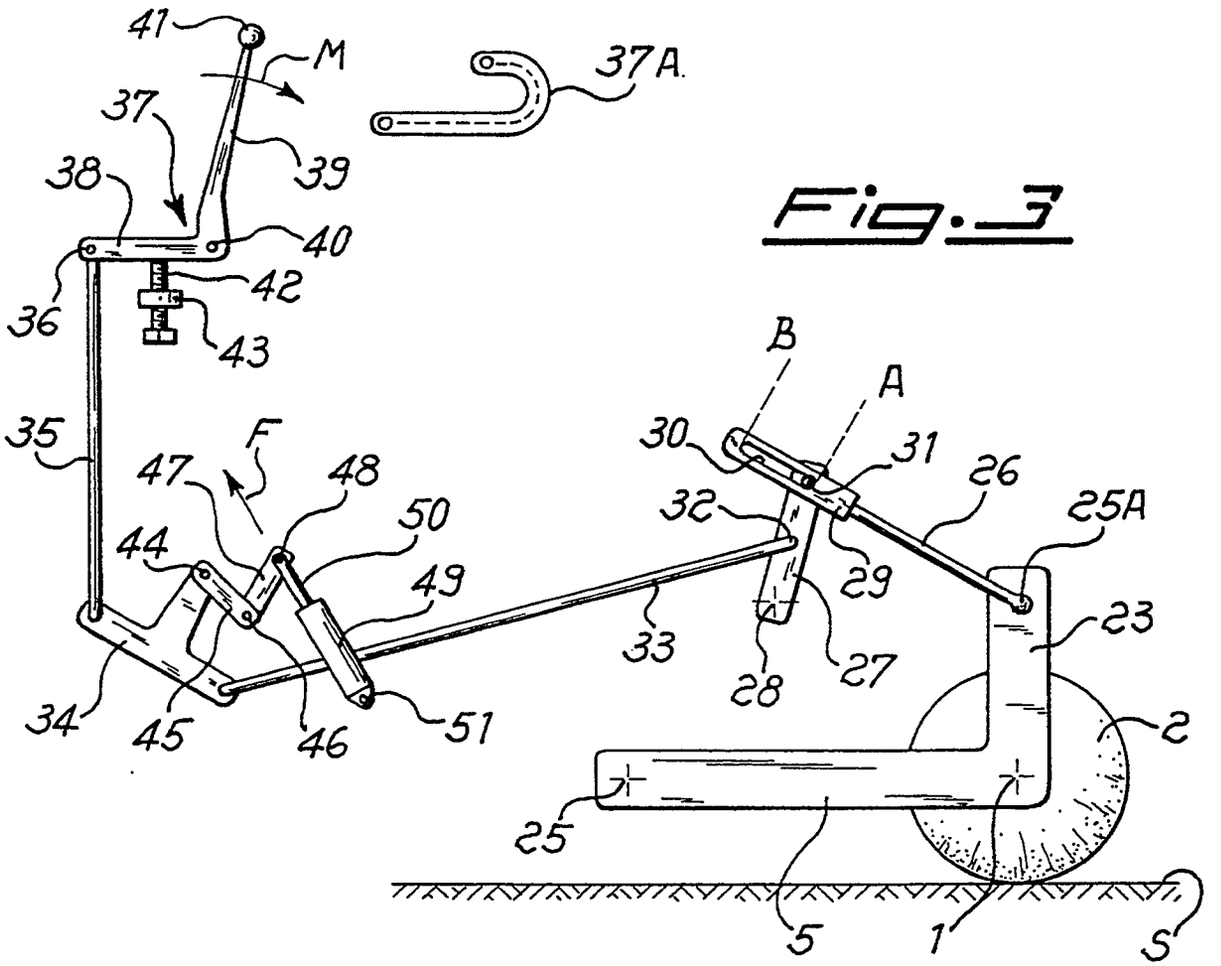
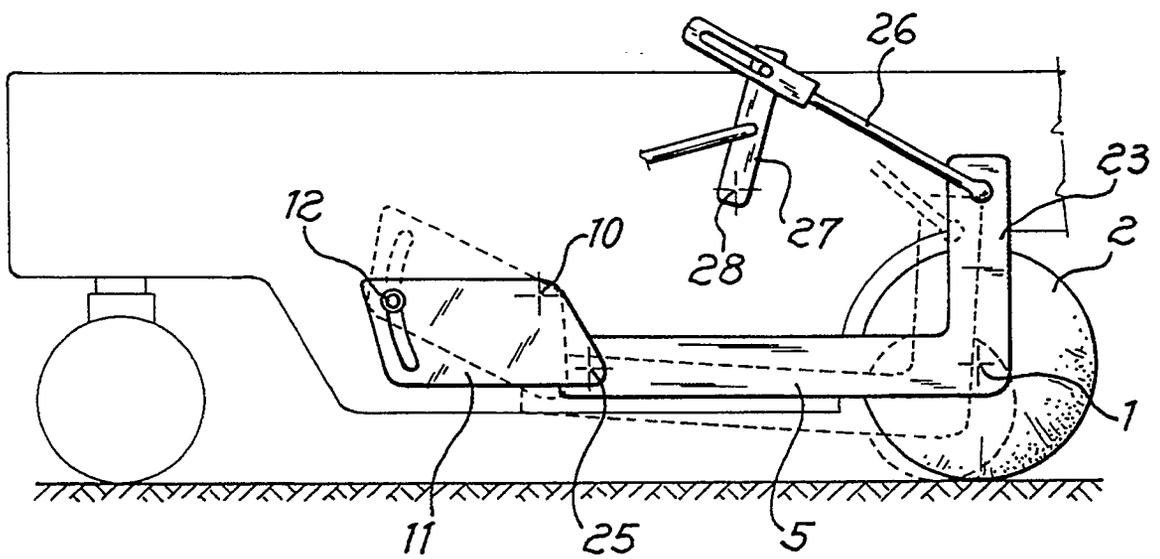

41
M
37A
37
39
38
40
42
36
43
35
F
47
48
50
44
49
34
45
46
51
B
A
30
31
26
25A
32
29
33
28
27
23
2
25
5
1
S

Fig.3

Fig.4


26
23
12
10
28
27
2
1
11
25
5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0246

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X Y A	DE-A-2 455 200 (KIBO) * the whole document * ---	1,7,9 10 8	E01H1/05
Y	FR-A-2 627 787 (ROUSSEL) * page 3, line 20 - line 23; figure * ---	10	
X A	DE-C-704 922 (STREICHER) * the whole document * ---	1 2,3	
X	GB-A-2 126 633 (HESTAIR EAGLE) * page 5, line 116 - page 6, line 26; figure 4 * ---	1	
A	EP-A-0 134 409 (FMC CORP.) * the whole document * ---	1,7,8,9	
A	US-A-1 369 106 (HOFFER) * page 2, line 7 - line 54 * * page 4, line 33 - line 48; figures * -----	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09 SEPTEMBER 1991	DIJKSTRA G.

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 (P0401)