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(54) **Dust control system**

(57) The invention relates to a dust control system comprising a housing arranged to be mounted on a vehicle or a frame movably supported for movement upon a surface to be swept, which housing is arranged to at least partially enclose at least one rotatable sweeping

device, and where the at least one rotatable sweeping device is mounted to the said vehicle or frame. The dust control system further comprises at least one chamber for laying dust, in particular airborne dust, wherein said chamber is provided with at least one liquid atomizer means.

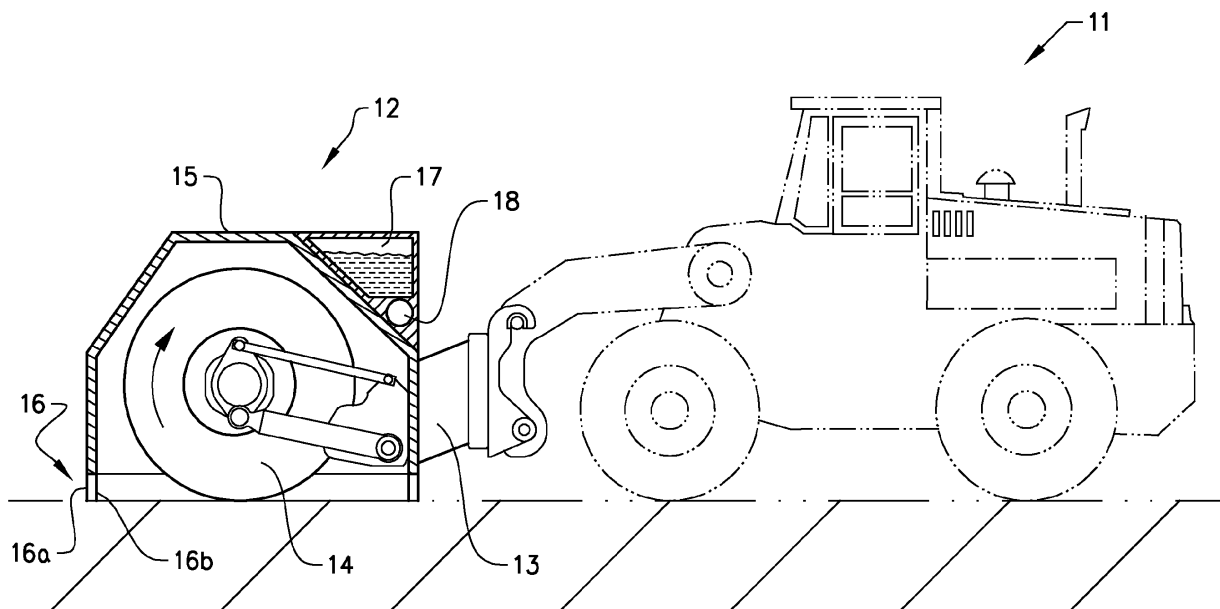


FIG. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to a dust control system, and in particular a road cleaning machine, or a road sweeping machine, fitted with the dust control system.

BACKGROUND ART

[0002] The terms "road cleaning" and "road sweeping" are used broadly to include cleaning and sweeping of other areas such as pedestrian precincts, footpaths, car parks etc. Road cleaning machines are machines for lifting dirt off the road and into a collector. Road sweeping machines are road cleaning machines that are designed to brush the dirt off the road, generally towards, or into, a collector or container. In many road sweeping machines, a suction pipe or a similar air extraction means along with a ground following suction nozzle is provided for sucking swept dirt from the road, and to act as a conduit for passing sucked up dirt and dust into the collector. The collector is usually fitted at or on the back of the road cleaning or road sweeping machine. In order to contain the dust and debris and facilitate for it to be sucked into the collector, a housing in some form is often provided. This housing will at least partially enclose the brush or brushes, as well as the suction pipe. The suction pipe is usually connected to a vacuum source for providing the suction, e.g. a fan. The dirt may pass through the vacuum source, e.g. a fan designed to allow the passage of dirt and debris through it, or it may bypass the vacuum source on its way to the collector. The brushes for brushing the road are usually formed either from metal wires or from stiff polymer fibres. The brushes, often two counter-rotating brushes, and sometimes more than two, are usually mounted on the road sweeping machine for rotation about a generally vertical axis. In a machine with two counter-rotating brushes, the brushes move the dirt towards the centreline of the road sweeping machine for lining it up for the suction pipe. The suction pipe may be assisted by a horizontal cylindrical brush located behind the counter-rotating brushes and in front of the suction pipe. An alternative solution may be to use just a single horizontal cylindrical brush located in front of the suction pipe.

[0003] The front nozzle of the suction pipe, therefore, is usually fitted at right angles to the centreline, behind the brush or brushes. As a result of the sweeping action, the dirt on the road can be moved a considerable distance by the brush or brushes. When the road is dry, the dirt will also usually be dry. Therefore, the action of the brushes moving the dirt will often tend to create a significant amount of airborne dust. In road cleaning machines that have a suction pipe, a portion of the airborne dust is carried with the dirt into the collector, where it can be contained by means of a filter, a cyclone-type air/dirt separation

system or a similar arrangement. However, a portion of the airborne dust can, if dry, escape past the suction pipe and/or the housing enclosing the brush or brushes. This airborne dust comprises very fine particles which can be irritating to other road users and may be a health hazard to the driver of the road sweeping vehicle.

[0004] The dust generated by the brushes can be contained by water sprays or sprinklers, which are commonly used by road sweeping machines either to knock down the dust or control the dust before it is created. For example, most sweeping machine manufacturers use or fit water sprays or sprinklers ahead of their brushes. First, this wets the dirt before the brush touches it, thereby substantially reducing the amount of airborne dust created upon sweeping the dirt. Second, the water spray helps to wet airborne dust created by the brushes.

[0005] Manufacturers of road sweeping machines also introduce water spray into the suction pipe. This helps to reduce the amount of airborne dust entering the collector. Truck mounted sweepers, i.e. large road sweeping machines, also spray water for dust control. In particular they spray water ahead of the nozzle of the suction pipe, but behind the brushes, since the larger size of the machine provides plenty of room for doing so. They also spray water within the suction pipe between the nozzle and the collector, as described above, and in front of and perhaps onto the brushes. Prior art road sweeping machines commonly use coarse spray jets which require large amounts of water. For this purpose, the road sweeping machines have to carry a large amount of water. Further, the road sweeping machines will suffer from the added cost of needing to be designed to handle or carry the large quantities of water laden dirt and dust that will be sucked into in the collector. As a result of the increased weight of the machine, more fuel will be required to power the machine. Also, the high water content reduces the amount of dust and debris collected per load in the collector as dust control water will take up a high percentage of the load.

[0006] GB 2420813 discloses a road cleaning machine comprising a suction pipe and a collector for collecting dirt sucked up by the suction pipe, and a dust control system comprising a water atomiser arranged to dispense an atomised spray of water droplets into the air in front of the suction pipe so as to be entrained in dust-laden air being sucked into the suction pipe. Although an improvement of the road sweeping machines described above, the machine will still cause water laden dirt and dust to be sucked into in the collector. Also, the arrangement will not solve the problem of airborne dust escaping past both the suction pipe and the housing enclosing the brush or brushes.

[0007] Hence, there is a need for a more effective or efficient dust control system for road cleaning or road sweeping machines that solves the above problems.

DISCLOSURE OF INVENTION

[0008] The problems are solved by a dust control system, a method for operating a dust control system and a vehicle provided with such a system, as defined by the appended claims.

[0009] In the following text, terms such as "front", "rear", "side" and "transverse" are defined relative to a central longitudinal axis of the vehicle in its main direction of travel.

[0010] A dust control system according to the invention is intended for use on a surface sweeping vehicle. The dust control system is either detachably mounted onto the vehicle or forms an integrated part of the vehicle.

[0011] The invention relates to a dust control system comprising a housing arranged to be mounted on a vehicle or a frame movably supported for movement upon a surface to be swept, which housing is arranged to at least partially enclose at least one rotatable sweeping device, and where the at least one rotatable sweeping device is mounted to the said vehicle or frame. The frame can incorporate the arrangement supporting and driving the rotatable sweeping device. As the dust control system according to the invention is intended for use on a surface sweeping vehicle, the main direction of travel is determined by the vehicle used. Optionally, a suction means for extracting dust swept by the at least one sweeping device into a dust collector can be mounted to the said frame. The dust collector can be mounted in a suitable location, such as above or to the rear of the at least one sweeping device.

[0012] The dust control system further comprises at least one chamber for laying dust, in particular airborne dust, wherein said chamber is mounted at least to one side of or at least partially surrounding the said sweeping device. Alternatively the said chamber is mounted at least to the rear of either of or the said sweeping device and the suction means. The at least one dust laying chamber comprises a substantially enclosed chamber that is open towards the swept surface and extends adjacent or into contact with the said swept surface. In this way, the lower portion of the chamber forms two substantially parallel wall sections extending at least to one side of or at least partially surrounding the said sweeping device.

