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(54) **Sweeper arrangement for sweeping a roof gutter**

(57) A sweeper arrangement with a sweeper (3) for sweeping a roof gutter (1) comprises a chassis (6), wheels (7) mounted on the chassis for, when in use, moving the sweeper to-and-fro along the upwardly directed inner side of the gutter (1), and also at least one brush

(8) mounted rotatably about an axis on the chassis. The axis of rotation of the at least one brush (8) is extending into the directions of travel of the sweeper (3). A roof gutter can, by means of the sweeper arrangement according to the invention, be effectively cleaned automatically.

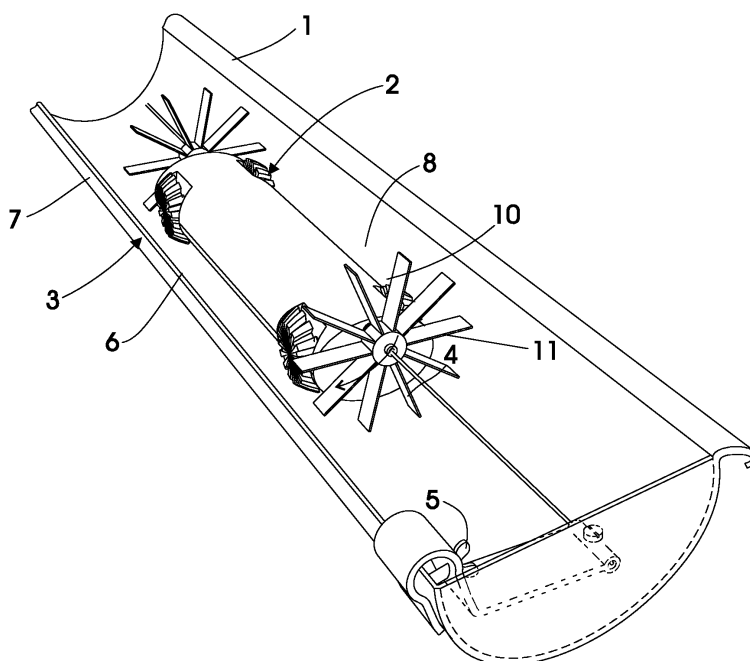


Fig. 1

Description

[0001] A sweeper arrangement with a sweeper for sweeping a roof gutter comprises a chassis, wheels mounted on the chassis for, when in use, moving the sweeper to-and-fro along the upwardly directed inner side of the gutter, and at least one brush mounted rotatably about an axis on the chassis.

[0002] Roof gutters are used for catching rainwater falling on a normally inclined roof on a building for being conducted to a sewer via a downpipe.

[0003] Dirt like e.g. leaves from trees is frequently deposited on the roof. In rainy weather, such dirt is carried along with the flow of rainwater to the gutter which then cannot function as required any more.

[0004] The result can be that the rainwater overflows the edge of the gutter and runs down along the building which thereby can be damaged.

[0005] The downpipe for draining off the water from the gutter can moreover be blocked up with the dirt. This is a serious problem since such downpipes normally are long and narrow and therefore extremely difficult to clean.

[0006] It therefore is, as can be appreciated, utterly necessary to clean roof gutters regularly. This work is however time consuming, laboriously and in some cases also dangerous to carry out.

[0007] Gutters on e.g. single-family houses can sometimes be manually cleaned when the operator is standing on a ladder. The ladder has to be moved all the time to be able to clean new areas of the gutter. However, the cleaning operation is still difficult and troublesome to carry out, and the operator easily risks getting soiled.

[0008] In order to improve this simple manual cleaning method, cleaning tools in form of scrapers or shovels are attached to the end of a long stick have been developed. These tools can be used for cleaning gutters on relatively low buildings. The advantage is that the operator can walk along the building during the cleaning operation without having to move a ladder all the time. The tools are however rather difficult to use since the areas of the gutter to be cleaned are far above the head of the operator and cannot be seen. The gutter cannot be sufficiently cleaned by means of such tools.

[0009] Gutters on higher apartment buildings are cleaned while the operator is climbing on the roof close to the edge of the roof. It goes without saying that such climbing operations are extremely dangerous to carry out.

[0010] Attempts have been made to solve these problems by sending a flow of cleaning water along a gutter however without obtaining an adequate cleaning result. The result of the cleaning process might very well be that the downpipe is clogged by dirt in the cleaning water which then will overflow the edge of the gutter and cause damage to the building. Cleaning a gutter with a flow of water is also costly since much water has to be used.

