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

(11) Publication number: **0 476 483 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91115246.0**

(51) Int. Cl.5: **E01H 1/08**, E01H 1/04

(22) Date of filing: **10.09.91**

(30) Priority: **10.09.90 IT 4687290**
07.12.90 IT 4690690

(43) Date of publication of application:
25.03.92 Bulletin 92/13

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR LI LU NL SE

(71) Applicant: **Bettuzzi, Massimo**
Via Verdi, 34
I-41014 Castelvetro, Modena(IT)

(72) Inventor: **Bettuzzi, Massimo**
Via Verdi, 34
I-41014 Castelvetro, Modena(IT)

(74) Representative: **Lecce, Giovanni**
Dott. Giovanni Lecce & C. S.r.l. Via G. Negri 10
I-20123 Milano(IT)

(54) Universal motor sweeper unit.

(57) A universal unit (1) for motor sweepers and the like comprises a box (2) from whose lower opening (3) project the peripheral ends of the bristles constituting a rotating cylindrical brush (4). Said brush (4) is combined in approach with a tank (7) or (7') in which is positioned a cylindrical conveyor with radial bristles (5) or with a conveyor belt (6) which is also rotating or sliding.

The box (2) is equipped or not with an advanced suction chamber (44) communicating with the suction mouth (11) aligned with said seat or tank (7) or (7').

The brush (4) and the conveyor (6) are powered independently or in direct or indirect combination with each other. The universal unit (1) can be combined with a suction, collection and filter unit (15) integral with or separate from said box (2) which is positioned with or without said unit (15) at the front, side or rear of self-propelled or towed vehicles (17), (18), (19) or on fixed or telescopic extensible moving arms (16) placed on said vehicles.

Said applications may be single or double, with means rotating around fulcrums (23).

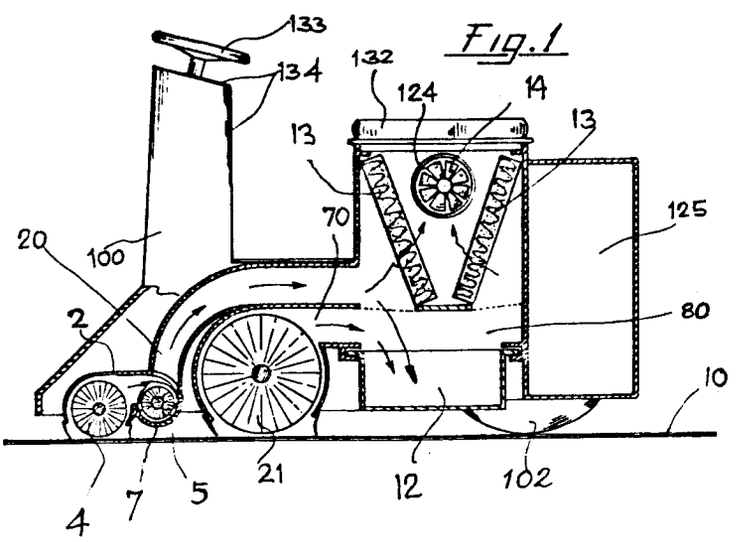


Fig.1

EP 0 476 483 A1

The present invention relates to a universal motor sweeper unit consisting substantially of a cylindrical rotating and conveying brush contained in an external box which can be coupled to self-propelled or towed means through structures and/or moving arms which are fixed or extensible with adjustable positioning and extension.

The cylindrical brush and the conveyor are powered and include integral or separate means of collection and suction.

Said universal unit is applicable singly or in pairs to self-propelled or towed vehicles or vehicles with moving arms, preferably combined with main central transverse rotating brushes with fixed position equipped or interconnected with boxes for containment of the sweepings.

Many types of machines conceived for automatically sweeping the ground and in particular streets, sidewalks, parkways and passages present in cities or inhabited places in general as well as the interior spaces of industrial, commercial or civil buildings are known at present.

Among the most widely used techniques for providing cleaning means there can be listed conical rotating brooms with vertical axis which, individually or in pairs, rotate in such a manner as to collect sweepings at their periphery and convey them to the centre of the machine in which are arranged the collection and suction means.

Other embodiments call for the employment of large cylindrical brushes with horizontal, transverse axis with the brushes arranged in opposed helices proceeding from the sides towards the centre. Rotation of said brushes in adherence with the ground causes conveyance toward the centre of the sweepings up to alignment with collection and suction mouths.

These devices whether equipped or not with optional height adjustment means have some shortcomings or limitations.

In particular said vertical conical brushes, even though they are capable or effectively collecting the sweepings from all corners have the drawback that they raise excessive dust and consequently cannot be used except when city pedestrian traffic is minimal or null.

The horizontal transverse rollers have the drawback that they are not capable of effectively collecting the sweepings along borders and/or edges.