[0013] At least one liquid atomizer means is provided to inject an atomized mist into the chamber in order to lay airborne dust generated by the at least one sweeping device. Airborne dust coming into contact with the atomized mist will flocculate or bind to the atomized liquid. Consequently, the airborne dust will be prevented from escaping past the lower portion of the chamber. In this way, the airborne dust will be retained within the housing or be laid to rest on the swept surface as the vehicle provided with the dust control system passes over it. A tank for a suitable liquid, such as water, and a pump for generating a liquid pressure for the said atomizer can be mounted to the frame. Alternatively, a liquid tank and a pump may be mounted on a vehicle carrying the dust

control system. The pump can be driven by any suitable means, e.g. hydraulically, mechanically or electrically, from a source of power provided on the frame or the said vehicle.

[0014] The invention is applicable to surface sweeping vehicle with at least one rotatable sweeping device comprising a horizontal rotary brush having a generally cylindrical shape and with its axis of rotation arranged substantially parallel with the swept surface and substantially transverse to the central longitudinal axis of the vehicle. A dust control system comprising these types of sweeping devices is primarily arranged to be detachably mounted onto a vehicle such as a tractor or wheel loader. Dust control systems for this type of vehicles may or may not be provided with suction means and a collector for dust and debris.

[0015] Additional sweeping devices can comprise a first and a second front sweeping device rotatable about axes directed towards the said surface to be swept. The first and second front sweeping devices can have a shape substantially in the form of a truncated cone with bristles extending along at least the outer surface of said cone. The first and second front sweeping devices are preferably rotated in counter directions, so that debris and dust is moved towards the central longitudinal axis of the vehicle and rearwards towards a suction means. A dust control system comprising these types of sweeping devices is primarily arranged to form an integrated part of the vehicle. Vehicles of this type are usually specialized machines used exclusively for surface or road sweeping. Dust control systems for this type of vehicles are usually provided with suction means and a collector for dust and debris.

[0016] The first and second front sweeping devices can have their axes of rotation directed substantially perpendicular to the swept surface. Alternatively the said axes can be directed at an angle diverging in a vertical upward direction and/or in a forward direction, relative to the central longitudinal axis of the vehicle. The sweeping devices can be conventional brushes or brooms as indicated by the prior art described above.

[0017] As stated above, the said dust laying chamber is mounted at least to one side of or at least partially surrounding the said sweeping device. Dust laying chambers can be mounted in the longitudinal and/or transverse direction relative to the sweeping device, that is, along a front portion and/or a rear portion and/or one or both sides of the said at least one sweeping device. Alternatively, dust laying chamber is mounted to the front, to the rear and along both sides of the said at least one sweeping device, thereby surrounding the said sweeping device. A dust laying chamber can also have an at least partially curved extension, in order to adapt to the shape of a sweeping device that has a circular outer contour.

[0018] The location of the dust laying chamber can depend on the design of the housing and how well it conforms to the swept surface. If the swept surface is even and smooth, then the lower portion of the housing can

conform closely to the surface, whereby only a rear dust laying chamber may be required. However, if the swept surface is rough and uneven, then a gap may be required between the lower portion of the housing and the surface to allow said housing to move across it while avoiding damage to the housing. In the latter case, the dust laying chamber can be arranged to surround the sweeping device and/or to be provided around the entire length of the lower portion of the housing encircling the sweeping device.

[0019] As stated above, a dust laying chamber comprises two substantially parallel wall sections extending at least to one side of or at least partially surrounding the said sweeping device. At least one of the said walls can comprise a resilient material arranged along the lower portion of the housing. According to one example, at least the wall section remote from the said at least one sweeping device can be made from a resilient material. A lower resilient portion can be provided along at least a part of the housing, which resilient portion extends adjacent or into contact with the said swept surface. The resilient portion can be made from a suitable wear resistant and resilient material, such as a rubber or elastomer material, and can be provided in the form of a skirt or as a row of bristles. The wall section facing the sweeping device can be provided with a similar resilient portion extending adjacent or into contact with the said swept surface, or be terminated a short distance above the swept surface. In the subsequent text, these wall sections will be referred to as outer and inner walls, respectively. The vertical extension of the chamber walls is preferably, but not necessarily, greater than 100 mm. The maximum vertical extension is dependent on the shape of the housing and the capacity of the liquid atomizer means to supply the atomized liquid required to fill the chamber. The spacing between the inner and outer walls is dependent on the size of the sweeping device and the design of the vehicle on which the sweeping device is mounted. For instance, a chamber located at the lower portion of a housing may have a spacing of about 30-50 mm. However, a chamber can also extend from a position adjacent a front or rear portion of a sweeping device and underneath a dust collector arranged in front of respectively to the rear of the sweeping device. In the latter case the chamber may have a limited height, but have a wall spacing in excess of 1 m. Chambers having relatively long extension and a relatively narrow spacing can be provided with struts or stiffening walls in order to maintain a desired spacing.

[0020] The height, spacing and length of the chamber or chambers decides the necessary capacity of the liquid atomizers. Their capacity and spacing is selected so that the volume of the chambers can be supplied with atomized liquid, for instance, to maintain a desired humidity within the chambers. Depending on the size and location of the said chambers, liquid atomizers need not be provided in all chambers. If the capacity of the liquid atomizers is sufficient, and the chambers are connected, it is possible to place atomizers in a first chamber and allow

the atomized fluid to flow out of the first chamber and be distributed to one or more adjacent chambers, or to all chambers enclosing the sweeping device.

[0021] The distance between the lower edges of the said walls and the swept surface is dependent on, for instance the type of surface being swept. If the swept surface is even and smooth, then the lower portion of the housing can conform closely to the surface, whereby both wall sections can be in contact with the swept surface. However, if the swept surface is rough and uneven, then a gap of up to a few centimeters (e.g. 2-3 cm) may be required between the lower edge of the inner wall and the swept surface, unless the inner wall comprises a resilient portion. Similarly, the vertical extension of the resilient portions of the inner and outer walls is dependent on the roughness of the swept surface. Consequently, the distance between the lower edge of the respective inner and outer wall, the vertical extension of these walls and type of material used is preferably selected to allow the said housing to move across the surface to be swept without causing damage to the housing or extensive wear on the inner and/or outer walls.

[0022] According to a first alternative, the said dust laying chamber is mounted within the housing, adjacent to and/or encircling the at least one sweeping device. This includes a chamber extending, for instance, from a position adjacent a front or rear portion of a sweeping device and underneath a dust collector arranged in front of respectively to the rear of the sweeping device. According to a second alternative, the said dust laying chamber is mounted to an outer surface of the housing, at least onto a rear portion thereof. According to a further alternative, the said dust laying chamber is an integrated part of the housing. In the latter case at least the lower portion of at least the rear portion of the housing comprises a double shell construction provided with one or more nozzles for providing an atomized mist.

[0023] As stated above, at least one liquid atomizer means is arranged in said at least one chamber to the rear and to the front and/or along both sides of the said at least one sweeping device. The liquid atomizer means can comprise an atomizer nozzle, which is a kind of nozzle for producing a fine spray of a liquid. The atomized droplets from the liquid atomizer preferably include a majority of droplets having a diameter of less than 200 μm . The atomizer nozzle can be a nozzle based on the Venturi effect, a rotary atomizer, or a similar suitable nozzle. The liquid used for this purpose is preferably, but not necessarily, water.

[0024] A water atomizer creates a mist of finely atomized water, which is much more efficient at laying dust than sprayed water. When water particles are approximately as small as, or more preferably at least as small as, the dust particles, dust laying can be so effective in a dust control system that wetting the dirt on the road is no longer essential for controlling dust creation by the brushes. Water sprayers and sprinklers as found on prior art road cleaning machines, generate water droplets that

are too large to control fine airborne dust effectively. As a result, in the water sprayers and sprinklers of prior art road sweeping machines, large quantities of water are needed in order for the dust control system to be as effective at dust control as the dust atomizer used in the dust control system of the present invention. Because a dust control system according to the invention is only required to supply the space between two wall sections of the dust laying chamber, the water consumption can be kept to a minimum. Also, if a dust collector is used it is possible to contain airborne dust and to avoid wetting of the dust drawn into the dust collector. The atomized droplets from the water atomizer preferably include a majority of droplets having a diameter of less than 200 μm , more preferably less than 100 μm and most preferably less than 40 μm and possibly less than 20 μm . Such droplets effectively float in the air like a mist. Atomizing the water is also an efficient use of water. A large amount of atomized water can be created with a small amount of liquid water. Therefore the water tank volume can be kept to a minimum. This allows the weight of the dust control system to be reduced or, alternatively, the volume of space on the vehicle available for the dust collector to be maximized.

