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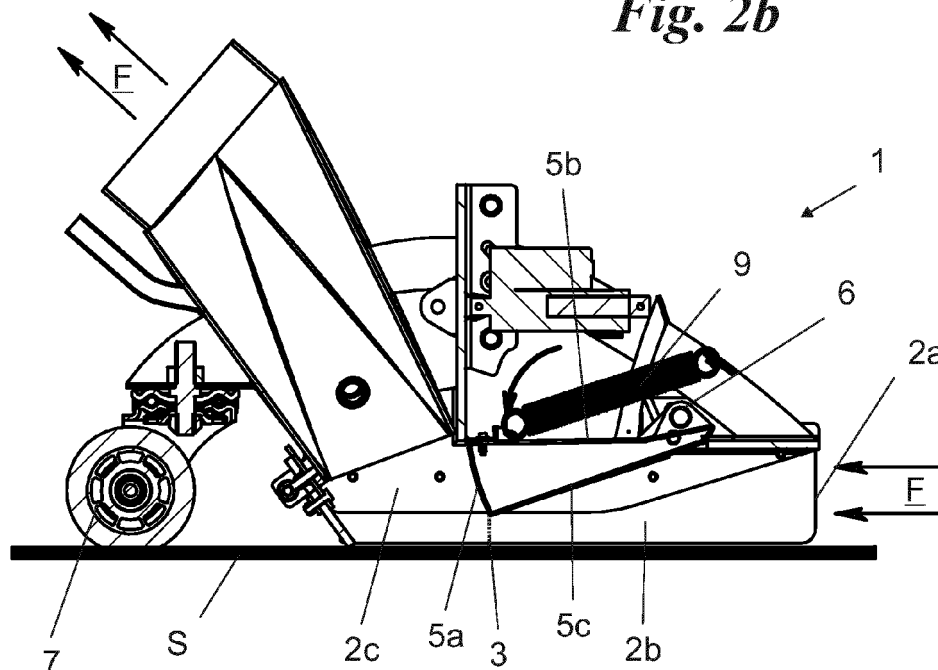
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(54) **Suction orifice of suction machines for ground cleaning**

(57) It is provided a suction orifice (1) for suction machines (10) adapted to enable removal of refuse from streets and the like, comprising a first casing (2) adapted to substantially come into contact with the surface to be cleaned (S) and defining a first suction chamber (2a) adapted to be passed through by the refuse and a first inlet section (2b) adapted to enable the refuse to enter

the first suction chamber (2a); and a choking element (5) adapted to partly overlap the first inlet section (2b) and defining a free section; and a passive actuation apparatus (6) adapted to define a slide path along which the choking element (5) is free to slide in an idle manner so as to vary its distance relative to the surface to be cleaned (S), thereby modifying the extension of the free section.

Fig. 2b



Description

[0001] The present invention relates to a suction orifice of suction machines for ground cleaning, of the type pointed out in the preamble of the first claim.

[0002] It is known that suction machines, used for cleaning streets, are provided with a suction orifice connected to a suction system suitable for refuse sucking. Generally they further comprise one or more brushes adapted to convey the refuse close to the suction orifice.

[0003] The suction orifice constitutes a fundamental part in suction machines. In particular the suction orifice defines a sucking opening through which passage of the sucked refuse occurs.

[0004] The area of the sucking opening greatly affects operation of the machine. In fact, if this area is wide, the machine can take in bulky refuse but the vacuum at the opening is weaker, due to the Bernoulli law. Otherwise, if the area is reduced, the vacuum at the opening is higher, and therefore the refuse and dust that are not very bulky can be better taken in, but the machine cannot suck in the bulky refuse. Some suction orifices are therefore provided with an adjusting member adapted to enable the operator to vary the area of the sucking opening depending on the size of the refuse to be sucked. This member comprises an air lock that partly overlaps the sucking opening and varies the section thereof.

[0005] This air lock is activated by suitable mechanisms controlled by the operator who increases the area of the sucking opening in the presence of refuse of big sizes, such as bottles and tins, or reduces it in the presence of dust or other refuse of small sizes.

[0006] The known art mentioned above has some important drawbacks.