[0011] More or less automatically functioning mechanical solutions have also been proposed.

[0012] The publication DE 103 15 855 thus mentions a gutter cleaner. The structure of this cleaner is however not closer specified. No drawings exist.

[0013] In the publication DE 198 31 474 is described another gutter cleaner which on wheels can travel along a gutter while cleaning the gutter with a brush placed on the end of a slide rod of a crank mechanism. This known gutter cleaner is complicated and expensive and cannot function effectively.

[0014] Moreover, the gutter cleaner can easily fall out of the gutter and cause injury to people passing below.

[0015] The above-mentioned disadvantages of the prior art gutter cleaners are according to the present invention remedied by

in a first aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph, with which a rain gutter can be cleaned automatically,

in a second aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph, with which a rain gutter can be cleaned effectively, in a third aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph which is easy and quickly to use,

in a fourth aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph, with which a rain gutter can be cleaned without risk of causing injury to anybody,

in a fifth aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph, in which the sweeper is secured against falling out of the gutter,

in a sixth aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph, with which a rain gutter can be cleaned without soiling the operator,

in a seventh aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph in which the brushes are self-purifying,

in an eighth aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph, with which a rain gutter can be cleaned without risk of causing damage to the building on which the gutter is mounted,

in a ninth aspect of the invention providing a sweeper arrangement of the kind mentioned in the opening paragraph, which has an inexpensive structure.

[0016] The novel and unique feature of the invention consists in the fact that the axis of rotation of the at least one brush is extending into the direction of travel of the sweeper so that the sweeping process takes place perpendicular to the longitudinal direction of the gutter to be cleaned.

[0017] In an expedient embodiment according to the invention, the sweeper can be equipped with two brushes extending from each their end of the chassis so that the sweeper can sweep the gutter in opposite directions and also be able to sweep the end regions of the gutter.

[0018] According to the invention, the rotations directions of the brushes can be chosen such that the brush during operation is sweeping the dirt into a direction perpendicular to the longitudinal direction of the gutter to be cleaned whereby the brushes, when having a sufficiently large diameter, can sweep the dirt over the longitudinal outer edge of the gutter, which in this way is freed from the dirt.

[0019] The backpressure from the sweeping process is pressing the sweeper in the direction going from the outer to the inner edge of the gutter, thereby advantageously securing the sweeper against falling out of the gutter.

[0020] According to the invention, the diameter of the brushes can be the same or larger than the diameter of a cylinder surface fitting the inside of the gutter to be cleaned for thereby at least approximately being able to clean the whole inner surface of the gutter. It is also obtained that the brushes get a large working surface giving the brushes a long lifetime.

[0021] In a preferred embodiment according to the invention, the bristles of the brushes are flexible so that they can adapt themselves to the contour of the gutter during rotation of the brushes.

[0022] This effect can be improved when the axis of rotation of the brushes is offset in the downwards direction in relation to the axis of the above-mentioned cylinder surface fitting the inside of the gutter so that the bristles are bent while passing the surface of the inner side of the gutter.

[0023] Thereby, it is also obtained that the dirt is acted upon by a force suitable for breaking up the dirt and sweeping it over the outer edge of the gutter.

[0024] Each of the brushes can, according to the invention, be formed like an impeller with flexible vanes. The vanes can have a cross section which is relatively larger than the cross section of normal bristles whereby it is obtained that the vanes also are acting on the dirt with a heavier load so that the sweeping effect is improved.

[0025] The sweeper can, according to the invention, be operated by means of an electric power supply and an electric circuit connecting the different components of the sweeper, e.g. a reversible electric motor for rotating the wheels of the sweeper and another electric motor for rotating the brushes.

[0026] The sweeper might, when traveling along a gutter to be cleaned, bump into an obstruction in the gutter. The obstruction could e.g. be a tile or a part of a tile which has fallen down into the gutter from the roof.

[0027] To avoid that the sweeper drives up on such obstruction at the risk of falling off the roof, the sweeper can according to the invention have a detector for detecting the obstruction and a reversing switch in the circuit adapted to reverse the direction of rotation of the reversible wheel motor when the at least one detector detects the obstruction so that the sweeper drives away from the obstruction instead of driving up on the obstruction.

[0028] The sweeper arrangement can, according to the invention, comprise two prearranged obstructions mounted in the gutter in a predetermined distance. Such prearranged obstructions could e.g. be placed at either end of the gutter with the advantageous result that the sweeper will travel along the gutter in both directions since the sweeper will change direction of travel every time it encounters one of the obstructions.