[0025] The said at least one liquid atomizer can be operated in response to a humidity sensor in order to maintain a predetermined humidity within said at least one chamber. If a humidity sensor is not used, then empirical testing of a particular dust control system can be performed to determine the operating capacity of the at least one liquid atomizer required to achieve dust control without wetting the swept surface. The operating capacity can, for instance, be mapped for different vehicle speeds, so that the capacity increases with increasing speed. The driver of a vehicle provided with a dust control system can also be given manual control of the operating capacity of the at least one liquid atomizer, allowing the amount of atomized liquid to be controlled and adapted continuously or stepwise for varying surface conditions. Operation of the at least one atomizer is preferably, but not necessarily, initiated while the at least one sweeping device is being rotated and/or while the vehicle provided with the dust control system is moving. This allows the use of a liquid, such as water, to be maximized. The at least one atomizer can also be switched on and off manually by an operator, for instance during wet conditions or when the vehicle is driven between sweeping locations.

[0026] The invention further relates to a method for laying dust raised by a surface sweeping vehicle provided with a dust control system as described above. As indicated above, such a dust control system comprises a housing arranged to be mounted on a vehicle or a frame movably supported for movement upon a surface to be swept, which housing is arranged to at least partially enclose at least one rotatable sweeping device, and where the at least one rotatable sweeping device is mounted to the said vehicle or frame.

[0027] The method involves the steps of;

- injecting an atomized mist from a liquid atomizer into at least one chamber mounted at least to one side of or at least partially surrounding the said sweeping device, wherein said dust laying chamber comprises an enclosed chamber that has an open portion facing the swept surface and extending adjacent or into contact with the said swept surface, and
- causing atomized mist to flow towards the open portion of the chamber and into contact with airborne dust, thereby binding at least a portion of the said airborne dust.

[0028] The invention also relates to a surface sweeping vehicle provided with a dust control system as described above. As indicated, the dust control system can be detachably mounted onto the vehicle, or be an integral part of the vehicle.

BRIEF DESCRIPTION OF DRAWINGS

[0029] The invention will be described in detail with reference to the attached figures. It is to be understood that the drawings are designed solely for the purpose of illustration and are not intended as a definition of the limits of the invention, for which reference should be made to the appended claims. It should be further understood that the drawings are not necessarily drawn to scale and that, unless otherwise indicated, they are merely intended to schematically illustrate the structures and procedures described herein.

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|----|-------------|--|
| 35 | Figure 1 | shows a schematically indicated vehicle provided with dust control system according to a first embodiment of the invention; |
| 40 | Figure 2A-B | show schematic plan views of a dust control system for a single brush; |
| 45 | Figure 3 | shows a schematically indicated vehicle provided with dust control system according to a second embodiment of the invention; |
| 50 | Figure 4 | shows a schematically indicated vehicle provided with dust control system according to a third embodiment of the invention; |
| 55 | Figure 5 | shows a schematic plan view of the dust control system of Figure 4; |
| | Figure 6 | shows a perspective view of the dust control system shown in Figure 5; |

- Figure 7 shows a perspective view of an enlarged cross-section of a dust laying chamber;
- Figure 8A-C shows possible configurations of the outer and inner wall sections of a dust laying chamber; and
- Figure 9 shows a schematic diagram of an arrangement for controlling a dust control system according to the invention.

EMBODIMENTS OF THE INVENTION

[0030] Figure 1 shows a schematically indicated vehicle 11 provided with dust control system 12 according to a first embodiment of the invention. The dust control system 12 comprises a frame 13 movably supported for movement upon the surface to be swept in a main direction of travel. A rotatable sweeping brush 14 is mounted to the said frame 13. The main direction of travel is determined by the vehicle 11. A housing 15 is mounted on said frame 13 and is arranged to enclose the upper, front, rear and side portions of the said rotatable sweeping brush 14. The vehicle 11 shown in Figure 1 is only intended to clear the surface of debris and dust and is not provided with a suction means for extracting dust swept by the at least one sweeping device into a dust collector mounted to the said frame.

[0031] The dust control system further comprises a chamber 16 for laying dust, in particular airborne dust, wherein said chamber in this example is mounted around all four sides of the said sweeping brush 14. The dust laying chamber 16 is mounted to a lower peripheral portion of the housing 15 and comprises a substantially enclosed chamber that is open towards the swept surface and extends adjacent or into contact with the said swept surface. The lower portion of the chamber 16 forms two parallel outer and inner wall sections 16a, 16b, respectively, extending around all four sides of the said sweeping brush 14.

[0032] A number of liquid atomizer nozzles (not shown) are provided to inject an atomized mist into the chamber 16 in order to lay airborne dust generated by the at least one sweeping brush 14. Airborne dust coming into contact with the atomized mist will flocculate or bind to the atomized liquid. Consequently, the airborne dust will be prevented from escaping past the lower portion of the chamber 16. In this way, the airborne dust will be retained within the housing 15 or be laid to rest on the swept surface as the vehicle 11 provided with the dust control system 12 passes over it. The arrangement in Figure 1 can be operated with liquid atomizers from Spraying Systems Co., models TN2 or TN3, providing liquid droplets between 100 and 200 μm , wherein four nozzles were evenly spaced along a width of 2,5 m behind the rotatable sweeping brush 14. The chamber 16 has a vertical extension of 250 mm with the inner and outer walls 16a, 16b at a spacing of 150 mm around the entire lower pe-

riphery of the housing 15. In order to maintain a desired humidity within the chamber to contain airborne dust, the water consumption is 8-10 l/hr per nozzle.

[0033] A tank 17 for a suitable liquid, such as water, and a pump 18 for generating a liquid pressure for the said atomizer are mounted to the housing 15. Alternatively, the liquid tank and the pump may be mounted on the vehicle carrying the dust control system. The pump can be driven by any suitable means, e.g. hydraulically, mechanically or electrically, from a source of power provided on the frame or the said vehicle.

[0034] The invention shown in Figure 1 is applicable to surface sweeping vehicle with at least one rotatable sweeping device comprising a horizontal rotary brush having a generally cylindrical shape and with its axis of rotation arranged substantially parallel with the swept surface and substantially transverse to the central longitudinal axis of the vehicle. A dust control system comprising these types of sweeping devices is primarily arranged to be detachably mounted onto a vehicle such as a tractor or wheel loader. Dust control systems for this type of vehicles may or may not be provided with suction means and a collector for dust and debris.

[0035] Figures 2A and 2B show schematic plan views of two alternative embodiments of a dust control system suitable for an arrangement as shown in Figure 1. According to a first alternative shown in Figure 2A, a dust laying chamber 21 with its parallel outer and inner wall sections 21 a, 21 b is mounted within a housing 22, adjacent to and encircles a cylindrical sweeping brush 23 with a horizontal axis of rotation. A number of nozzles (not shown) for providing an atomized mist are provided between the outer and inner wall sections 21 a, 21 b. According to a second alternative shown in Figure 2B, a dust laying chamber 25 is an integrated part of the housing (compare Fig. 1) and encircles a sweeping brush 26. In the latter case at least the lower portion of the housing comprises the chamber 25 having a double shell construction comprising parallel outer and inner wall sections 25a, 25b and a number of nozzles (not shown) for providing an atomized mist.

[0036] Figure 3 shows a schematically indicated vehicle 31 provided with dust control system 32 according to a second embodiment of the invention. The dust control system 32 comprises a frame 33 movably supported for movement upon the surface to be swept in a main direction of travel. A rotatable cylindrical sweeping brush 34 with a horizontal axis of rotation is mounted to the said frame. A housing 35 is mounted on said frame and is arranged to enclose the upper, front, rear and side portions of the said rotatable sweeping brush 34. The vehicle 31 shown in Figure 3 is intended to clear the surface of debris and dust and is provided with a suction means 39 for extracting dust swept by the sweeping brush into a dust collector (not shown) mounted to the said frame. The dust control system further comprises a chamber 36 for laying dust mounted to a lower peripheral portion of the housing 35. The lower portion of the chamber 36

forms two parallel outer and inner wall sections 36a, 36b, respectively, extending around all sides of the said sweeping brush 34. In this case, a chamber arrangement as indicated in Figures 2A or 2B could be used. Alternatively, the outer and inner wall sections 36a, 36b of the chamber 36 can extend along the front and rear sides of the said sweeping brush 34. In this case the side portions can comprise skirts or a row of bristles conforming to and continuously contacting the swept surface and effectively preventing dust from escaping.