To obviate said drawbacks and based on general engineering improvements, there have been provided lately more complex machines in which there have been made pairs of side and central rollers whose simultaneous operation ensures better cleaning action, both side and central.

One of these solutions calls for the use of pluralities of conical brushes with vertical axis mounted on moving arms equipped with sensors which make it possible to detect the presence of any of obstacles and cause automatic backing or extension of said arms.

Said devices, which allow effective use in variable width paths such as corridors and the like and/or with variable height such as steps, although they are of course valid, display some drawbacks. In particular they use conical brushes which, as already mentioned, in their rotary action raise a lot of dust. The obstacle-sensing devices are of the electronic type, very sensitive and delicate and basically very costly.

Another drawback is the fact that the conical brushes with vertical axis perform their cleaning action well in the presence of dust and small refuse but are ineffective in the presence of larger bodies.

The subject matter of the present invention is elimination the above mentioned shortcomings.

The invention as characterized in the claims solves the problem by means of a universal unit for motor sweepers by means of which there are achieved the following results. The unit equipped or not with collection and suction means for the sweepings, can be applied on any mobile vehicle, self-propelled or towed. Each unit comprises at least one rotating brush with cylindrical bristles with a coupled conveyor element with helical bristled or with a belt with transverse entrainment blades. Each unit or pair of units is supported by a moving fixed or telescopic arm or by means adjustable laterally, transversely and in height.

The cleaning unit can be made up of a combination of rotating cylindrical brushes with helically arranged bristles with substantially parallel axes and of which one is preferably fixed in a central position and the others are front and lateral with the capability of extension outward. Said lateral brushes are extended mechanically, manually or electronically and are preferably combined with rotating screw conveyors for conveyance of the sweepings toward the centre of the unit and a large central brush and/or aspirator.

The motor sweeper machine as a whole and in accordance with the disposition of the above mentioned cleaning brushes can be of the self-propelled type or the manually moved type.

The advantages achieved by the present invention consist essentially of the fact that with said universal unit it is possible to perform sweepings collection operations in any environment, interior or exterior, with or without obstacles, within the scope of its integral configuration of simple and economical type.

The combination of large horizontal cylindrical brushes with helical bristles allows perfect collection of sweepings and any refuse even if heavy. The combination of helical rotating conveyors with

the front brushes allows reliable and total collection of refuse and sweepings in general with no manual finishing work.

The motor sweeper system, whether self-propelled or manually moved, is easy to maneuver, includes filters for purification of the suction air and a sweepings collection box and is capable of operating on surfaces between a minimum width corresponding to the length of a fixed cylindrical central brush and a maximum width corresponding to the sum of said length of the central brush and the lengths of the front brushes extended laterally.

The invention is described below in greater detail in accordance with embodiments given only by way of nonlimiting example with reference to the annexed drawings wherein -

FIG. 1 shows schematically a longitudinal cross section of a machine of the self-propelled type equipped with the universal unit,

FIG. 2 shows schematically a plan view of an assembly consisting of universal units,

FIG. 3 shows a cross section of a first embodiment example of the universal unit with conveyor with spiral cylindrical bristles,

FIG. 4 shows a cross section of a second embodiment example of the universal unit with longitudinal belt conveyor with transverse entrainment blades,

FIG. 5 shows some examples of applications of the present invention on a self-propelled vehicle with different solutions of the position supporting and adjustment means, another example of adjustable mobile support for the universal unit,

FIG. 7 shows an application of the universal unit complete with collection and suction means, applied to the end of a mobile arm which may be fixed or telescopic,

FIGS. 8 and 9 show two distinct applications by way of example of universal units complete with collection and suction means applied to the structure of conventional tow cars and/or tractors,

FIG. 10 shows schematically a front view of two paired universal units equipped with transverse, vertical, longitudinal and rotary adjustment means,

FIG. 11 shows schematically a configuration for universal units equipped with conveyors perpendicular to the cylindrical brush, and

FIG. 12 shows schematically plan views of self-propelled vehicles or the like combined with universal units in the operating phase before, during and after overcoming obstacles.

The FIGS. illustrate universal units (1) for motor sweepers and the like substantially consisting of an external box (2) which includes a lower opening (3) from which projects the peripheral end of a powered cylindrical brush (4) coupled with a conveyor (5) or (6) inserted in a seat (7) substantially parallel with said brush.

The rotating brush (4) is preferably cylindrical with bristles parallel or in a single or double helical spiral converging toward the centre while the conveyors may be cylindrical (5) or helical spiral, also with bristles, or with laminations of rigid material, or they can consist of conveyor belts (6) supported by end rollers (8) and equipped with transverse entrainment blades (9).