[0029] Dirt, like e.g. leaves, could be deposited in such a layer in the gutter that the sweeper tilts up when passing the layer. Tilting too much could result in the sweeper driving over the outer edge of the gutter and falls down implying the risk that the sweeper could hit a person.

[0030] To avoid said risk the sweeper could, according to the invention, be equipped with an inclinometer connected to the circuit and adapted for switching the electric power supply off when the detector registers a predetermined inclination of the sweeper, e.g. 10°. Thereby, it is safely obtained that the sweeper comes to a standstill instead of driving over the edge of the gutter.

[0031] In another embodiment according to the invention the sweeper can be secured against falling down by means of a safety wire stretched between two anchors attached to the gutter in a predetermined distance from each other. The anchors can preferably be attached at either end of the gutter.

[0032] The axles of the brushes can moreover be hollow so that the safety wire can extend through the hollow axles and the chassis of the sweeper. Thereby, the position of the sweeper in the gutter is safely maintained by means of the safety wire.

[0033] The electric power supply could by way of example be a solar cell or a battery.

[0034] In order to give a battery a long life, the sweeper arrangement can according to the invention be equipped with a timer for switching the electric power supply off in predetermined time intervals. This means that electric power is only used when necessary. The rest of the time the sweeper is standing by.

[0035] When using rechargeable batteries a charger station can be placed at e.g. one of the ends of the gutter for charging the batteries every time the sweeper is in that end of the gutter.

[0036] The invention will be explained in greater detail below describing further advantageous properties and example embodiments with reference to the drawings, in which

Fig. 1 is a perspective view of a sweeper arrangement according to the invention,

Fig. 2 shows the same, seen from the end,

Fig. 3 shows schematically an axial cross section, seen from the side, of a sweeper of the sweeper arrangement shown in fig. 1,

Fig. 4 shows a section taken along the line IV-IV in fig 3, and

Fig. 5 is a flow chart showing the interconnections of the different components of the sweeper.

[0037] Fig. 1 shows a roof gutter 1 with a sweeper ar-

rangement 2 according to the invention. It is assumed that the gutter is attached to a building (not shown) close to the lower edge of a roof (not shown) of the building. The building could for example be a high building, a family house, a hall or a shed.

[0038] The arrangement comprises a sweeper 3 and in this case also a safety wire 4 attached to the gutter by means of an anchor 5 attached to the gutter. The construction of this anchor can be of any kind and will therefore not be discussed any further here.

[0039] The sweeper is in this case travelling between two anchors of which only one can be seen in the figure. The anchors are preferably placed at opposite ends of the gutter so that the sweeper is allowed to travel all the way between the two ends of the gutter.

[0040] The safety wire effectively prevents the sweeper from falling out of the gutter.

[0041] It is noted that the sweeper arrangement in another embodiment does not include such safety wire and anchors.

[0042] The sweeper comprises a chassis 6 with wheels 7 for driving the chassis along the gutter. Two opposite brushes 8 are rotatably mounted on the chassis by means of an axle 9 (not seen in fig. 1). The rotation axis of the axle is directed into the same direction as the travelling directions of the sweeper.

[0043] Fig. 2 shows the sweeper arrangement from the end and also the gutter in cross section.

[0044] As can be seen in figs. 1 and 2, each of the brushes 8 has a shape like a star with a number of lamellas 10 attached to a hub 11 which again is attached to the axle 9. Owing to the flexibility of the lamellas and the relatively large space between them is this brush self-purifying contrary to usual brushes which tends to be made useless by the dirt.

[0045] The cross section of the gutter is circular or elliptical and the shape of the wheel is adapted to fit the shape of the gutter. The wheels are equipped with grooves (fig. 1) for preventing or reducing sliding of the wheels on the gutter during the sweeper's drive along the gutter.

[0046] In an expedient embodiment, the wheels are replaceable so that another set of wheels fitting a gutter of another shape can be mounted on the chassis.

[0047] Figs. 3 and 4 show in sections the sweeper seen from the side and from below. The gutter is not shown in these figures.

[0048] Two pairs of wheel axles 12 are rotatably mounted on the chassis 6 of the sweeper. On opposite end parts of each axle are mounted a wheel 7. One of the axles is during operation rotated by means of a reversible wheel motor 13 via a gear transmission 14. In another embodiment (not shown) both axles and thereby all four wheels are rotated.

[0049] The sweeper also comprises two brushes 8 rotatably arranged at their respective end of the sweeper. The brushes have a common axle 9 extending in the directions of travel of the sweeper. During operation the

axle and thereby the brushes is rotated by means of a brush motor 15 via a gear transmission 16.