[0037] Figure 4 shows a schematically indicated vehicle 41 provided with dust control system 42 according to a third embodiment of the invention. The dust control system 42 comprises a frame 43 movably supported for movement upon the surface to be swept in a main direction of travel. A rotatable cylindrical sweeping brush 44 with a horizontal axis of rotation is mounted to the said frame 43. Additional sweeping devices 47, 48 (only one shown) comprise a first and a second front sweeping device rotatable about axes directed towards the said surface to be swept. The first and second front sweeping devices 47, 48 are rotated in counter directions, so that debris and dust is moved towards the central longitudinal axis of the vehicle and rearwards towards the cylindrical sweeping brush 44 and a suction means 49. The main direction of travel is determined by the vehicle 41. A housing 45 is mounted on said frame 43 and is arranged to enclose the upper, front, rear and side portions of the said rotatable sweeping brush 44. The vehicle 41 shown in Figure 4 is intended to clear the surface of debris and dust and is provided with a suction means 49 for extracting dust swept by the sweeping brush into a dust collector (not shown) mounted to the said frame. The dust control system comprises a chamber 46 for laying dust mounted to a lower peripheral portion of the housing 45. The lower portion of the chamber 46 forms two parallel outer and inner wall sections 46a, 46b, respectively, extending around at least three sides of the said sweeping brush 44, as indicated in Figure 5.

[0038] Dust control systems comprising the types of sweeping devices shown in Figures 3 and 4 are arranged to form an integrated part of the vehicle. Vehicles of this type are specialized machines used exclusively for surface or road sweeping. Dust control systems for this type of vehicles are usually provided with suction means and a collector for dust and debris.

[0039] Figure 5 shows a schematic plan view of an embodiment of a dust control system suitable for use in the vehicle of Figure 4. According to a first alternative shown in Figure 5, a dust laying chamber 51 with its parallel outer and inner wall sections 51a, 51 b is an integrated part of the housing (see Fig.6) and partially encircles a sweeping brush 54 and a pair of first and second front sweeping devices 57, 58. In the first alternative, the lower portion of the housing comprising the chamber 51 and a number of nozzles (not shown) for providing an atomized mist extends along the rear and side portions of the housing. As the front sweeping devices 57, 58 are

intended to sweep along the edge of, for instance, a pavement, the sweeping devices must extend a short distance transversely outside the outer limiting surface of the respective side portion.

[0040] According to a second alternative shown in Figure 5, the dust laying chamber 51 with its parallel outer and inner wall sections 51a, 51 b can be provided with an optional chamber 52 (indicated with dash-dotted lines) at the portion of the housing. As the chamber 51, the optional chamber 52 is also provided with parallel outer and inner wall sections 51 a, 51 b and a number of nozzles (not shown) for providing an atomized mist.

[0041] Figure 6 shows a perspective view of the dust control system of Figure 5. As described above, the system comprises a dust laying chamber 51 with parallel outer and inner wall sections 51 a, 51 b integrated with a lower part of a housing 53. The chamber 51 partially encircles a sweeping brush 54 and a pair of first and second front sweeping devices 57, 58.

[0042] Figure 7 shows a perspective view of an enlarged cross-section of a dust laying chamber 71 attached to a housing 73. The chamber 71 comprises two substantially parallel outer and inner wall sections 71 a, 71 b and forms a lower resilient portion attached to the housing along at least the wall section 71 a remote from the said at least one sweeping device (not shown). The resilient portion of the outer wall section 71 a extends downwards so that its lower edge is located adjacent or in contact with the swept surface. Each wall section can be provided in the form of a skirt or as a row of bristles. The resilient portion can be made from a suitable wear resistant and resilient material, such as a rubber or elastomer material. A supply pipe 74 for a liquid, such as water is attached to the lower part of the housing 73, between outer and inner wall sections 71 a, 71 b. A number of liquid atomizing nozzles 75 are schematically indicated along the supply pipe 74.

[0043] Figure 8A-8C shows a number of possible configurations of the outer and inner wall sections of a dust laying chamber 81 attached to the lower front part of a housing 83. The arrow A indicated the direction of travel. A supply pipe 84 for a liquid, such as water is attached to the lower part of the housing 73, between outer and inner wall sections of the chamber 81.

[0044] Figure 8A shows a first alternative example, where two substantially parallel outer and inner wall sections 81 a, 81 b formed by a pair of lower resilient portions. The outer and inner wall sections 81 a, 81 b comprises skirts of equal length, which are both in contact with the swept surface and act as a barrier for airborne dust. The atomized liquid contained within the chamber 81 will come into contact with and bind dust escaping past.

[0045] Figure 8B shows a second alternative example, where two substantially parallel outer and inner wall sections 85a, 85b formed by a pair of lower resilient portions of unequal length. The outer wall section 85a comprises a skirt that is in contact with the swept surface and acts as a barrier for airborne dust. The inner wall section 85b

is slightly shorter than the outer wall section 85a and allows more mixing of airborne dust and atomized liquid mist, which can be used for increasing the dust laying capacity of the system.

[0046] Figure 8C shows a third alternative example, where two substantially parallel outer and inner wall sections 81 a, 81 b formed by a pair of lower resilient portions of equal length, wherein the outer wall section 86a comprises a skirt and the inner wall section 86b comprises a row of bristles. The outer and inner wall sections 86a, 86b are both in contact with the swept surface and act as a barrier for airborne dust. The atomized liquid contained within the chamber 81 will come into contact with and bind dust escaping past.

[0047] The distance of the lower edges of the said walls is dependent on, for instance the type of surface being swept. If the swept surface is even and smooth, then the lower portion of the housing can conform closely to the surface, whereby both wall sections can be in contact with the swept surface. However, if the swept surface is rough and uneven, then a gap of up to a few centimeters (e.g. 2-3 cm) may be required between the lower edge of the inner wall and the swept surface, unless the inner wall comprises a resilient portion. Similarly, the vertical extension of the resilient portions of the inner and outer walls is dependent on the roughness of the swept surface. Consequently, the distance between the lower edge of the respective inner and outer wall, the vertical extension of these walls and type of material used is preferably selected to allow the said housing to move across the surface to be swept without causing damage to the housing or extensive wear on the inner and/or outer walls.

[0048] Figure 9 shows a schematic diagram of an arrangement for controlling a dust control system according to the invention. When applied to a vehicle as shown in Figure 1, the dust control system comprises a chamber 16 for laying dust, wherein the said chamber is mounted adjacent a sweeping brush 14 (see Fig. 1). The dust laying chamber 16 is mounted to a lower peripheral portion of the housing 15 and comprises a substantially enclosed chamber that is open towards the swept surface and extends adjacent or into contact with the said swept surface. The lower portion of the chamber 16 forms two parallel outer and inner wall sections 16a, 16b, respectively, enclosing the sweeping brush 14. A tank 17 for a suitable liquid, such as water, and a pump 18 for generating a liquid pressure to a supply tube 19 for a number of atomizers mounted to the housing 15. The atomizers are arranged to fill the chamber with droplets of the atomized liquid. The said atomizers can be operated in response to a humidity sensor 91 mounted at a suitable location on or in the chamber 16. A signal from the humidity sensor 91 is transmitted to a control unit 92, which controls operation of the pump 18 in order to maintain a predetermined humidity within the said chamber 16.

[0049] Operation of the atomizers can also be initiated by the control unit 92 when the sweeping brush 14 is being rotated, in response to a displacement sensor 93,

and/or in response to a rotation sensor 94 connected to a vehicle wheel 95, indicating that the vehicle is moving. This allows the use of a liquid, such as water, to be maximized, as compared to a continuously operated atomizer with is operated at ignition on for the vehicle. The at least one atomizer can also be switched on and off manually by an operator using a switch 96. This allows the use of a liquid, such as water, to be maximized, as compared to a continuously operated atomizer with is operated at ignition on for the vehicle.

[0050] As stated above, the said dust laying chamber is mounted at least to one side of or at least partially surrounding the said sweeping device. Dust laying chambers can also be mounted along both sides of the said at least one sweeping device. Alternatively, dust laying chamber is mounted to the front, to the rear and along both sides of the said at least one sweeping device, thereby surrounding the said sweeping device. The location of the dust laying chamber can depend on the design of the housing and how well it conforms to the swept surface. If the swept surface is even and smooth, then the lower portion of the housing can conform closely to the surface, whereby only a rear dust laying chamber may be required. However, if the swept surface is rough and uneven, then a gap may be required between the lower portion of the housing and the surface to allow said housing to move across it while avoiding damage to the housing. In the latter case, the dust laying chamber can be arranged to surround the sweeping device and/or to be provided around the entire length of the lower portion of the housing encircling the sweeping device.

[0051] The invention is not limited to the above examples, but may be varied freely within the scope of the appended claims.

Claims

1. A dust control system comprising a housing arranged to be mounted on a vehicle or a frame movably supported for movement upon a surface to be swept, which housing is arranged to at least partially enclose at least one rotatable sweeping device, and where the at least one rotatable sweeping device is mounted to the said vehicle or frame; characterized in that the system further comprises at least one chamber for laying airborne dust, wherein said chamber is mounted at least to one side of or at least partially surrounding the said sweeping device; said dust laying chamber comprising an enclosed chamber that is open towards the swept surface and extends adjacent or into contact with the said swept surface; and at least one liquid atomizer means for injecting an atomized mist into the chamber in order to lay airborne dust generated by the at least one sweeping device.
2. A dust control system according to claim 1, charac-

terized in that the at least one rotatable sweeping device comprises a horizontal cylindrical rotary brush.