[0007] A first important problem is represented by the fact that the suction process is not optimal both from the point of view of the quality of the cleaning operation and from the point of view of the energy consumption during this process.

[0008] In fact, for optimising the process, the operator is obliged to continuously vary the area of the sucking opening and therefore to act on the appropriate operating elements without interruption, which obviously cannot be obtained in an optimal manner.

[0009] Therefore, in order to avoid suction problems due to the presence of refuse of big sizes, the operator usually leaves the air lock fully lifted up so that the maximum possible area is open and suction of any refuse is allowed, irrespective of the size. This choice brings about a reduction in the cleaning quality. In fact, the greater section causes a vacuum reduction in the suction chamber and therefore the suction ability is reduced, which leads to the impossibility of sucking dust and refuse of small sizes.

[0010] To partly obviate said problem, the maximum area of the sucking opening is generally particularly reduced and therefore sucking of bulky refuse is not allowed. A further defect resides in that, when the sucking

opening is partly closed, there is a great pressure difference between the outer region and the region inside the suction orifice, thus determining arising of turbulence that will worsen the cleaning quality.

[0011] Under this situation, the technical task underlying the present invention is to devise a suction orifice of suction machines for ground cleaning that is able to substantially obviate the mentioned drawbacks.

[0012] Within the scope of this technical task, it is an important aim of the invention to obtain a suction orifice of suction machines for ground cleaning that enables an optimal cleaning of the streets to be carried out in a simple manner under any condition.

[0013] The technical task mentioned and the aims specified are achieved by a suction orifice of suction machines for ground cleaning, as claimed in the appended Claim 1.

[0014] Preferred embodiments are highlighted in the sub-claims.

[0015] The features and advantages of the invention are hereinafter clarified by the detailed description of a preferred embodiment of the invention, with reference to the accompanying drawings, in which:

Fig. 1a is an axonometric view of the suction orifice according to the invention, in a first position;

Fig. 1b is an axonometric view of the suction orifice according to the invention, in a second position;

Fig. 2a is a side view of the suction orifice according to the invention;

Fig. 2b shows the section of Fig. 2a with the suction orifice in a further configuration and in median section;

Fig. 3 shows a top view of the suction orifice according to the invention; and

Fig. 4 shows a suction machine provided with a suction orifice according to the invention.

[0016] With reference to the mentioned figures, the suction orifice of suction machines for ground cleaning according to the invention is generally identified by reference numeral **1**.

[0017] It is adapted to suck or take in refuse of reduced sizes, such as dust and the like, or refuse of big sizes, such as bottles, tins or other refuse that can accumulate on the ground **S**, in particular in streets or the like. Specifically, by the term "big sizes" it is identified any refuse having sizes generally in the order of centimetres and preferably included between 3 cm and 10 cm.

[0018] The suction orifice **1** is adapted to be disposed on a suction machine **10**, known by itself. The suction machine **10** briefly comprises at least one suction orifice **1**, one or more brushes **11** adapted to convey the refuse to be removed towards the suction orifice **1**, an adjusting system **12** adapted to vary the distance of the suction orifice **1** from the ground **S** and defining a work position at which the orifice **1** is substantially in contact with the ground **S** and a non-work or rest position at which the

orifice 1 is raised from the ground S.

[0019] The suction machine 10 further comprises: a sucking system 13 adapted to create the vacuum within a vessel or tank 14 in communication for fluid passage with the suction orifice 1 through a transport duct 15. This vacuum creates a suction flow **F** entering the suction orifice 1 and adapted to enable the refuse to be sucked and to be collected inside vessel 14.

[0020] In particular, the suction orifice 1 defines a channel 2 connected to the inner volume of vessel 14 through the transport duct 15 and adapted to be directly in contact with the external refuse to be collected.

[0021] From a structural standpoint, channel 2 is defined partly by a casing 4 of metal material and partly by the ground S. Casing 4 therefore defines the side edges 4a, upper edge 4b and rear edge 4c of channel 2, while the lower edge is preferably defined by the ground S, and the front edge, or front opening 2a is left open for sucking the refuse in. The side 4a and rear 4c edges are then preferably provided with seals 4d for ensuring contact thereof with the ground S.