[0050] The gear transmissions 14 and 16 are not part of the invention and may within the scope of the invention be of any other kind than the ones shown in figs. 3 and 4.

[0051] The operation and function of the sweeper when operating in a roof gutter will now be explained in more detail with reference to fig. 5.

[0052] The sweeper 3, which is indicated by the dotted line, is in this case operated by means of a battery.

The current is switched on by means of an on-off switch for bringing the sweeper in an operative state.

[0053] A timer is adjusted to switch between operative modes and standby modes and to determine the length of time the sweeper is in operative mode and in stand by mode, respectively.

[0054] The sweeper is, in its operative mode, driving along the gutter while sweeping dirt deposited in the gutter over the edge of the gutter by means of the rotating brushes.

[0055] An inclinometer serves to register the inclination of the sweeper and to cut off the current when a maximum value for the inclination is registered to thereby switch the sweeper to standby mode in which it cannot drive over the edge of the gutter.

[0056] An obstruction detector serves for detecting obstructions in the gutter and via a reversing switch reverse the drive motor when the sweeper encounters an obstruction of a given size so that the sweeper now drives in the opposite direction.

[0057] End stops as for example the anchor 5 shown in fig. 1 serves as prearranged obstructions. The reversing switch reverses the direction of rotation of the wheel motor and thereby of the wheel every time the obstruction detector detects one of said anchors whereby the travel direction of the sweeper advantageously is reversed.

[0058] This implies that the direction of traveling of the sweeper is changed every time it has arrived to an end of the gutter. Thereby, it is ensured that the roof gutter is cleaned in its total length and to a degree which depends on the setting of the timer. The timer may e.g. be set to one run of the sweeper along the length of the gutter when the contamination of the gutter is insignificant and to more runs if the contamination is significant.

Example

[0059] A sweeper according to the invention was used for cleaning a roof gutter.

[0060] The gutter had an elliptical cross section, a length of 12 meters, a depth of 80 mm and a width of 125 mm.

[0061] The sweeper had an overall length of 350 mm, and a weight of 1.5 kg.

[0062] The four wheels of the sweeper were all drive wheels. The traveling speed was 150 cm/min.

[0063] Each of the two brushes of the sweeper had the shape of a star with ten radially extending lamellas, each

having a rectangular cross section. The thickness of each lamella was 2 mm and the width 20 mm. The material was a non-woven fibre cleaning cloth.

[0064] The diameter of the brushes was 100 mm and the number of revolutions per minute was approx. 120 rpm. The distance of the rotation axis over the bottom of the gutter was 40 mm when the sweeper was placed in the gutter.

[0065] The gutter was filled with a heavy layer of leaves and also with larger objects like spruce cones especially during the season where the trees are shedding their leaves.

[0066] The gutter was kept clean by setting the timer to go back and fourth once a day in October. The operation time spent in a 12-meter gutter was approximately 16 minutes a day.