3. A dust control system according to claim 2, characterized in that a first and a second front sweeping device rotatable about an axis directed towards the said surface to be swept, with the first and second front brooms rotating in counter directions. 5
4. A dust control system according to any one of claims 1-3, characterized in that said dust laying chamber is mounted along one or more of a rear portion and/or a front portion and/or a side portion of the said at least one sweeping device. 10
5. A dust control system according to any one of claims 1-3, characterized in that said dust laying chamber is mounted to the front, to the rear and along both sides of the said at least one sweeping device. 15
6. A dust control system according to any one of claims 1-5, characterized in that said dust laying chamber comprises a lower resilient portion along at least a section remote from the said at least one sweeping device, which resilient portion extends adjacent or into contact with the said swept surface. 20
7. A dust control system according to any one of claims 1-6, characterized in that said dust laying chamber is mounted within the housing. 25
8. A dust control system according to any one of claims 1-6, characterized in that said dust laying chamber is mounted to an outer surface of the housing. 30
9. A dust control system according to any one of claims 1-6, characterized in that said dust laying chamber is a part of the housing. 35
10. A dust control system according to any one of the above claims, characterized in that at least one liquid atomizer means is arranged in said at least one chamber to the front and/or along both sides of the said at least one sweeping device. 40
11. A dust control system according to any one of the above claims, characterized in that said at least one atomizer is operated in response to a humidity sensor, in order to maintain a predetermined humidity within said at least one chamber. 45
12. A dust control system according to any one of the above claims, characterized in that said at least one atomizer is operated while the sweeping device is being rotated. 50
13. A dust control system according to any one of the

above claims, characterized in that said at least one atomizer is operated while the frame is in motion.

14. A method for laying dust raised by a surface sweeping vehicle provided with a dust control system according to claim 1-13, said dust control system comprising a housing arranged to be mounted on a vehicle or a frame movably supported for movement upon a surface to be swept, which housing is arranged to at least partially enclose at least one rotatable sweeping device, and where the at least one rotatable sweeping device is mounted to the said vehicle or frame; characterized in that the method involves

- injecting an atomized mist from a liquid atomizer into at least one chamber mounted at least to one side of or at least partially surrounding the said sweeping device, said dust laying chamber comprising an enclosed chamber that has an open portion facing the swept surface and extending adjacent or into contact with the said swept surface
- causing atomized mist to flow towards the open portion of the chamber and into contact with airborne dust, thereby binding at least a portion of the said airborne dust.

15. A surface sweeping vehicle characterized in that it is provided with a dust control system according to claims 1-13.
16. A surface sweeping vehicle characterized in that the dust control system is detachably mounted onto the vehicle.
17. A surface sweeping vehicle characterized in that the dust control system is an integrated part of the vehicle.