[0022] Finally, suitable wheels 7 or runners are fastened to casing 4 for defining the distance of the orifice 1 from the ground S in said work position.

[0023] Channel 2 advantageously comprises a first portion 2b converging from the front opening to the inside of channel 2. Convergence is suitably defined only along section planes of channel 2 parallel to the ground S, while in a direction perpendicular to the ground the height of channel 2 preferably remains constant. Convergence of the first portion preferably achieves a normal-section area reduction included between 60% and 80%. The front opening 2a which is the maximum value of portion 2b achieves the important result of increasing the cleaning track (60% - 80%).

[0024] Channel 2 also comprises a second portion 2c, in communication for fluid passage with the first portion and the transport duct 15. At this second portion 2c, casing 4 is therefore connected to the transport duct 15. Said transport duct 15 is preferably defined by a tubular structure connected to the inner volume of vessel 14.

[0025] The first and second portions 2b and 2c of channel 2 are ideally divided by an inlet opening 3 extending at right angles to the direction of the suction flow **F**.

[0026] At said inlet opening 3, the suction orifice 1 further comprises a choking element 5 adapted to vary the area of the inlet opening 3 itself. In particular, the choking element 5 defines an open position (Fig. 2a) at which the area of the inlet opening 3 has the maximum extension, and a closed position (Fig. 2b) at which the area of the inlet opening 3 has a minimum extension. The two open and closed positions are finally defined by suitable end-of-stroke elements and, in the closed position (Fig. 2b) the area of the inlet opening 3 is preferably limited to a fraction included between one half and one fifth and is more preferably equal to about one fourth, relative to the area of the inlet opening defined by the choking element 5 in the closed position (Fig. 2b).

[0027] The choking element 5 is adapted to automatically vary the area of the inlet opening 3 depending on the sizes of said refuse to be collected.

[0028] The term "automatically" means that the operator must not expressly intervene for varying the area of the inlet opening 3 but said area is automatically increased for sucking said refuse of big sizes and automatically reduced for sucking the refuse of small sizes such as dust and the like.

[0029] This automatic character is preferably obtained by means of the choking element 5 adapted to move in an idle manner between said open position (Fig. 2a) and said closed position (Figs. 1 b and 2b). Consequently, when no force is exerted by the refuse being sucked on the choking element 5, said element is disposed in the closed position (Fig. 2b) as it is, for example, only stimulated by the weight force or by suitable elastic elements. Otherwise, when there is the presence of refuse exerting a sufficient force, the choking element takes the open position (Fig. 2a).

[0030] In a possible variant, the automatic closed and open positions can be obtained by suitable sensors detecting the presence of refuse of big sizes and by actuating means for the choking element 5, as hereinafter described.

[0031] In detail, the choking element 5 comprises an obstruction surface 5a adapted to overlap the inlet opening 3 to reduce the area thereof. It further consists of a prismatic shell (Figs. 1 b, 2b) having a triangular base and an axis parallel to the ground S and perpendicular to the flow **F** direction. A first side face of the prismatic shell constitutes the obstruction surface 5a, a second upper face 5b constitutes a hooking surface, and a third lower face constitutes a base surface 5c preferably forming part of the upper edge 4b of channel 2.

[0032] The choking element 5 is further fastened in a motion-admitting manner to casing 4, preferably by means of a hinge 6 the rotation axis of which is parallel to the ground S and is disposed at the corner opposite to the obstruction surface 5a. In addition, the choking element 5 is preferably idle with respect to rotation around said hinge 6 and therefore reduces the inlet opening 3 by restricting the height thereof but leaving the width unchanged.

[0033] The choking element 5 is further supported by an elastic element 9 adapted to exert force in a direction opposite to the force of gravity, preferably by an amount not exceeding the force of gravity itself and adapted to lighten the force exerted downwards on element 5.

[0034] As previously described, element 5 defines an open position and a closed position. In particular, in the open position (Fig. 2a), the obstruction surface 5a does not interfere with the inlet opening 3 and the base surface 5c is aligned with the upper edge 4b, the overall height of the opening from the ground S to the base surface 5c being 8-12 cm. In the closed position (Fig. 2b), on the contrary, the base surface 5c interferes with the inlet opening 3 to the maximum extent and the obstruction

surface 5a is disposed within channel 2, the overall height of the opening from the ground S to the base surface 5c being 2-5 cm. Preferably, the suction orifice 1 further comprises actuating means 8 for the choking element 5, preferably consisting of a fluid-operated, preferably electric, cylinder 8a, acting on a bracket 8b rigidly connected to the choking element 5 itself.

