



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.09.2010 Bulletin 2010/38

(51) Int Cl.:
E01H 1/08 (2006.01)

(21) Application number: **10002331.6**

(22) Date of filing: **05.03.2010**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA ME RS

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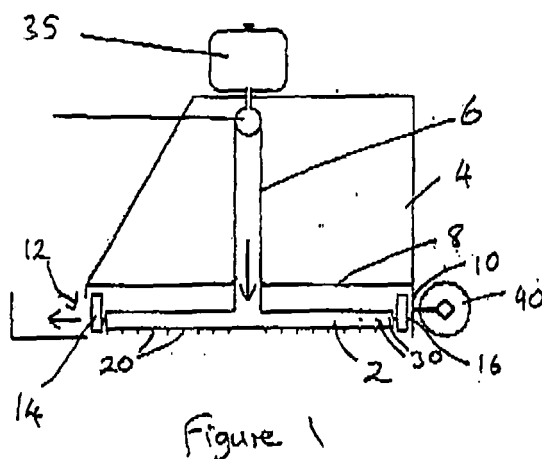
(30) Priority: **16.03.2009 GB 0904417**

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(54) **Apparatus for cleaning surfaces**

(57) An apparatus for cleaning a surface comprising an elongate air plenum (2) rotatably mounted beneath a cover (4) for rotation about an axis perpendicular to a longitudinal axis of the air plenum, said air plenum being

connectable to a source of pressurised air and being provided with at least one first air outlet directing pressurised air at and in a direction substantially perpendicular to a surface to be cleaned.



Description

[0001] This Invention relates to an apparatus for cleaning surfaces, such as roadways, runways, slipways, quaysides, railways, car parks, storage areas, drive-ways, sports surfaces, and in particular athletics tracks, and in particular to a cleaning apparatus for removing fine and coarse Infill materials from artificial playing surfaces such as artificial grass surfaces.

[0002] Artificial or synthetic grass is a man-made surface manufactured from synthetic materials, made to look like natural grass. It is most often used in arenas for sports that were originally or are normally played on grass. However, it is now being used on residential lawns and commercial applications as well.

[0003] The most common type of synthetic turf uses polyethylene or polypropylene fibres, typically around 10mm to 80mm long, which are tufted into a backing material. The material is infilled with a layer of silica sand and/or granulated rubber to support and stabilise the fibres, to enhance drainage and provide ballast to the material.

[0004] Over time, the Infill layer becomes compacted and dirt and debris contaminate the infill and form a crust on top of the infill layer, inhibiting drainage of surface water. Organic material, such as leaves, may be broken down and mixed into the infill, leading to the growth of moss and algae on the surface of the infill layer. It is therefore desirable to periodically, typically annually, clean or replace at least an upper layer of the infill material to remove this crust of dirt, debris and organic matter.

[0005] According to the present invention there is provided an apparatus for cleaning a surface comprising an elongate air plenum rotatably mounted beneath a cover for rotation about an axis perpendicular to a longitudinal axis of the air plenum, said air plenum being connectable to a source of pressurised air and being provided with at least one first air outlet directing pressurised air at and in a direction substantially perpendicular to a surface to be cleaned.

[0006] The at least one first air outlet may comprise a plurality of apertures formed in a lower face of the air plenum. Alternatively, the first air outlet may comprise an elongate slot formed in a lower face of the air plenum.

[0007] Preferably the cover is provided with a depending side wall to define a substantially closed air chamber over the surface to be cleaned, a tangentially arranged exit port being provided in the side wall of the cover for extracting material dislodged from the surface by said first air jets. Scraper members may be provided on outer ends of the air plenum, said scraper members engaging an inner face of the side wall for dislodging material that may collect on the side wall.

[0008] Preferably the air plenum is provided with at least one second air outlet directing pressurised air in a direction substantially parallel to said surface to be cleaned to entrain material dislodged by said first air jets towards said tangentially arranged exit. The at least one

second air outlet may comprise a plurality of apertures provided in one or both of the side faces of the air plenum, preferably in a leading face of the air plenum.

[0009] At least one further air outlet may be provided in an upper face of the air plenum for dislodging material that may collect on an underside of the cover.

[0010] The air plenum may be provided with a substantially centrally mounted elongate air supply pipe having a central axis about which the air plenum is rotatable.

The air pipe may be mounted to rotate with the air plenum. An air supply manifold may be provided at a distal end of the air supply pipe remote from the air plenum, said air supply manifold being connectable to a source of pressurised air, such as a compressor. The air supply pipe may be connected to the air supply manifold by means of a suitable sealed bearing.

[0011] A drive pulley or drive gear may be provided on the air supply pipe, said drive pulley or drive gear being driven by a motor to rotate the air plenum. Preferably the motor comprises an electric motor or an internal combustion engine. In a preferred embodiment, a drive pulley is provided on said air supply pipe, said drive pulley being driven by said motor via a drive belt. The air plenum may be adapted to be rotatably driven, in use, via a power take off of a vehicle to which the apparatus is attachable.