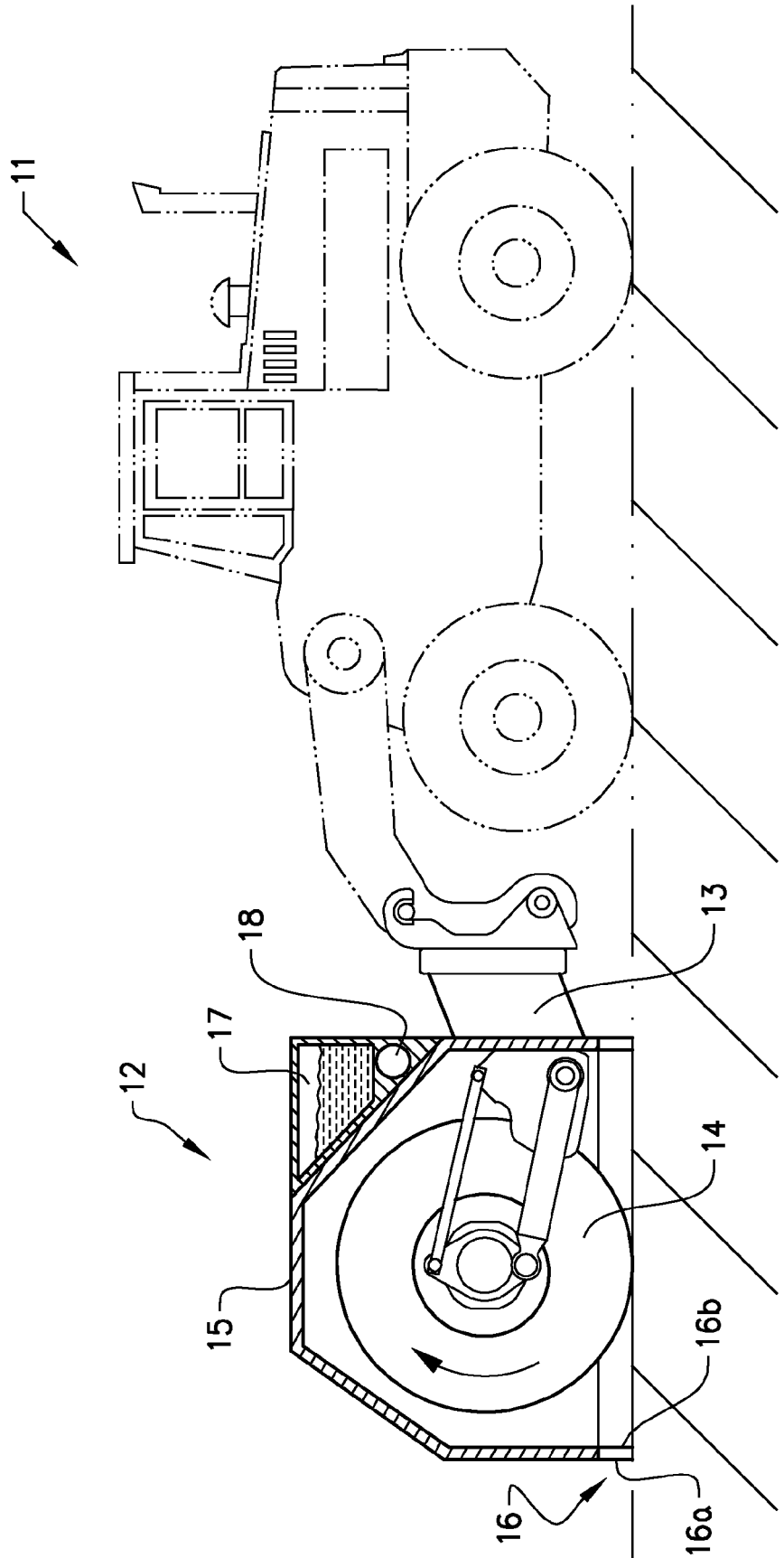


FIG. 1

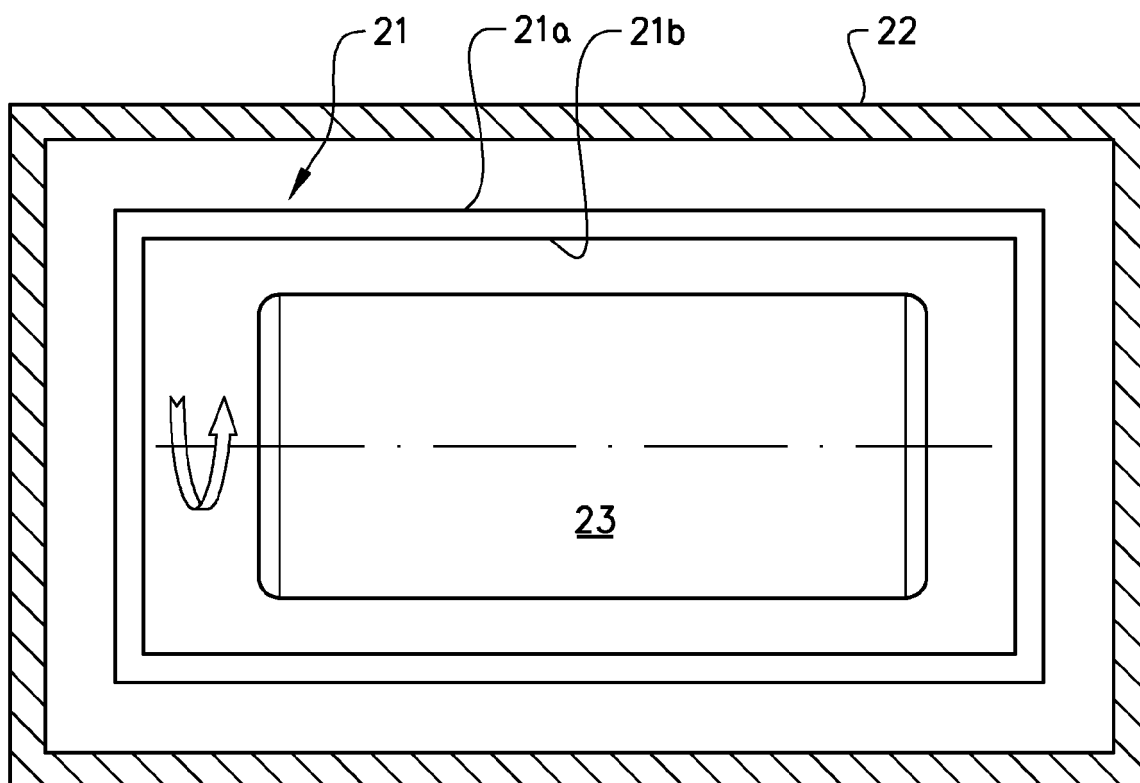


FIG. 2A

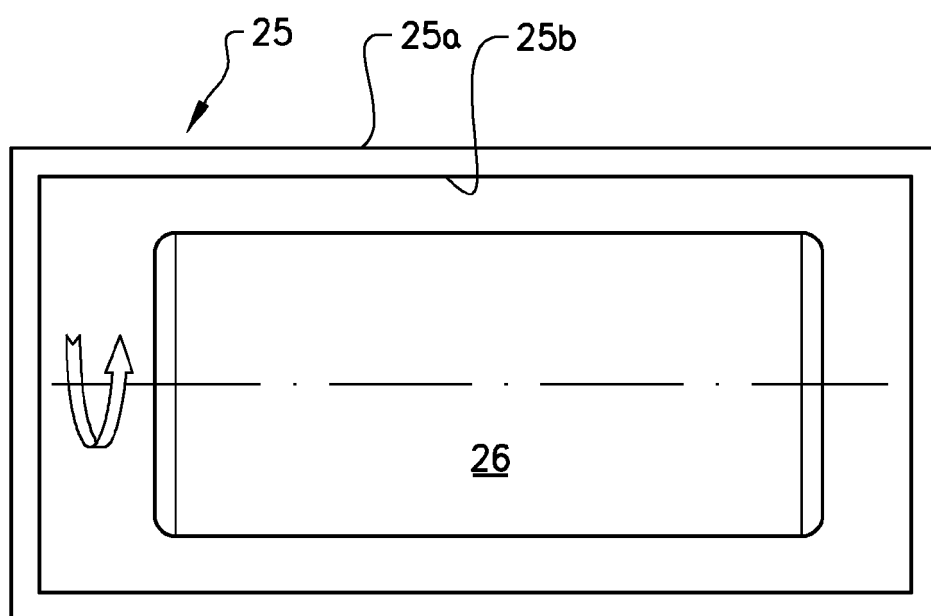


FIG. 2B