Claims

1. A sweeper arrangement with a sweeper (3) for sweeping a roof gutter (1) comprises
 - a chassis (6),
 - wheels (7) mounted on the chassis for, when in use, moving the sweeper to-and-fro along the upwardly directed inner side of the gutter (1), and
 - at least one brush (8) mounted rotatably about an axis on the chassis,**characterized in**
 - **that** the axis of rotation of the at least one brush (8) is extending into the direction of travel of the sweeper (3).
2. A sweeper arrangement according to claim 1, **characterized in that** the sweeping direction of the at least one brush (8) is crosswise the longitudinal direction of the gutter (1).
3. A sweeper arrangement according to claim 1 or 2, **characterized in that** the sweeper (3) comprises two brushes (8) projecting in opposite directions from their respective end of the chassis (6).
4. A sweeper arrangement according to claim 1, 2 or 3, **characterized in that** the brushes (8) have flexible bristles.
5. A sweeper arrangement according to any of the claims 1 - 4, **characterized in that** each brush (8) is formed like an impeller with flexible vanes.
6. A sweeper arrangement according to any of the claims 1 - 5, **characterized in that** the diameter of the at least one brush (8) is the same or larger than the diameter of a cylinder surface fitting the inside of the gutter (1) to be cleaned.
7. A sweeper arrangement according to any of the claims 1 - 6, **characterized in that** the axis of rotation of the at least one brush (8) is offset in the downwards direction in relation to the axis of said cylinder surface.
8. A sweeper arrangement according to any of the claims 1 - 7, **characterized in that** the sweeper comprises a reversible electric motor (15) for rotating at least one of the wheels (12) of the sweeper (3).
9. A sweeper arrangement according to any of the claims 1 - 8, **characterized in that** the sweeper (3) comprises an electric motor (16) for rotating the at least one brush (8).
10. A sweeper arrangement according to any of the claims 1 - 9, **characterized in that** the sweeper (3) comprises an electric power supply and an electric circuit connecting the electric power supply to the wheel motor (15) and the brush motor (16), respectively.
11. A sweeper arrangement according to claim 10, **characterized in that** the sweeper comprises at least one detector for detecting an obstruction of a predetermined size in the gutter, and a reversing switch in the circuit adapted to reverse the direction of rotation of the reversible wheel motor (15) when the at least one detector detects such obstruction in the gutter.
12. A sweeper arrangement according to claim 10 or 11, **characterized in that** the sweeper arrangement comprises two predetermined obstructions attached in a predetermined distance from each other in the gutter.
13. A sweeper arrangement according to claim 10, 11 or 12, **characterized in that** the sweeper comprises an inclinometer connected to the circuit and adapted for switching off the electric power supply when registering a predetermined inclination of the sweeper.
14. A sweeper arrangement according to any of the claims 10 - 13, **characterized in that** the sweeper arrangement comprises a timer for switching the electric power supply off in predetermined time intervals.
15. A sweeper arrangement according to any of the claims 1 - 14, **characterized in that** the sweeper arrangement (2) comprises a safety wire (4) stretched between two anchors (5) attached to the gutter (1) in a predetermined distance from each other, that the axles (9) of the brushes are hollow and that the safety wire is extending through said hollow axles and the chassis (6) of the sweeper (3).