In accordance with the normal operating method the direction of travel of the box is from right to left as viewed in FIGS. 3 and 4 and the direction of rotation of the rotating brush is clockwise, again in accordance with the above mentioned FIGS. In this manner the peripheral end of said brush (4) slides on the ground (10), collects the refuse and raises it while rotating to dump it into the seat (7) of the conveyor (5) or (6).

The refuse is then pushed or collected by the conveyor (5) or (6) until it reaches the mouth of the suction duct (11). Then it is sucked in and made to fall in to extractable collection boxes (12) while the suction air is appropriately purified through filters (13) and expelled to the atmosphere through the blowers (14).

In accordance with a 'universal' configuration the units (1) for motor sweepers and the like are separated by the suction, collection and filter units (15) and are configured in such a manner as to allow easy application to the end of the fixed or telescopic moving and rotating arms (16) arranged on the self-propelled vehicles (17) or trailers, or positioned at the front, side or rear of vehicles (17) especially conceived for said use or vehicles adaptable for the purpose at the time of need such as for example material handling trucks (18), tractors (19) and the like.

Said applications call for connection of units (1) for motor sweepers to suction, collection and filter units (15) through ducts or flexible hoses (20). In the above cases the suction, collection and filter units (15) used are the conventional ones applied on vehicles (17) or are configured in an independent and adequate manner for being applied to any means of transport.

FIGS. 1 and 2 illustrate a motor sweeper with variable width substantially consisting of a structure (100) on wheels and on which is positioned a first cylindrical brush (21) having bristles arranged from the periphery toward the centre in an opposing helical manner (50).

The main brush (21) is powered by means of belts, chains, gears or the like and positioned at the centre of the structure (100) and is oriented in such a manner that the ends of its bristles sweep the ground and is supported at the ends by fixed supports.

Opposite the entire length of the brush (21) in the rear position there opens a suction channel (70) which opens into a space (80) beneath which is placed an extractable collection box (12).

In front of the cylindrical brush (21) are arranged two box structures (2) which are opposed and extensible outside the periphery (110) of the structure (100) in the directions indicated by the arrows (112) in FIG. 2.

This extension is independent or simultaneous and is preferably but not in a limited manner provided by opposed pistons (113) fixed on one side (114) to the fixed structure (100) and on the other side (115) to the moving boxes (2) open on the bottom which slide along transverse guides (116).

The sliding movement of the boxes (2) can be provided also by different means such as mechanical devices and the like without going outside the scope of the invention.

In each box (2) is installed a first brush with helical bristles (4) preferably but not in a limited manner oriented with the horizontal axis placed substantially parallel to that of the central brush (21).

This preferred orientation can however be different, i.e. the axis of each brush (4) can be oblique to the axis of the main brush (21).

Each brush (4) is rotated by means of appropriate gears and is positioned in such a manner that the ends of its bristles touch the ground in the zone in front of that touched by the central main brush (21).

During travel of the motor sweeper over the ground the helical bristles of the front rotating brushes (4) perform collection and conveyance of the sweepings toward the centre of the machine.

In the collection action the sweepings are lifted and substantially dumped into seats or trough-like tanks (7) oriented parallel to said brushes (4). Inside the tanks (7) are present the conveyors (5) or (6) with bristles, paddles, belts or the like, also having rotary or translative motion. In the end zone turned toward the centre of the machine the seats or trough-like tanks (7) can be equipped with an opening with a flexible manifold (20).

The sweepings collected by the brushes (4) are thus dumped into the tanks (7) and the powered conveyors (5) and/or (6) push them toward the central zone of the machine from which they are made to fall at ground level aligned with the central main brush (21) or are sucked in through the manifolds (20) or even undergo the combined action of the two above mentioned conditions.

In all cases the sweepings are collected by the brushes (4) in front of and/or beside the central main brush (21) and are then redistributed to the centre thereof in such a manner as to facilitate the collection and suction action. Said action can be combined with the suction action produced through the manifold (20).

The capability of lateral extention of the box structures (2) allows the use of the motor sweeper in narrow zones not smaller than the space occupied (110) of said motor sweeper and in broader zones where it is possible to extend one or all the of box structures (2).

The rear suction channel (70) and the flexible manifolds (20) are connected in the rear part of the motor sweeper, allowing dumping of the sweepings into the extractable box (12).

The suction air is taken back toward the outside through filters (13) by means of powered blowers (14) preferably arranged opposite openings (124) provided in the sides of the motor sweeper.

The filters (13) can be the fixed type, extractable and/or interchangeable, or mounted on vibrating systems with cams, excentrics or the like which allow their beating even during operation. Said device aids self-cleaning and dumping of refuse in the collection box (12) below.

In the self-propelled version, illustrated in FIG. 1, the rear part (125) is used, for example, for containing the electric power batteries of the travel control motor. In other solutions power can be provided by internal combustion motors or others.