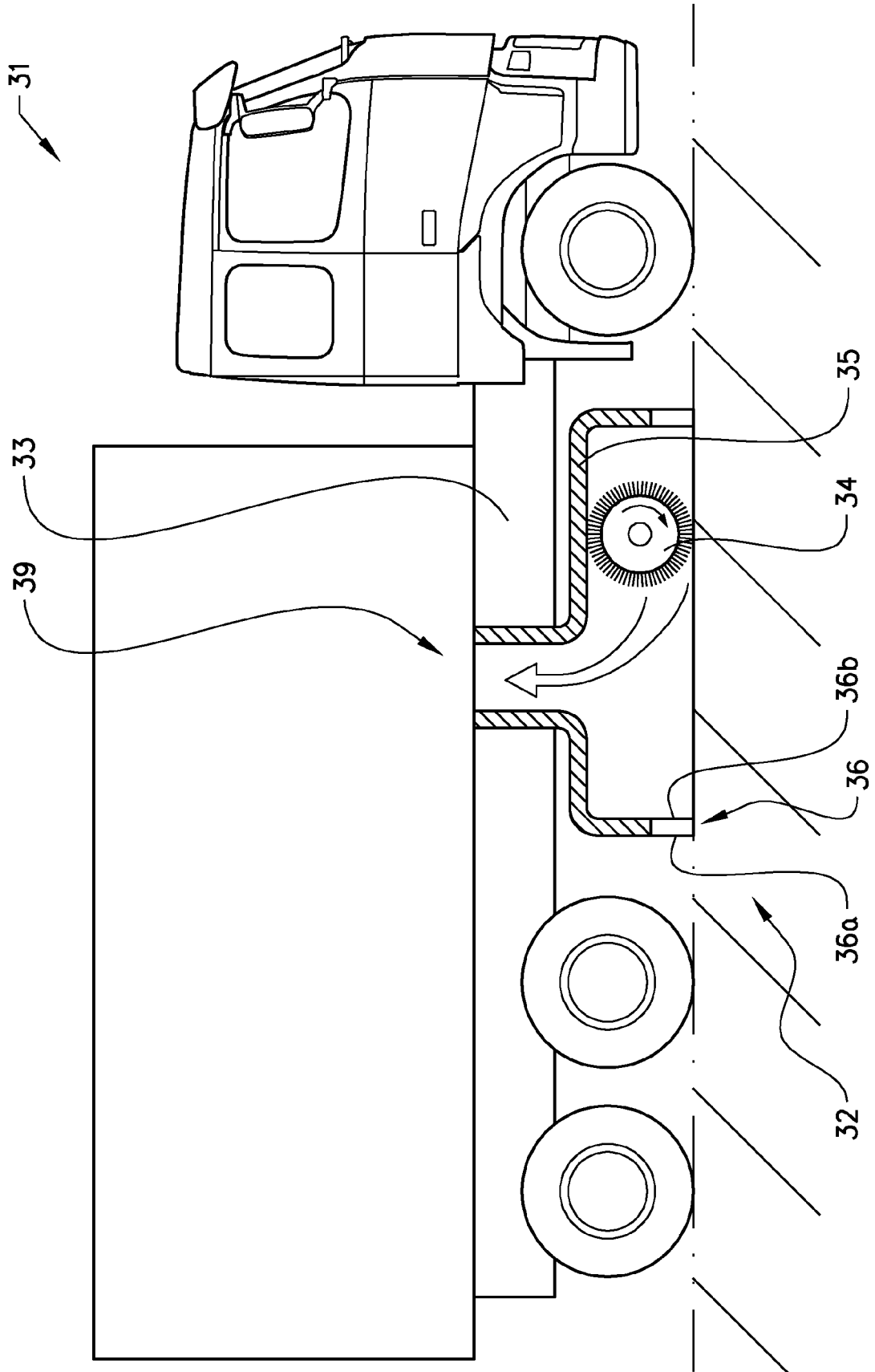


FIG. 3

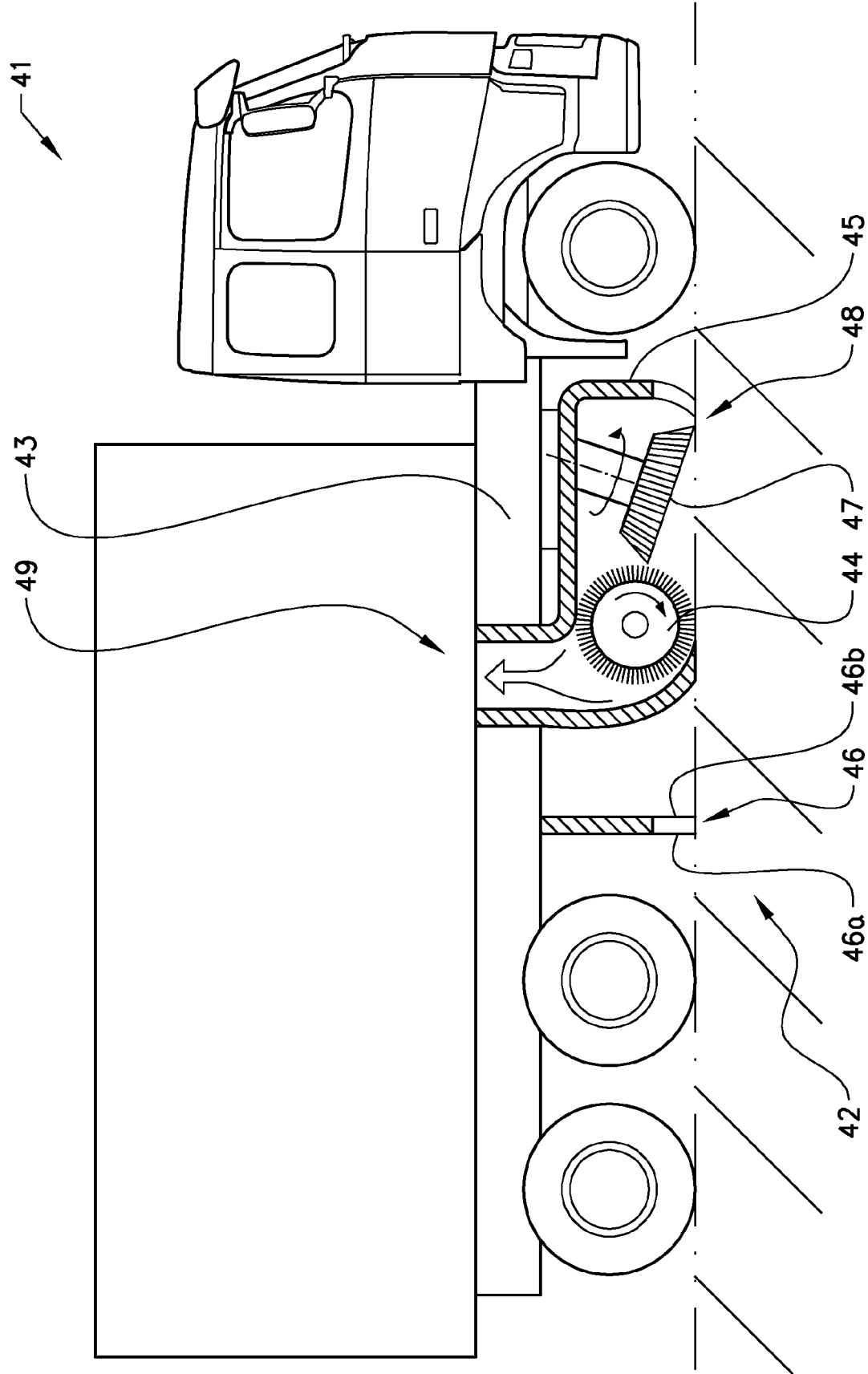
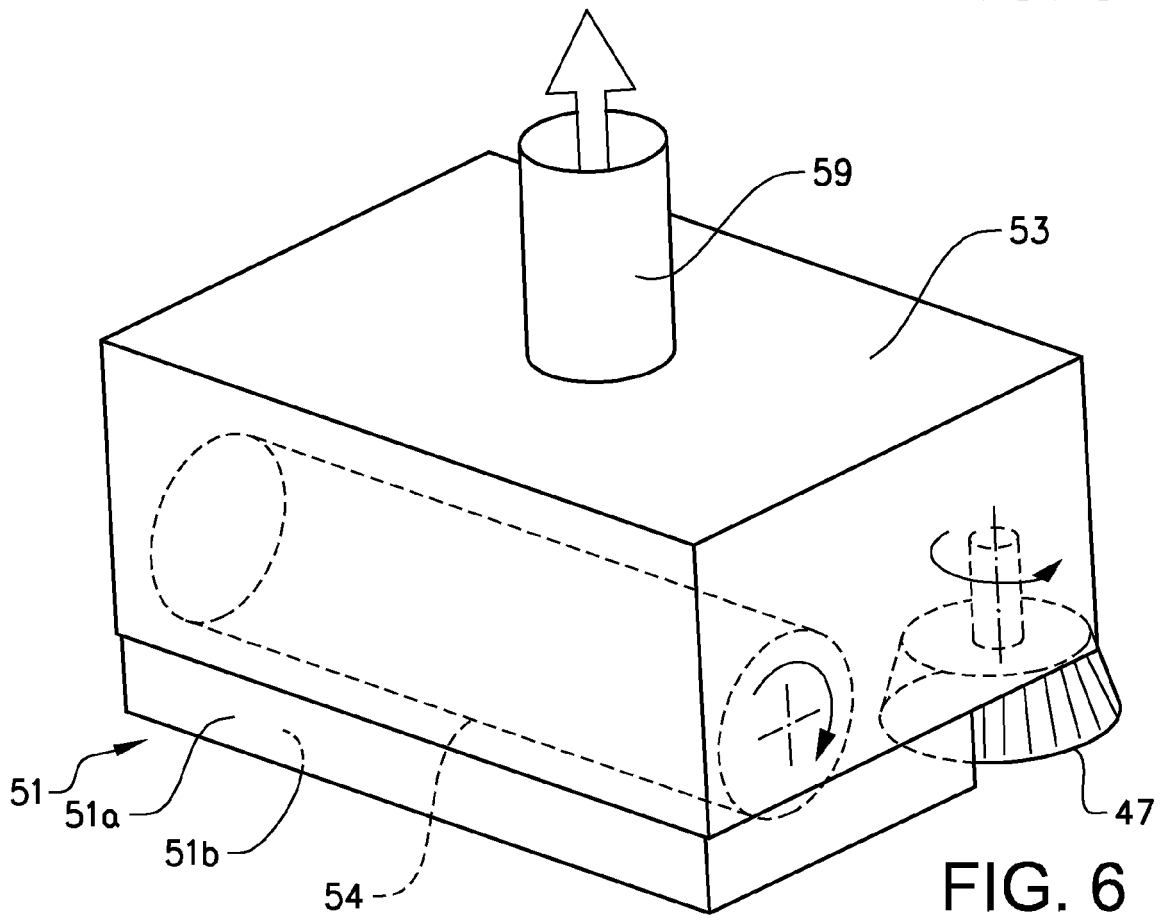
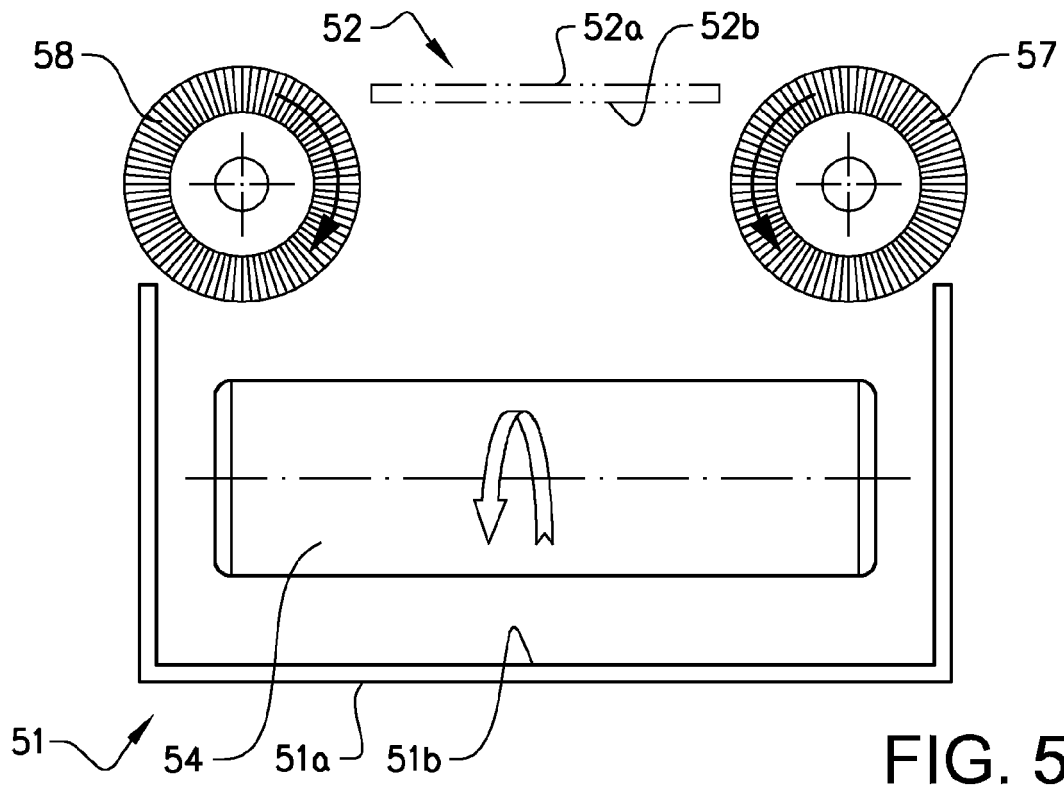