[0035] In an alternative embodiment not shown, the suction orifice 1 can also comprise sensors detecting the presence of refuse of big sizes, infrared, laser or similar sensors for example.

[0036] Operation of the suction orifice 1, described above as regards structure is the following.

[0037] When an operator uses the suction machine 10, he/she actuates and drives it, through the steering system, the motor and wheels of known type, along the ground S of streets or the like to be cleaned.

[0038] In particular, the adjusting system 12 puts orifice 1 in the work position, the sucking system 13 creates the vacuum in vessel 14 and the brushes 11 convey the refuse towards the suction orifice 1.

[0039] The vacuum created in tank 14 is transmitted to the transport duct 15 and the suction orifice 1. Therefore the vacuum gives rise to said flow F transferring the refuse from the ground S to the tank.

[0040] In particular, the refuse enters orifice 1 through the front opening 2a. Opening 2a is very wide and therefore captures a great amount of refuse, but at said opening the air flow F is rather slow. The refuse passes through the first converging portion 2b, while the area becomes narrower and the flow F speed increases, due to the Bernoulli law, making the refuse move quicker.

[0041] The refuse then reaches the inlet opening 3 and the choking element 5, at which two cases are to be distinguished.

[0042] In a first case the refuse has reduced sizes, it is in particular dust, leaves or the like. Thus the refuse does not interfere with the choking element 5 that keeps the closed position (Fig. 2b). In this position the area of the inlet opening 3 is minimum and, still due to the Bernoulli law, the flow F speed is very high. The refuse is therefore optimally taken in.

[0043] In a second case, when the refuse is of big sizes, as already said, the refuse interferes with the choking element 5 that is lifted up by the refuse itself against the weight force of element 5 possibly made lighter by the elastic element 9. In particular, the refuse impacts on the base surface 5c and while moving forward actuates element 5 disposing it to the open position (Fig. 2a) or to an intermediate position. Therefore also the bulky refuse can be automatically taken in without the operator's intervention.

[0044] When, as a variant, the presence of sensors is provided, activation or not of the actuating means 8 is caused by said sensors.

[0045] In addition, at all events, the operator can decide on maintaining the choking element 5 in a selected position, through the actuating means 8.

[0046] When the refuse 3 has entered the inlet opening 3, it reaches the second portion 2c of channel 2 and subsequently duct 15 and vessel 14, where it is gathered and then brought to the dump or the like.

5 [0047] The described suction orifice 1 achieves important advantages.

[0048] In particular, due to the automatic actuation of the choking element 5 the operator is not obliged to continuously and manually intervene on suitable operating elements.

10 [0049] At the same time the suction orifice 1 can suck refuse of any sizes in an optimal manner.

[0050] The efficiency of orifice 1 is then increased by the funnel-shaped conformation of the first portion 2a of channel 2.

15 [0051] The invention is susceptible of variations falling within the scope of the inventive idea defined by the independent claims.

20 [0052] All of the elements as described and claimed can be replaced by equivalent elements and the details, materials, shapes and sizes can be of any nature and magnitude.

25 Claims

1. A suction orifice (1) of a suction machine (10) adapted to suck refuse from the ground (S) and comprising an inlet opening (3) adapted to enable said refuse to enter said suction machine (10); and a choking element (5) adapted to vary the area of said inlet opening (3), **characterised in that** said choking element (5) is suitable to automatically vary said area of said inlet opening (3) as a function of the size of said refuse.
2. A suction orifice (1) as claimed in claim 1, wherein said choking element (5) is susceptible of movement by the force exerted by said refuse present at said suction orifice (1) and having big sizes.
3. A suction orifice (1) as claimed in claim 2, wherein said choking element (5) is available in an open position in which the area of said inlet opening (3) has the maximum extension and in a closed position in which the area of said inlet opening (3) has the minimum extension, wherein said choking element (5) can be moved in an idle manner between said positions and is placed in the closed position when no external force is acting thereon.
4. A suction orifice (1) as claimed in claim 1, comprising sensor means adapted to verify the presence of refuse of big sizes and actuating means (8) adapted to move said choking element (5), and automatically moved as a function of the information from said sensor means.