In the front part a system, e.g. with cams connected to at least one piston or equivalent, permits raising and/or lowering of the motor sweeper structure in relation to the ground level (10). In this manner the action of the brushes (4) can also be exerted on planes above ground level as for example steps and the like.

The self-propelled version includes a driver's seat (132), a steering wheel (133) and a control panel (134) from which the operator can operate the described operating devices. This solution is preferably equipped with rear steering wheels (102).

In another solution with manual handling, to the optionally faired bearing structure (100) there is applied a rear handlebar on which are located the controls. The sweepings collection box (12) and the air filters (13) are preferably extractable from the rear part of the structure (100).

In all cases the solutions described and illustrated are given only by way of nonlimiting example even though they are variable in their external appearance and/or the configuration of the component parts are included in the scope of the innovative concept of the present invention whose fundamental function consists of comprising box structures (2) laterally extensible beyond the basic structure of the motor sweeper (100) equipped with rotating brushes with helical bristles (4) and conveyors (5) or (6) combined with a conventional rotating central main brush (21) with opposing hel-

ical bristles (50).

Said boxes (2) being operated independently or simultaneously by the operators.

In other specific embodiments the universal units (1) for motor sweepers and the suction, collection and filter units (15) are assembled in single blocks optionally combined with a central rotating main brush (21) of the conventional type having the function of completing the refuse collection phase and conveying said refuse into the collection boxes (12). In said single blocks the universal units (1) can be present individually as shown for example in figures 7 and 8 in relation to applications to the ends of moving rotating arms (16) or in replacement of the forks of forklift trucks (18) or they can be double and opposed with lateral extension possible, simultaneously or independently, as shown in the application to the supports of a tractor (19) in FIG. 9 or to specially conceived vehicles (17) as shown in FIG. 5.

In these applications there are also provided independent rotating devices similar or corresponding to those illustrated in FIG. 6 which also allow, in addition to transverse extension in accordance with the indications of the arrows (22), rotation in one direction or the other, around the fulcrum (23) in accordance with the arrows (24).

Traversing of the universal unit (1) is achieved by means of the coupling of a lead-nut (25) with a powered lead screw (26). The lead-nut (25) is connected to the box (2) which includes bushes (27) which run along a transverse guide (28). Rotation of the cylindrical brush (4) and the conveyor (5) is provided for example by means of a hydraulic motor (29) which drives a grooved bar (30) on which is engaged a toothed belt (31) which meshes with the gears (32) and (33) keyed onto the axles of said brush (4) and conveyor (5). The configuration described of the translating movement of the units (1) is given by way of nonlimiting example. Indeed, it can be of another type such as for example that shown in FIG. (10) in which the translations are achieved by pistons (34) and powering of the rotating brushes (4) is direct on their axles with internal branches for the conveyors (5) and (6).

Similarly, forward and backward rotation in accordance with the arrows (24) is obtained by lateral pistons (35). The oscillations and/or vertical inclinations in accordance with the arrows (36) are obtained by means of pistons (37). Raising and lowering in accordance with the arrows (38) are obtained by means of the pistons (39). Other movements in the above directions are obtained by means of conventional devices applied to the vehicles employed such as the pistons (40) of the moving arms (16), the raising piston (41) of the trucks (18), the rotation controls (42) of the fifth wheels (43) and so forth.

In particular FIG. 10 also shows a double and opposed application of the universal unit (1) on a fixed structure which, in addition to allowing translation of the units in accordance with the arrows (22), is capable of rotating around the central fulcrum (23) in accordance with the arrows (24) and move vertically in accordance with the arrows (38) by utilizing the movement of a conventional moving arm (16).

In their basic configuration the universal units (1) for motor sweepers are preferably equipped with a front suction chamber (44) peripheral to the seat of the cylindrical brush (4) and through which is taken in the first dust which the flexible front blades (45) encounter during travel and brushing against the ground.

FIG. (11) shows another embodiment of the universal unit (1) with an arrangement of the conveyor means (5) or (6) orthogonal to the cylindrical brush (4). In this case the seat (7') containing the conveyor (5) has substantially the form of a hopper with a lower channel in which is inserted said conveyor, which can be either the helical bristle type (5) or belt (6) type with transverse entrainment blades (9).

FIG. 12 shows schematical top views of some examples of possible configurations of the systems applied for example to self-propelled vehicles (17) and shown in sequential operating phases from below upward in accordance with the numbers 1, 2 and 3 in spaces containing many obstacles (46) such as for example plants, pillars, receptacles, poles, constructions and the like.

In the solution indicated by a the self-propelled vehicle comprises two front universal units (1) adjustable in transverse extension and rotating around the fulcrums (23). In travel (from bottom to top), in the presence of an obstacle (46), after striking the obstacle the engaged unit (1) is capable of rotating around its fulcrum (23) while the vehicle (17) continues its travel. After passing beyond the obstacle the unit (1) returns to its normal operating position, i.e. at a right angle to the vehicle.