FIG. 4



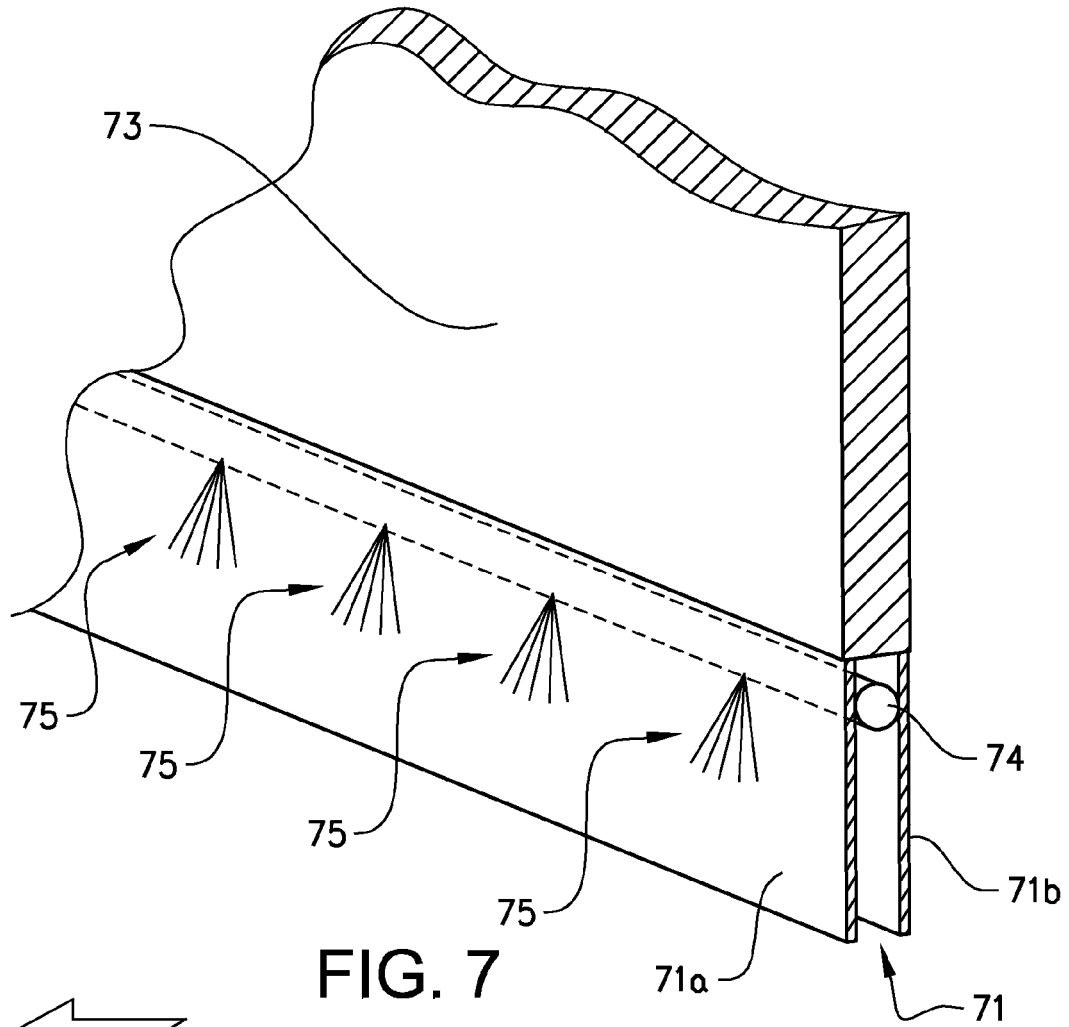


FIG. 7

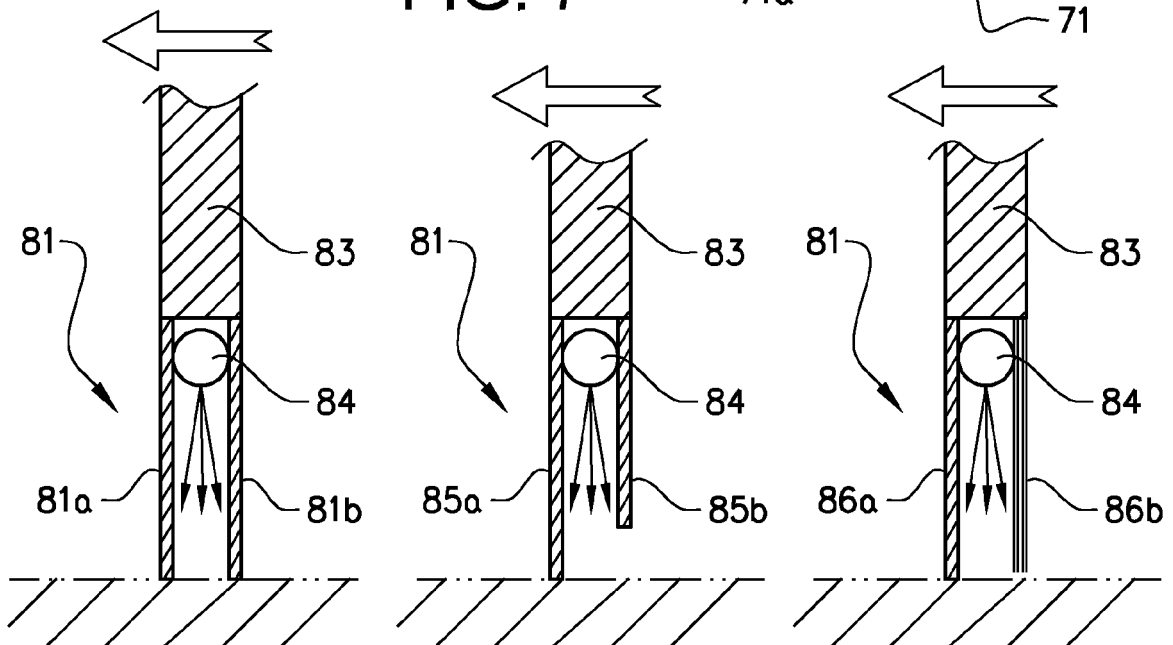


FIG. 8A

FIG. 8B

FIG. 8C

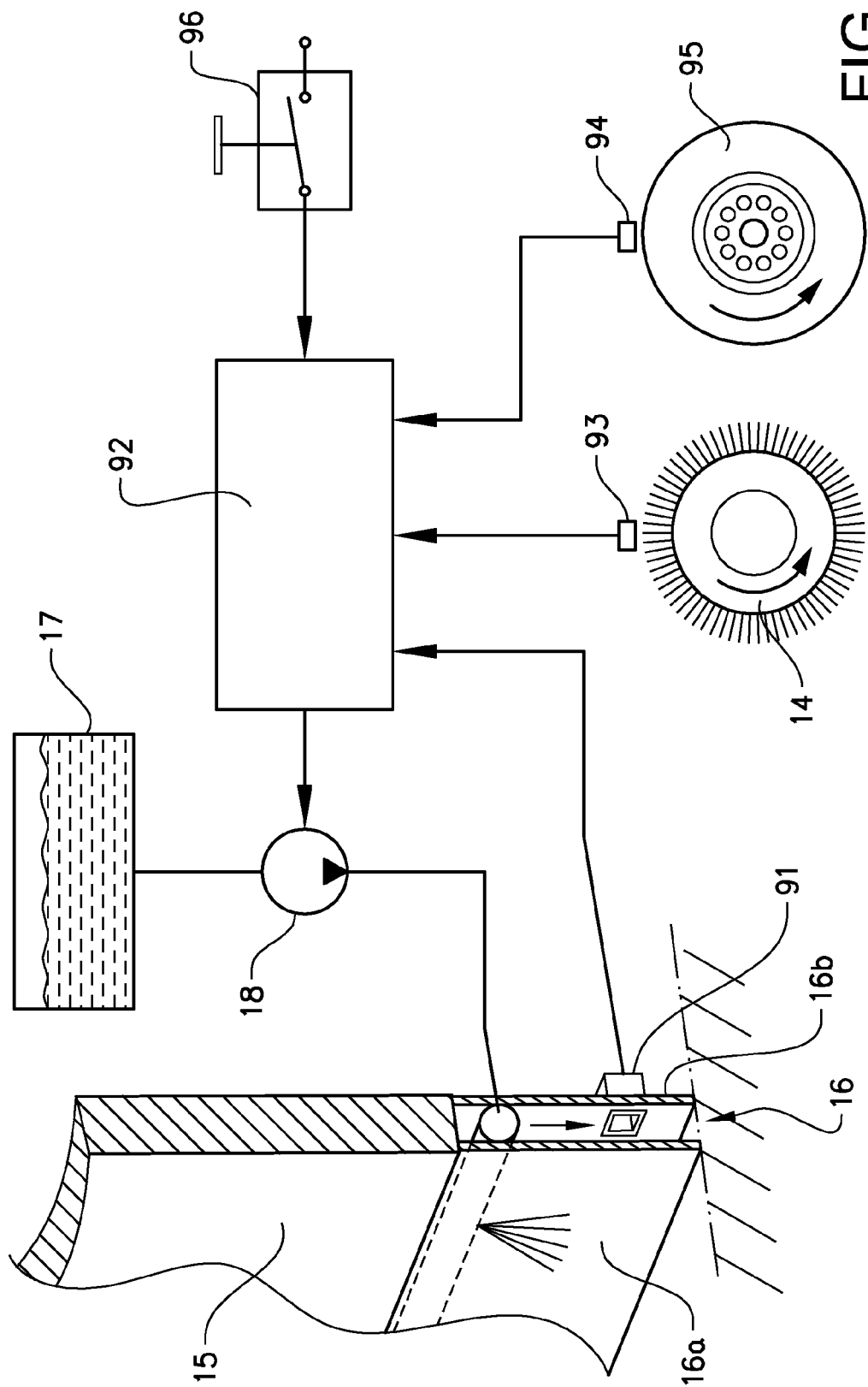


FIG. 9

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 2420813 A [0006]