5. A suction orifice (1) as claimed in one or more of the preceding claims, defining a channel (2) adapted to be placed directly in contact with the external refuse to be sucked in and comprising a first portion (2b) extending from an outer front opening (2a) to said inlet opening (3), and wherein said first portion (2b) is a portion converging from said outer front opening (2a) to said inlet opening (3). 5

6. A suction orifice (1) as claimed in claim 5, wherein said convergence gives rise to a section variation included between 60% and 80%. 10

7. A suction orifice (1) as claimed in one or more of the preceding claims, wherein said choking element (5) is adapted to vary the area of the inlet opening (3) to a fraction included between one half and one fifth. 15

8. A suction orifice (1) as claimed in one or more of the preceding claims, defining a channel (2) adapted to be placed directly in contact with the external refuse to be sucked in, and wherein said channel (2) is defined partly by a casing (4) of metal material and partly by the ground (S). 20
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9. A suction orifice (1) as claimed in one or more of the preceding claims, wherein said choking element (5) is secured to said casing (4) by means of a hinge (6) the rotation axis of which is parallel to the ground (S). 30

10. A suction orifice (1) as claimed in one or more of claims 7-8, wherein said choking element (5) comprises a base surface (5c) and said casing (4) defines an upper edge (4b) of said channel (2), and wherein in said open position said base surface (5c) is continuous with said upper edge (4b). 35