In the solution indicated by b the self-propelled vehicle (17) includes a moving arm (16) to the end of which is constrained a double universal unit (1) similar to the one shown in FIG. (10). Similarly to the above configuration the double unit (1) includes a central fulcrum (23) around which it can rotate in either direction if it strikes against an obstacle (46) and can then return to its normal working position after having passed beyond the obstacle, continuing the advancing motion of the vehicle (17).

In solution c the arm (16) of the self-propelled vehicle (17) supports only the universal unit (1) with fulcrum at one end.

Behaviour is similar to that of the above solu-

tions.

In other cases not shown the fulcrums (23) can consist of the rotating base plates (47) of the self-propelled vehicles (17) or be placed in the centre of the units (1) and the like.

The powering and/or piston operating systems are preferably hydraulic using hydraulic control units either independent or or in combination with those already equipping the vehicles.

Claims

1. Universal unit (1) for motor sweepers and the like characterized in that it comprises a box (2) from whose lower opening (3) project the peripheral ends of the bristles of a cylindrical brush with straight or helical bristles (4) and which couples parallel to a seat or longitudinal tank (7) where there is installed a conveyor consisting of a cylinder with straight or helical radial bristles (5) or a conveyor belt (6) supported by end rollers (8) and equipped with transverse blades (9), said box being equipped or not with a front dust suction chamber (44) peripheral to the seat of the cylindrical brush (4) and connected to a suction mouth (11) aligned with said seat or tank (7), said cylindrical brush (4) and conveyor (5) or (6) being equipped with independent or combined powering, direct or indirect, and said assembly or universal unit (1) being combined with a suction, collection and filtering unit (15) integral with or separate from said box (2).

2. Universal unit (1) in accordance with claim 1 characterized in that it is applied independently or in combination with suction, collection and filtering units (15) at the front, side or rear to self-propelled or towed vehicles (17), (18), (19) or to the ends of fixed or telescopic moving extensible arms (16) placed on said vehicles and said applications can be individual or double and opposed with means rotating around fulcrums (23) and comprise specific structures for combination with self-propelled vehicles (17) and/or include alternative or standard structures for application on vehicles usable normally for other functions such as fork-lift trucks (18), tractors (19) and the like.

3. Universal unit (1) in accordance with claims 1 and 2 characterized in that it comprises devices for adjustment of position vertically, transversely and in rotation in the two opposite directions, combined with the forward or backward translative movement of self-propelled and/or towed vehicles on which said unit is applicable, said devices being hydraulic such as hydraulic motors, pistons and the like, or mechanical with independent or simultaneous movement.

4. Universal unit (1) in accordance with claims 1 to 3 characterized in that the seats (7) of the conveyors (5) or (6) are with normal containment tank or hopper (7').

5. Universal unit (1) in accordance with claims 1 to 4 characterized in that it is applied to motor sweepers of variable width (100) comprising at least two front opposed boxes (2) extensible laterally beyond the outer periphery of the space occupied (110) of the motor sweeper and coupled to at least one main powered transverse cylindrical brush (21) placed in the centre of the motor sweeper with the bristles projecting downward to brush the ground (10), said boxes (2) being arranged with the horizontal axes of their cylindrical brushes (4) and their conveyors (5) and (6) in parallel alignment or in an oblique position in relation to the horizontal axis of said cylindrical main brush (21) and said combinations being in addition inclusive of means of suction (20), air filtering (13), suction (14) and refuse collection (12).

6. Universal unit (1) in accordance with claims 1 to 5 characterized in that the combinations of the boxes (2) with motor sweepers with central main brushes (21), the bristles of the front and side cylindrical brushes (4) and the bristles or spatulas of the corresponding conveyors (5) or (6) are oriented in such a manner that in movement the sweepings collected assume a transverse movement direction from the outside toward the centre of the machine.

7. Universal unit (1) combined with a motor sweeper (100) characterized in that the conveyors (5) and (6) and the central main brush (21) are combined with respective suction manifolds (20) and (70) which flow together in a common chamber (80) in which is placed at least one collection box (12) for the sweepings and one or more extractable and interchangeable air filters (13) equipped or not with vibrating systems, said suction manifolds (20) and (70), said chamber (80) and said filters (13) being connected with the outside of the structure (100) of the motor sweeper through powered blowers (14).

8. Universal unit in accordance with claims 1 to 7 characterized in that it is combined with a motor sweeper of the self-propelled or manual movement type or applicable and/or adaptable

to application on towed means or means usable also for other activities.

9. Universal unit (1) for motor sweepers or the like in accordance with the above claims as described and illustrated and for the specified purposes.