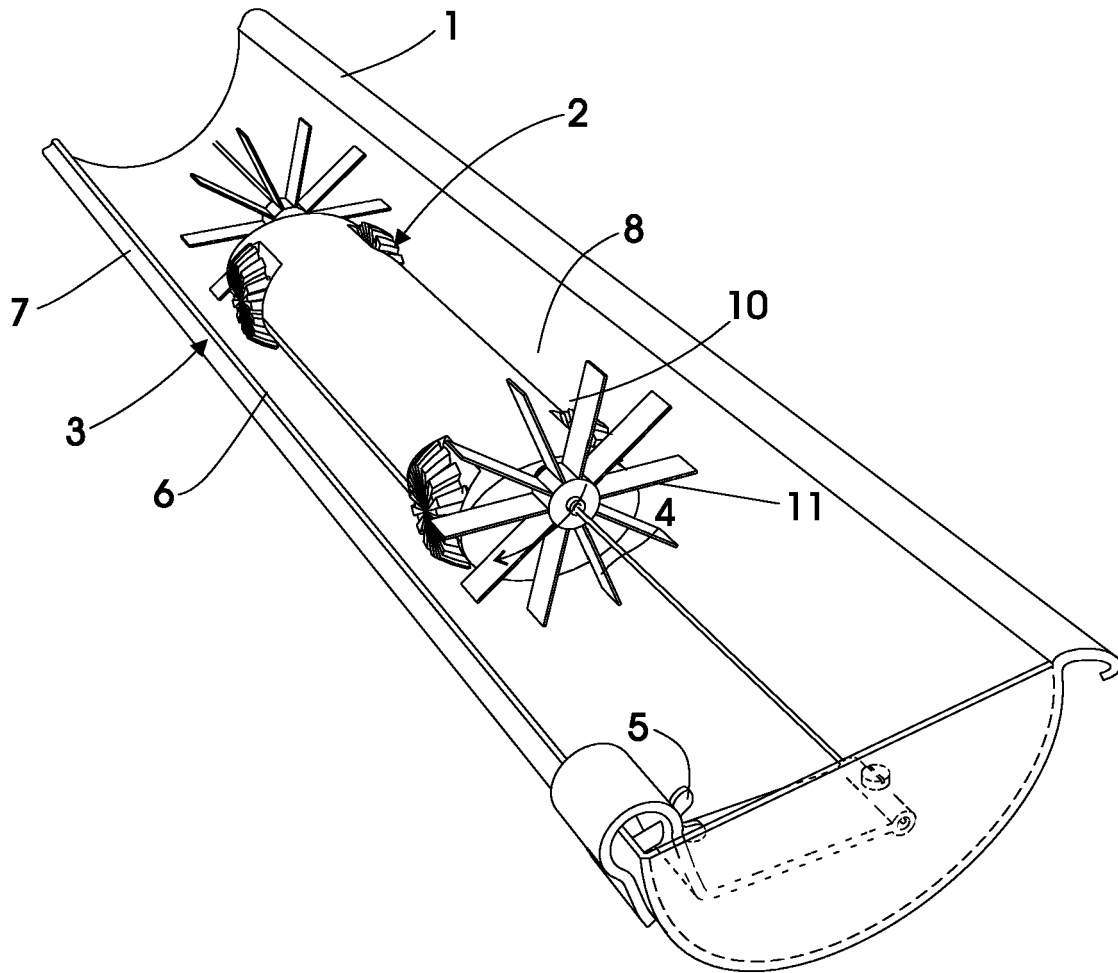


Fig. 1

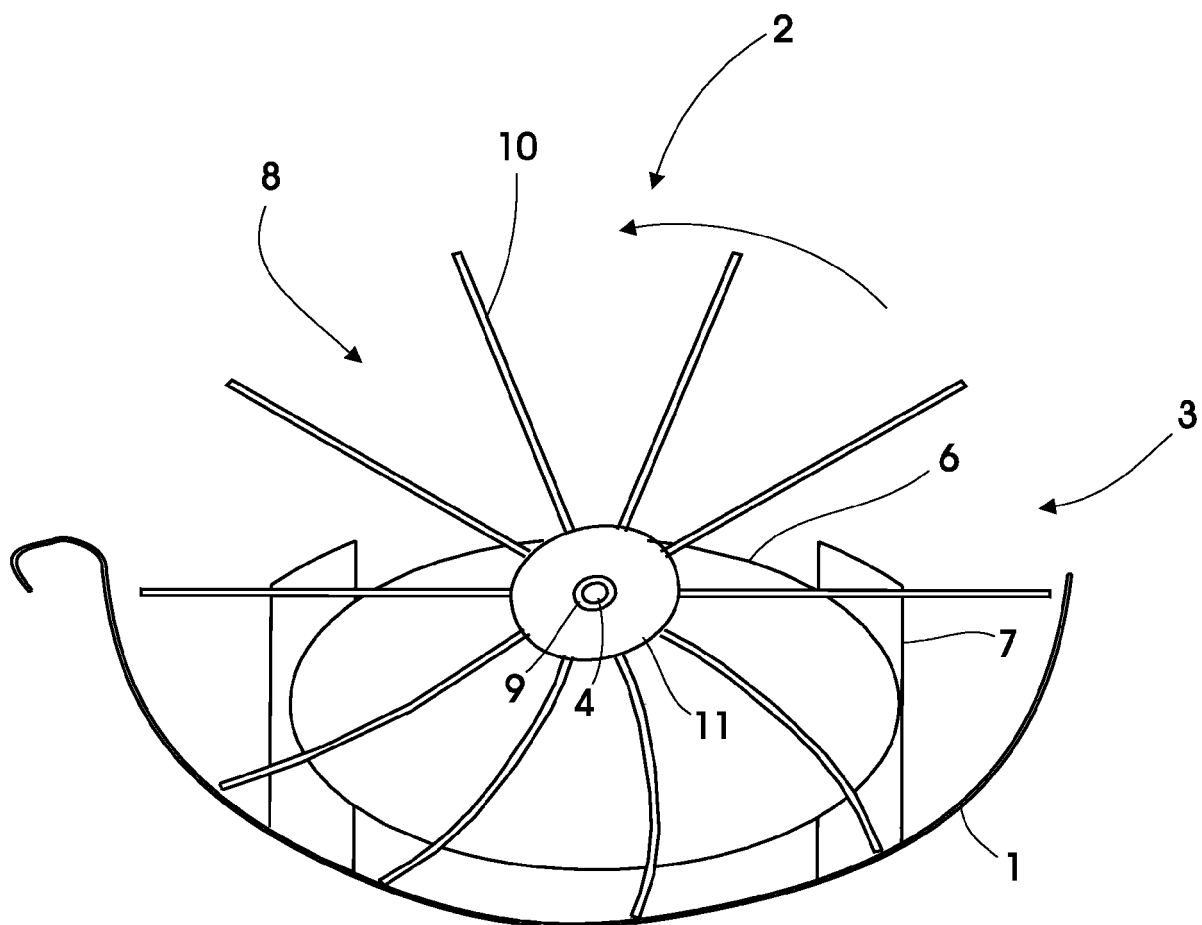


Fig. 2

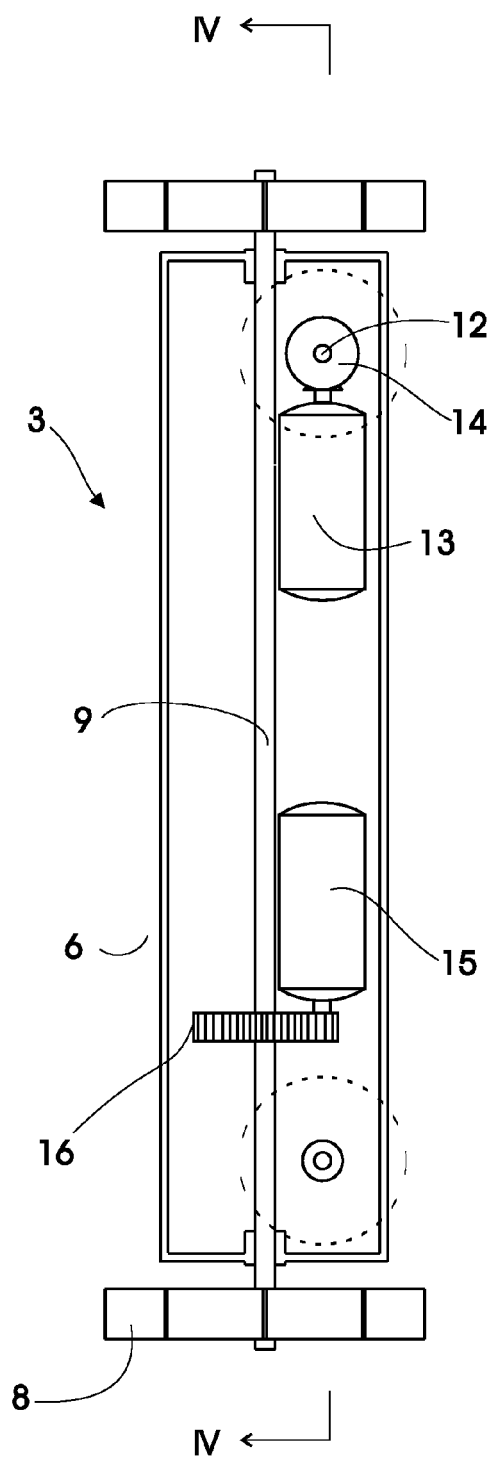


Fig. 3

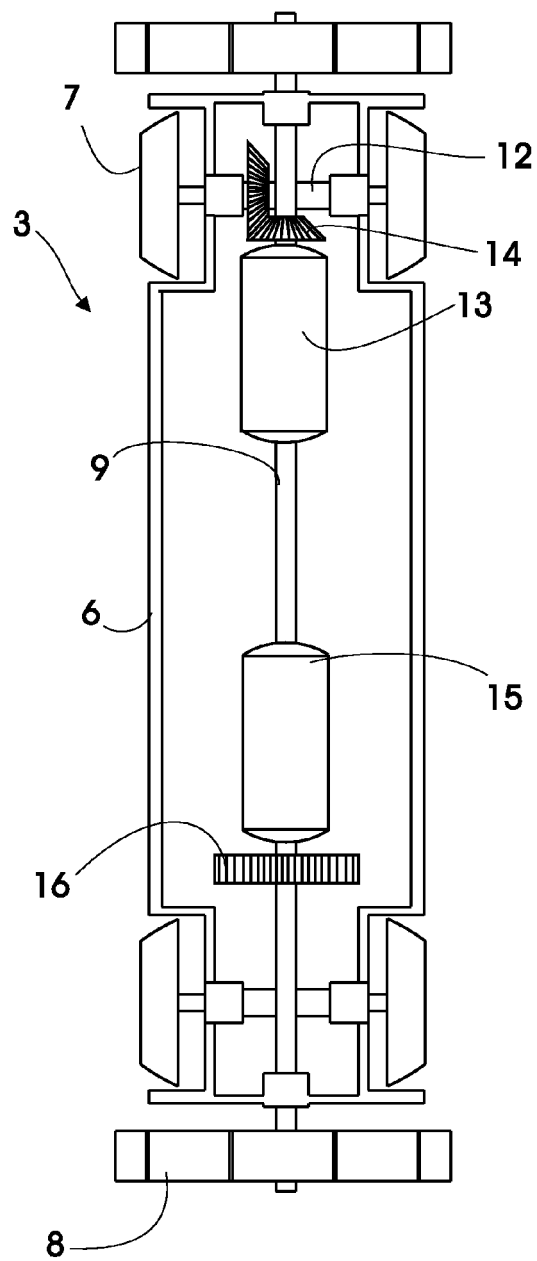


Fig. 4

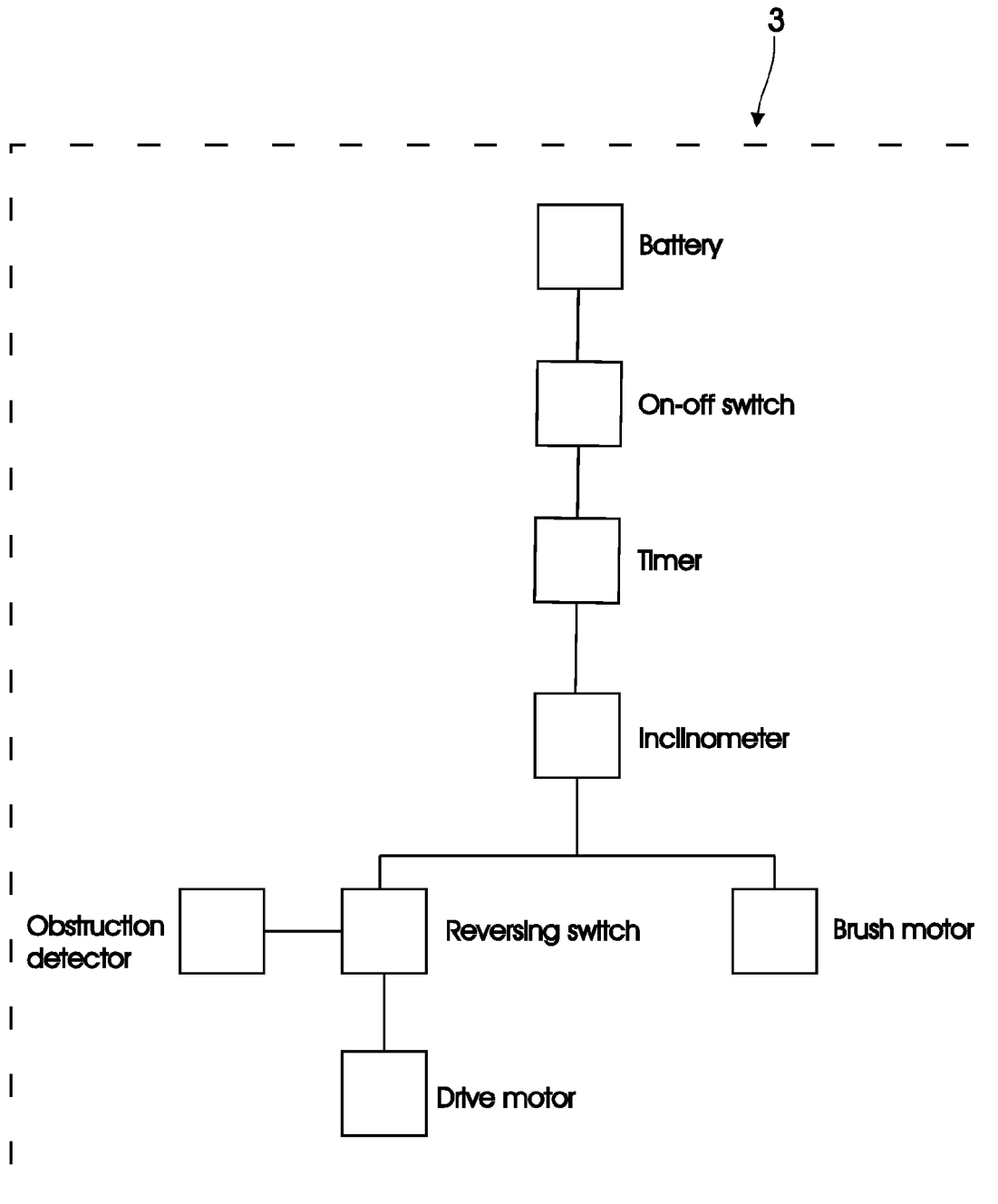


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 12 2375

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 93 10 420 U1 (SCHOENROCK ARMIN [DE]) 5 January 1994 (1994-01-05) * the whole document *	1,2, 4-10,12	INV. E04D13/076
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			TECHNICAL FIELDS SEARCHED (IPC)
			E04D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 March 2007	Examiner Vratsanou, Violandi
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 12 2375

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
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19-03-2007

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REFERENCES CITED IN THE DESCRIPTION

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