11. A suction orifice (1) as claimed in one or more of the preceding claims, comprising an elastic element (9) that, when said machine is in use, is adapted to exert a force on said choking element (5) that is opposite to the force of gravity by an amount not exceeding the force of gravity itself and suitable for lightening the force exerted downwards on said element (5). 40
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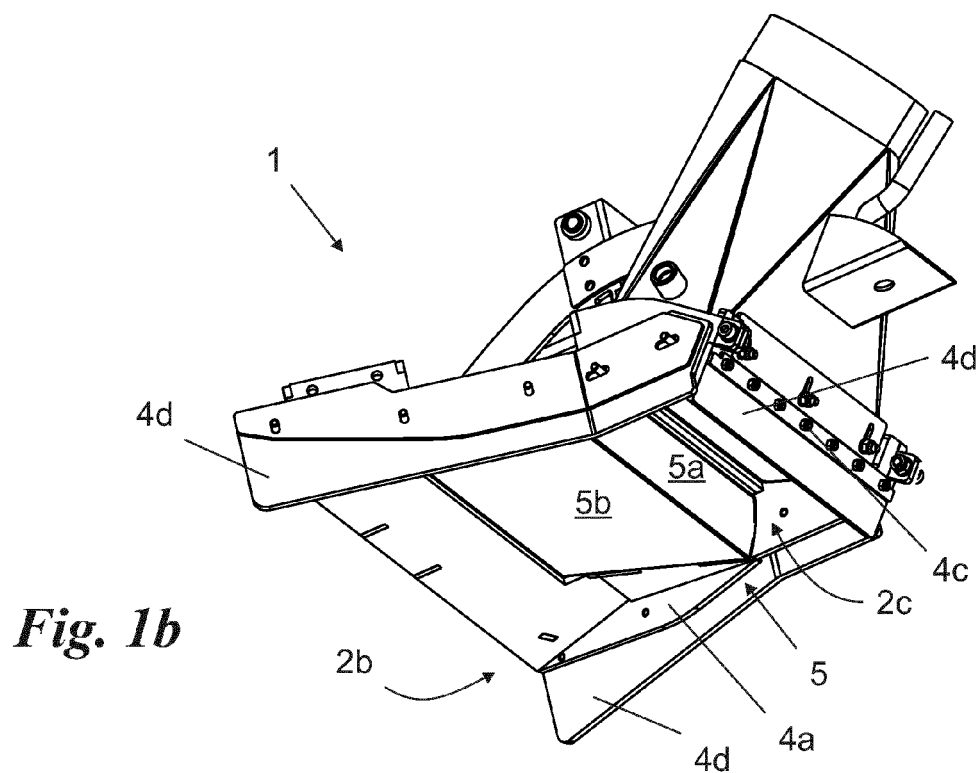
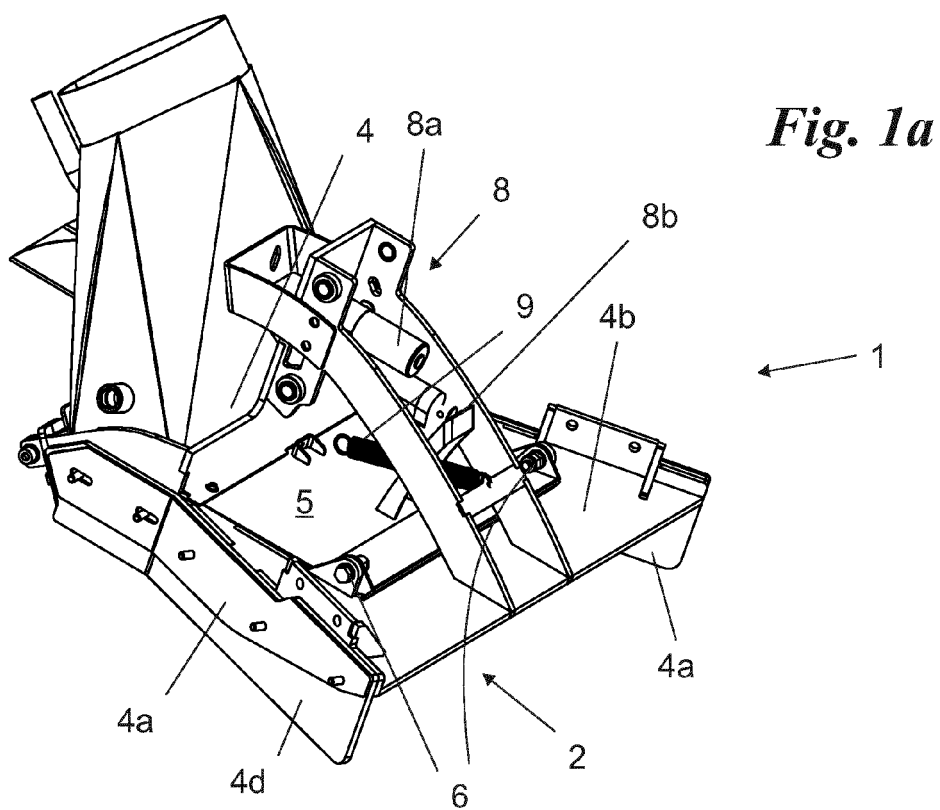