Fig.1

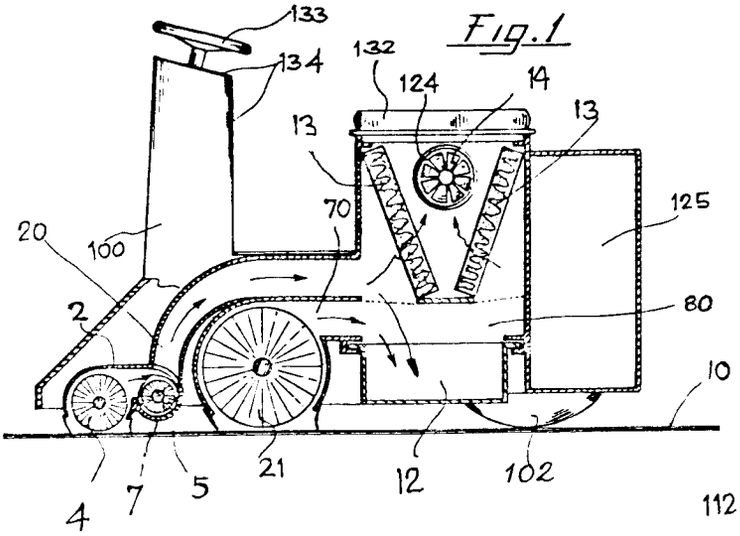


Fig.2

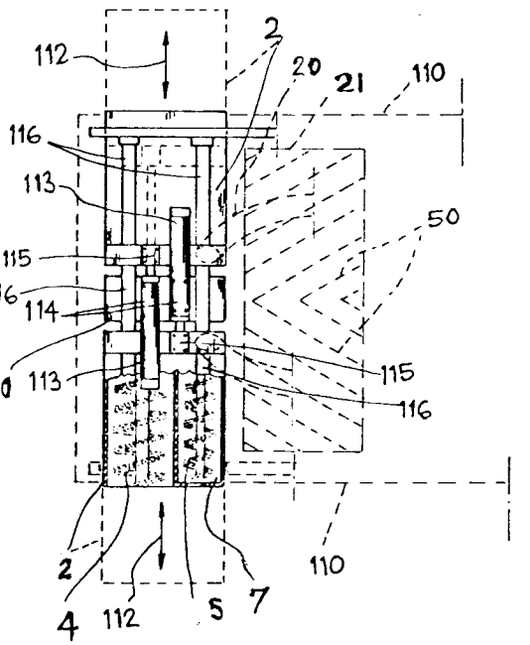


Fig.3

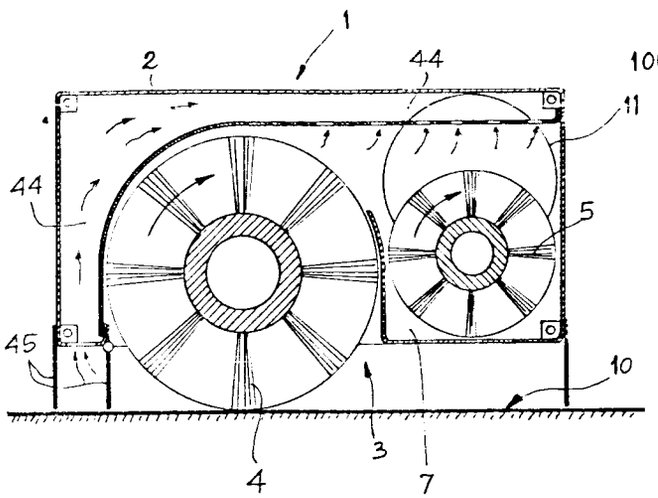
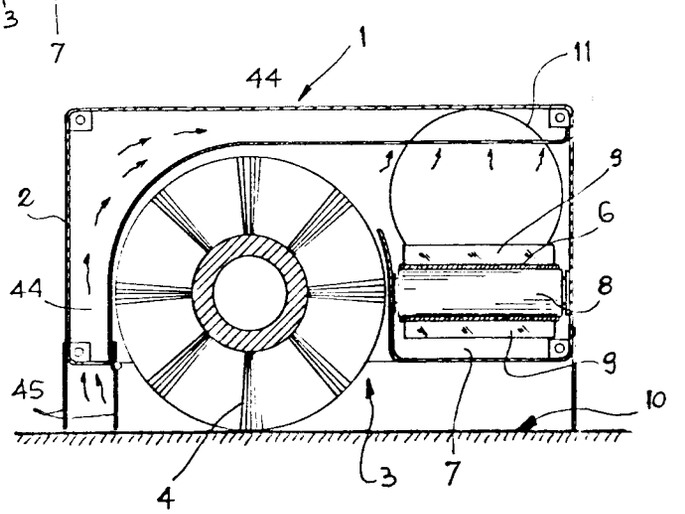