[0012] Means may be provided for delivering a liquid to the air plenum to be entrained in the air stream exiting the air plenum via said at least one first air outlet. A tank may be provided on the apparatus for delivering said liquid to the air plenum. The liquid may be water or a liquid containing chemicals such as pesticides, insecticides, herbicides, colouring agents, cleaning agents, or de icing agents. The tank may be pressurised. The liquid may be delivered to the air plenum by one or more inlets provided in the air plenum and/or in the air supply pipe and/or the air supply manifold. The flow of liquid may be controlled by one or more valves. The liquid may be entrained into the air supplied to the air plenum via a venturi nozzle.

[0013] The apparatus may be provided with a vibration mechanism, such as an eccentrically mounted plate, bar, or roller to excite and dislodge material from the surface to be cleaned and/or from the surfaces of the cover.

[0014] Preferably a material collection device is connected to said exit port for collecting material dislodged from the surface to be cleaned. In one embodiment the collection device comprises one or more screw conveyors for conveying said material to a collection vessel or chamber. Additionally or alternatively the collection device may comprise or include a separating device, such as a cyclone separator, for separating and collecting solids material dislodged from the surface to be cleaned from the air stream exiting the cover.

[0015] The apparatus may be adapted to be mounted on a vehicle to be traversed across a surface to be cleaned. In one embodiment the apparatus is adapted to be mounted on a three point linkage of a tractor. Alternatively the apparatus may comprise a wheeled frame

arranged to be towed behind a vehicle, such as a tractor. In an alternative embodiment the apparatus may be self propelled.

[0016] One or more brushing devices may be mounted to the front, and/or sides and/or rear of the cleaning apparatus. The one or more brushing devices may comprise bristles or metal tangs provided on one or more brushing heads. The one or more brushing devices may be raised and lowered to increase or decrease the pressure on the surface to be cleaned. The one or more brushing devices may be fixed in position or may be mounted to oscillate horizontally or vertically or may be rotatably driven.

[0017] An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional side elevation of a cleaning apparatus according to an embodiment of the present invention;

Figure 2 is a sectional end elevation of the apparatus of Figure 1;

Figure 3 is a sectional plan view of the apparatus of Figure 1.

[0018] As shown in the drawings, a cleaning apparatus according to the present invention comprises an elongate hollow box section air plenum 2 mounted horizontally beneath a cover 4 for rotation about a central vertical axis. Alternatively the air plenum 2 may have any other shape or cross section, for example S shaped or otherwise curved.

[0019] A vertically extending air supply pipe extends centrally from the air plenum 2 for supplying compressed air to the air plenum, the air supply pipe 6 being mounted in the cover via bearings such that air plenum 2 and air supply pipe are rotatable about the axis of the air supply pipe 6. The upper end of the air supply pipe may 6 extend into an air supply manifold (not shown), via a sealed bearing to permit rotation of the air supply pipe with respect to the air supply manifold, the air supply manifold being connectable to a source of compressed air, such as a compressor.

[0020] A pulley (not shown) may be mounted on the air supply pipe so that the air supply pipe and air plenum may be rotated by a motor, preferably a hydraulic motor (although an electric motor or other drive source may be used) via a drive belt. A belt tensioning device may be provided. The belt tension may be selected to enable the belt to slip in the air plenum becomes jammed to prevent damage to the motor and/or air plenum.

[0021] The cover 4 comprises a horizontal upper wall 8 and a substantially circular peripheral depending side wall 10 defining a substantially closed chamber over the air plenum 2 and the surface to be cleaned. A tangentially arranged outlet 12 is defined in the side wall 10 through

which air and any entrained particulate material may pass.

[0022] Scraper blades 14, 16 are mounted on the outer ends of the air plenum 2 to engage the inner face of the side wall 10.

[0023] A plurality of substantially vertically arranged first air jets 20 are provided in a lower face of the air plenum 2 for directing a stream of compressed air at and perpendicular to the surface to be cleaned to dislodge particulate material and debris therefrom.

[0024] A plurality of second air jets 30 are provided in a leading side face of the air plenum 2 for directing a stream of air parallel to the surface to be cleaned to entrain dislodged particulate material towards and out of the outlet 12.

[0025] A tank 35 mounted on top of the cover, the tank 35 having a liquid outlet for delivering a liquid into the air plenum 2 via the air supply pipe 6. The liquid may be water or a liquid containing chemicals such as pesticides, insecticides, herbicides, colouring agents, cleaning agents, or de icing agents. The tank 35 may be pressurised and/or the liquid may be entrained into the flowing air by the venturi effect. The flow of liquid into the air stream may be controlled by a valve.