Fig. 2a

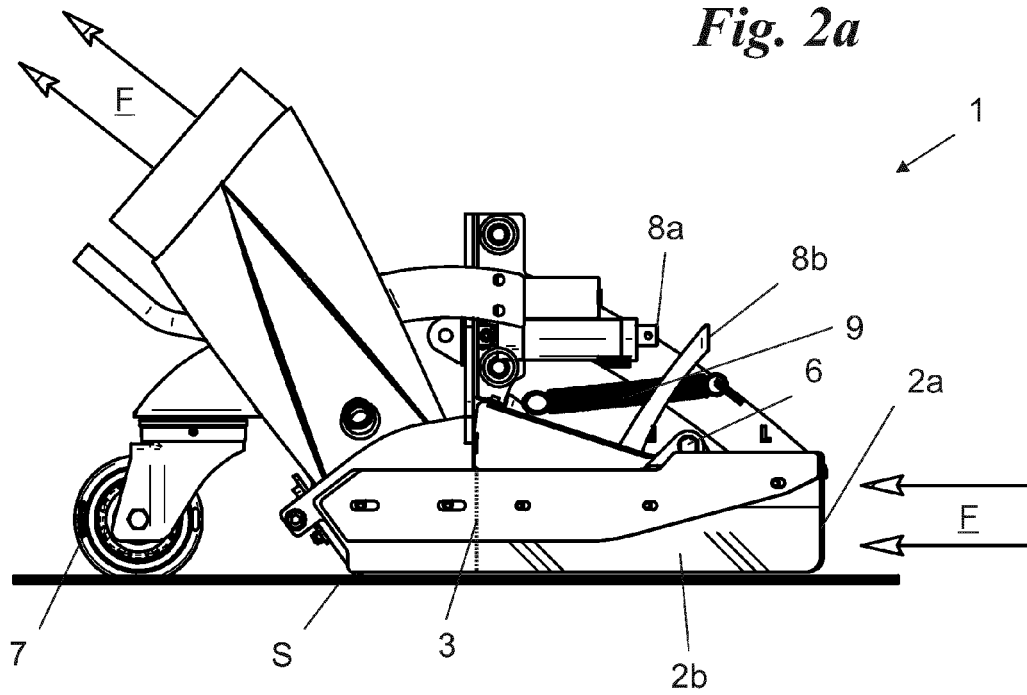
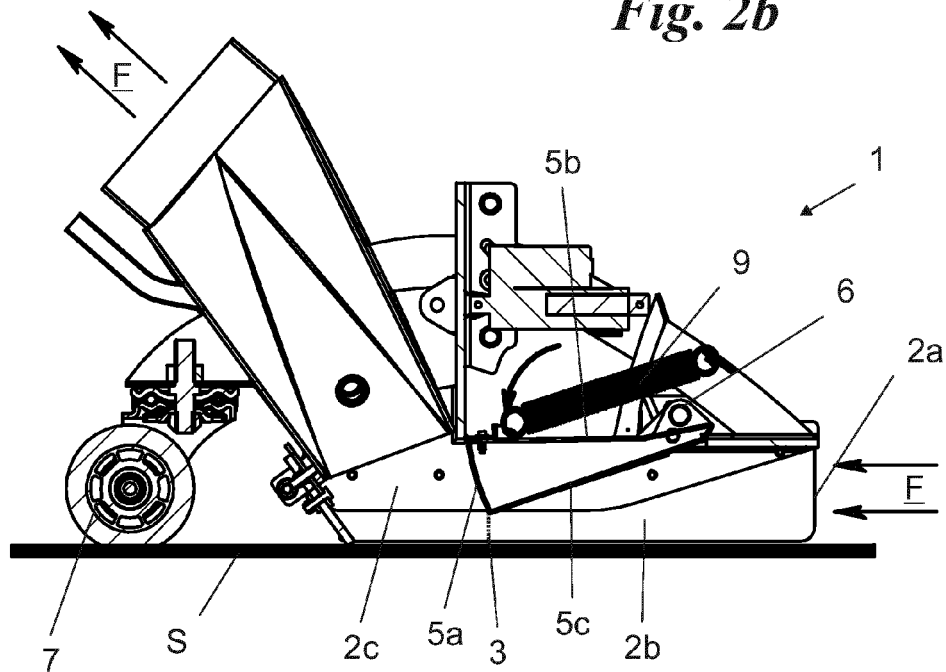