Fig.4



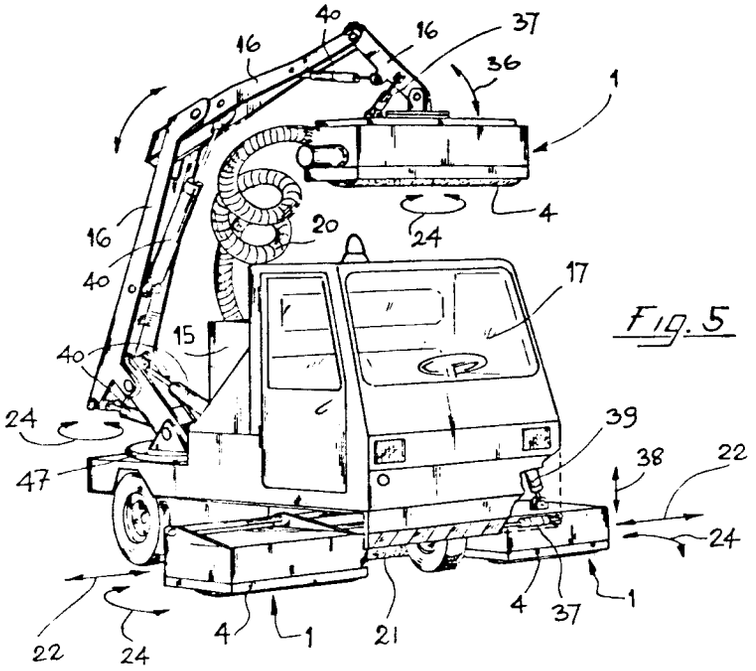


Fig. 5

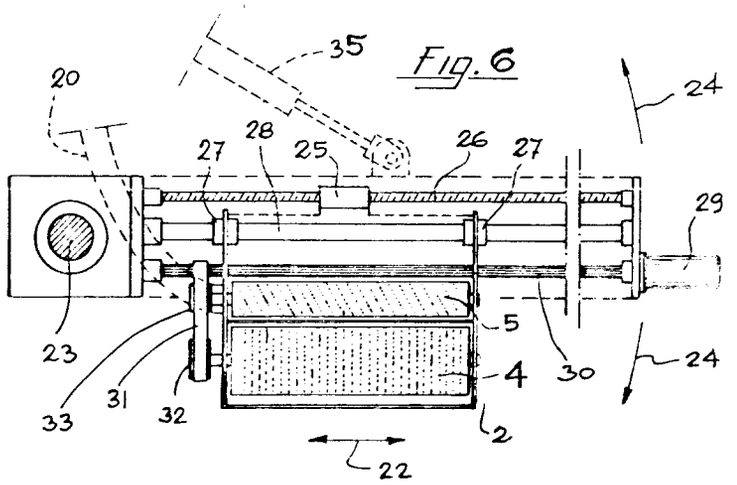


Fig. 6

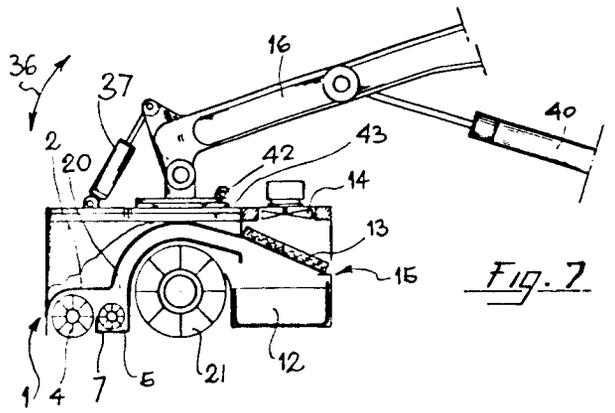


Fig. 7

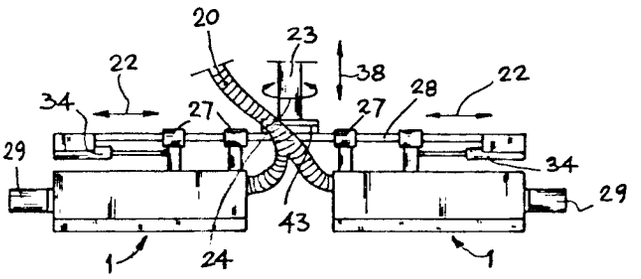


Fig. 10

Fig. 9

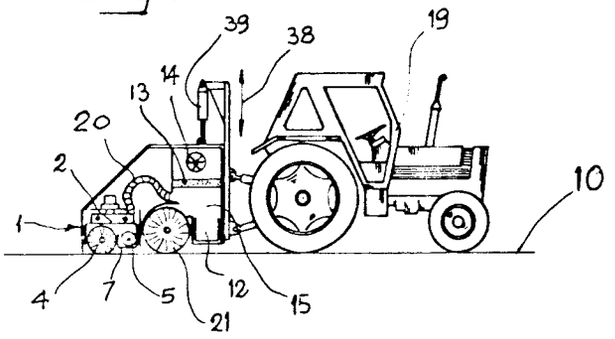
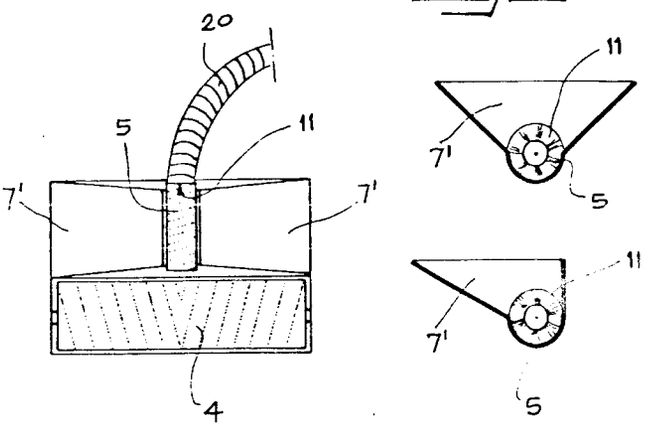


Fig. 11



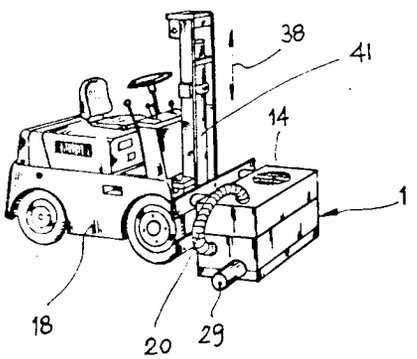
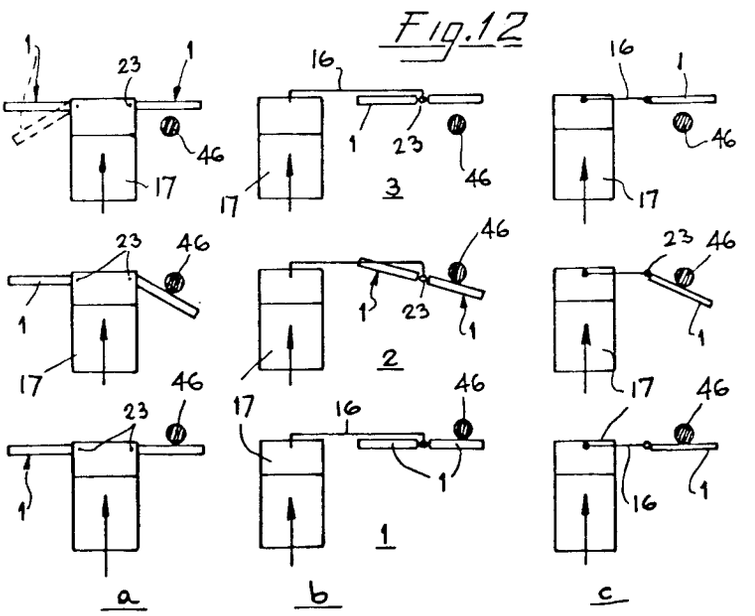


Fig. 8

Fig. 12



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 5246

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)
Y	FR-A-2 084 470 (STRAUB) * page 3, line 36 - page 5, line 21 * * * page 6, line 5 - line 7 * * * page 6, line 15 - line 27; figures 1-4,10-12 * *	1-3,5,7-9	E 01 H 1/08 E 01 H 1/04
Y	GB-A-380 596 (LEWIN) * page 1, line 54 - line 106; figures * *	1-3,5,7-9	
A	US-A-4 754 521 (ZONI) * abstract; figures 1-3,6 * *	1,8,9	
A	FR-A-412 693 (SANTIN ET AL.) * figures 2,3 * *	1,8,9	
A	GB-A-107 470 (BARNETT ET AL.) * figures * *	1,8,9	
A	FR-A-2 297 286 (LE MATERIEL DE VOIRIE) * claim 1; figures * *	1,8,9	
A	DE-U-8 806 413 (R.C.M. S.P.A. CASINALBO) * page 8, paragraph 8 - page 11, paragraph 3; figures 1,2 * *	1,6,8,9	
A	DE-A-2 150 496 (CROKER) * figures 6,7 * *	1,8,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 01 H

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	18 December 91	DE COENE P.J.S.

CATEGORY OF CITED DOCUMENTS

- X : particularly relevant if taken alone
- Y : particularly relevant if combined with another document of the same catagory
- 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