[0026] A particulate collection device (not shown) may be connected to the outlet 12 for receiving particulate material therefrom. In one embodiment the particulate collection device may comprise a cyclone separator. In an alternative embodiment, particularly suited for wet material, the particulate collection device may comprise one or more screw conveyors for conveying particulate material from the outlet 12 to a collection hopper. Such one or more screw conveyors or augers may be powered by the same motor as that used for rotating the air plenum.

[0027] A rotatable brush 40 may be mounted behind the cover. Alternatively, or additionally, an eccentrically mounted member may be rotatably mounted on the cover for imparting a substantially vertical vibratory movement to the cover to encourage displacement of material from the surface and to dislodge material from the surfaces of the cover 4.

[0028] The apparatus may be adapted to be mounted on the rear of a small tractor or other suitable vehicle, for example by being adapted to be fitted to the three point linkage of a tractor.

[0029] The above described apparatus is particularly suitable for removing infill material from an artificial grass playing surface. The vertically arranged first air jets 20 are particularly effective at dislodging and lifting wet sand from between the tufts of synthetic grass and the rotary motion of the air plenum 2 beneath the cover 4, along with the second air jets 30, are effective at entraining the infill towards and out of the outlet 12 to a suitable collection device, such as a screw conveyor. Cleaning agents and herbicides may be added to the air stream via the tank 35 to assist cleaning of the surface and to discourage the growth of algae or moss.

[0030] The invention is not limited to the embodiments

described herein but can be amended or modified without departing from the scope of the present invention. While the above described embodiment of the present invention is described in relation to an apparatus for removing infill material from an artificial playing surface, a cleaning apparatus in accordance with the present invention may be utilised for removing material from and cleaning a wide variety of surfaces.

Claims

1. An apparatus for cleaning a surface comprising an elongate air plenum (2) rotatably mounted beneath a cover (4) for rotation about an axis perpendicular to a longitudinal axis of the air plenum, said air plenum being connectable to a source of pressurised air and being provided with at least one first air outlet directing pressurised air at and in a direction substantially perpendicular to a surface to be cleaned. 5
2. An apparatus as claimed in claim 1, wherein the at least one first air outlet comprises a plurality of apertures or air jets (20) formed in a lower face of the air plenum. 15
3. An apparatus as claimed in claim 1, wherein the at least one first air outlet comprises an elongate slot formed in a lower face of the air plenum (2). 20
4. An apparatus as claimed in any preceding claim, wherein the cover (4) is provided with a depending side wall (10) to define a substantially closed air chamber over the surface to be cleaned, a tangentially arranged exit port (12) being provided in the side wall (10) of the cover (4) for extracting material dislodged from the surface by said at least one first air outlet. 25
5. An apparatus as claimed in claim 4, wherein scraper members (14,16) are provided on outer ends of the air plenum, said scraper members engaging an inner face of the side wall for dislodging material that may collect on the side wall. 30
6. An apparatus as claimed in any preceding claim, wherein the air plenum (2) is provided with at least one second air outlet directing pressurised air in a direction substantially parallel to said surface to be cleaned to entrain material dislodged by said first air jets towards said tangentially arranged exit. 35
7. An apparatus as claimed in claim 6, wherein the at least one second air outlet comprises a plurality of apertures or air jets (30) provided in one or both of the side faces of the air plenum (2), preferably in a leading face of the air plenum (2). 40
8. An apparatus as claimed in any preceding claim, wherein at least one further air outlet is provided in an upper face of the air plenum (2) for dislodging material that may collect on an underside of the cover (4). 45
9. An apparatus as claimed in any preceding claim, wherein the air plenum (2) is provided with a substantially centrally mounted elongate air supply pipe (6) having a central axis about which the air plenum (2) is rotatable. 50
10. An apparatus as claimed in claim 9, wherein the air supply pipe (6) is mounted to rotate with the air plenum (2), an air supply manifold being provided at a distal end of the air supply pipe (6) remote from the air plenum (2), said air supply manifold being connectable to a source of pressurised air, such as a compressor, the air supply pipe (6) being connected to the air supply manifold by means of a sealed bearing. 55
11. An apparatus as claimed in any preceding claim, wherein means are provided for delivering a liquid to the air plenum (2) to be entrained in the air stream exiting the air plenum (2) via said at least one first air outlet.
12. An apparatus as claimed in claim 11, wherein said liquid may be entrained into the air supplied to the air plenum via a venturi nozzle.
13. An apparatus as claimed in any preceding claim, wherein a material collection device is connected to said exit port (12) for collecting material dislodged from the surface to be cleaned.
14. An apparatus as claimed in claim 13, wherein the collection device comprises one or more screw conveyors for conveying said material to a collection vessel or chamber and/or wherein the collection device comprises or includes a separating device, such as a cyclone separator, for separating and collecting solids material dislodged from the surface to be cleaned from the air stream exiting the cover.
15. An apparatus as claimed in any preceding claim, wherein one or more brushing devices are mounted to the front, and/or sides and/or rear or of the cleaning apparatus.