Fig. 2b



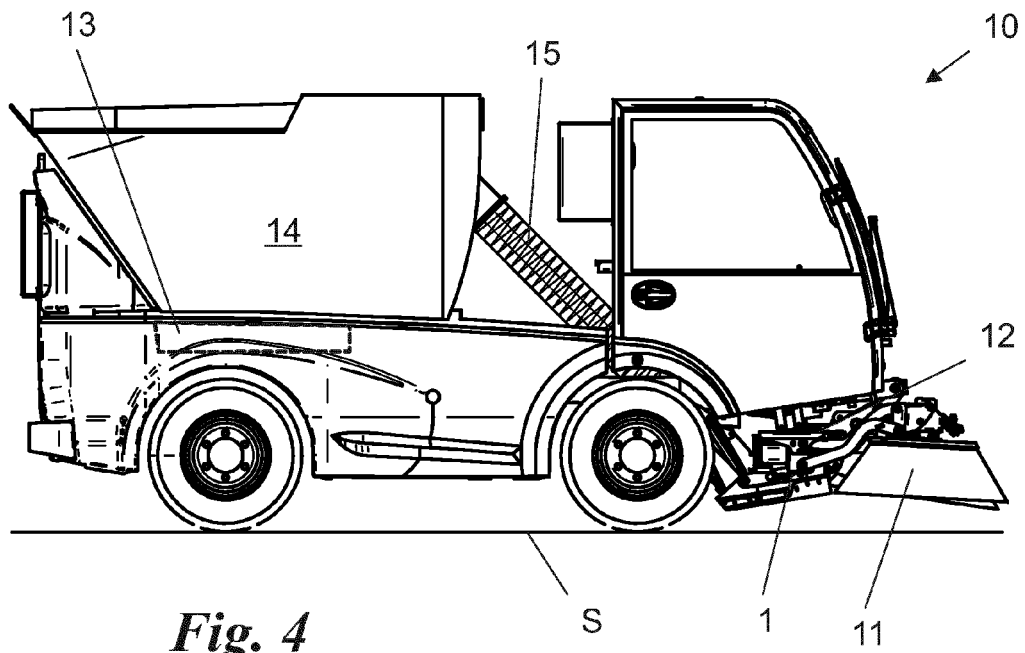


Fig. 4

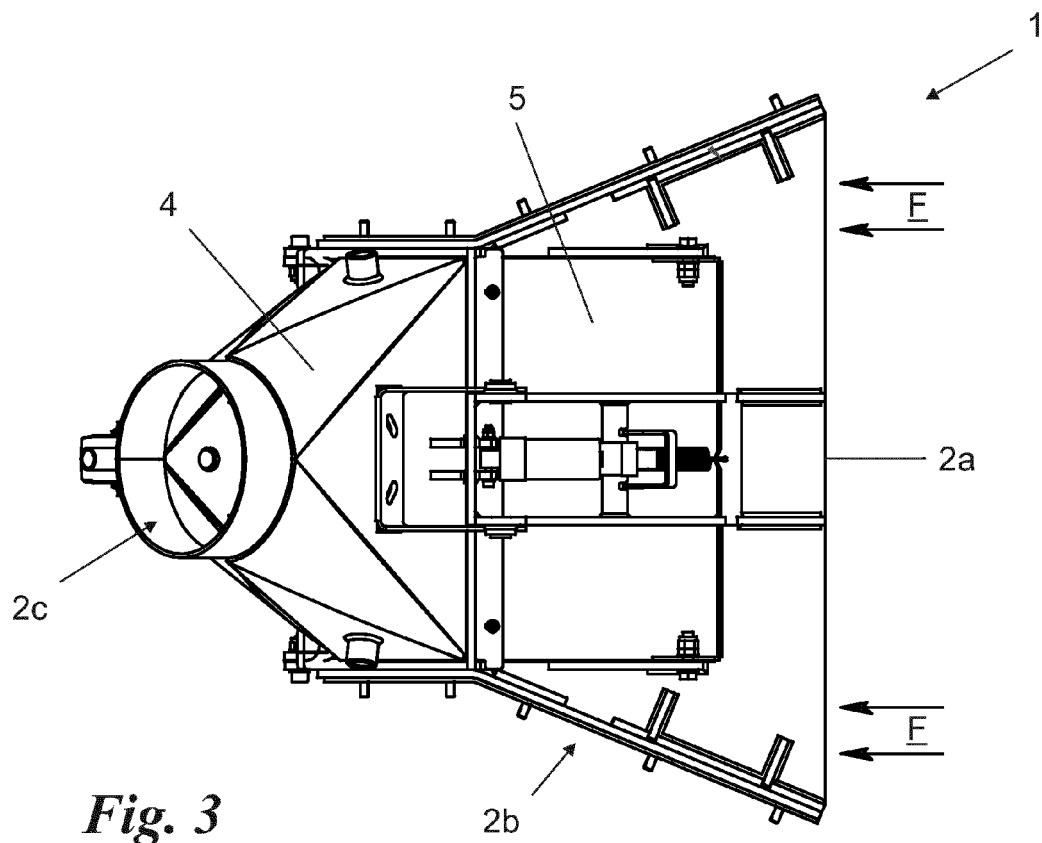


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 12 17 3190

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 August 2012	Examiner Tran, Kim Lien
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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