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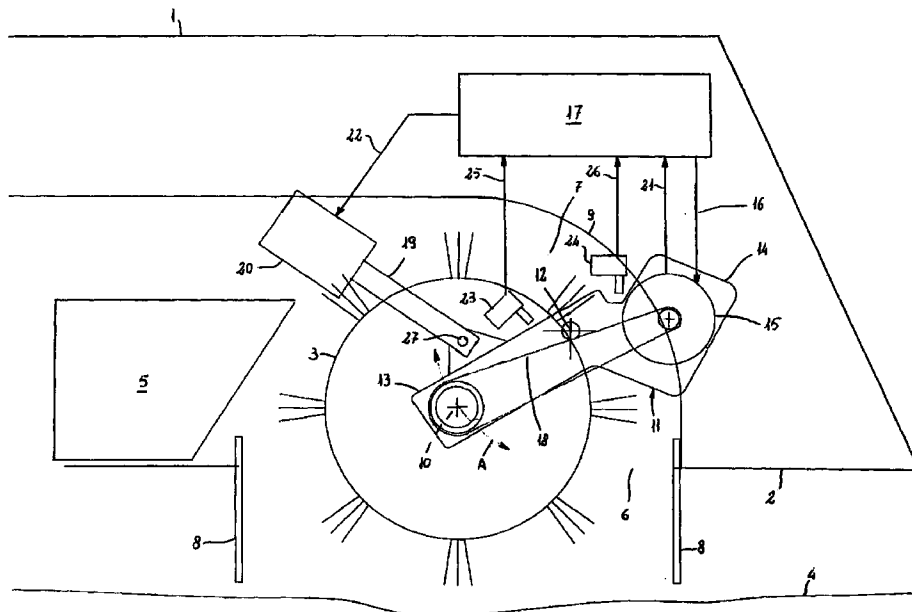
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(54) Motor-sweeper

(57) Motor-sweeper with a horizontally rotating brush roller (3) in contact with the floor to collect the dirt therefrom and send it into a collecting bin (5) through a conveying channel (6, 7). The brush roller (3) is hinged on a lever (11) that is adapted to be actuated by an actuator (20) to vary the position of the brush roller in a direction (A) that is substantially inclined downwards

frontally. Control means (17) detect the operating pressure of the brush roller (3) with respect to the floor (4), compare such a pressure with a reference value, and drive the actuator (20) so as to keep both the operating pressure of the brush roller (3) and the cross-section area of said channel (6, 7) constant.



Description

The present invention refers to a motor-sweeper, or similar apparatus, ie. a motor-propelled machine for collecting dirt, wastes and/or debris from a floor.

As described for instance in IT-A-1 207 081, motor-sweepers mainly comprise a flatbed under which there is provided a compartment accomodating a brush roller adapted to rotate in contact with the floor surface, about a horizontal axis, in order to collect the dirt scattered on said floor and convey it towards a collection bin, which is usually arranged on the rear portion of the apparatus. In particular, the brush roller lifts the dirt from the floor and forces it towards the collection bin along a trajectory through the air along a channel that is defined between the same brush roller and an appropriately shaped case associated therewith. To be more precise, said channel extends towards the rear portion of the apparatus through at least a curvilinear portion that partially surrounds the front portion of the brush roller. In other words, the guarding case and the brush roller substantially form an arrangement operating as a centrifugal fan transporting the dirt towards the collection bin.

In a preferred manner, the action of the brush roller is assisted by at least an auxiliary brush provided in the form of a disc rotating in contact with the floor about a vertical axis, said auxiliary brush being arranged under the flatbed so as to convey the dirt towards the brush roller which in turn transports it towards the collection bin in the afore described manner. To such a purpose, said auxiliary brush is preferably arranged in an advanced position, and laterally, with respect to the brush roller.

In order to enable the brushes to exert an effective mechanical action on the dirt lying on the floor without on the other hand damaging the same floor, it is appropriate for the brushes themselves to be kept in contact with the floor with a pre-determined pressure, ie. force, which should preferably be constant under any and all operating conditions, while at the same time taking into due account the wear-down effect which the brushes undergo in use.

As described for instance in EP-A-0 729 314, such a problem is substantially solved for the brush provided in a floor washing and drying machine through the use of an electronic control system enabling the operator to select a pre-determined operating pressure exerted by the same brush on the floor. Said system is further provided with a feedback control circuit which automatically regulates the vertical position of the auxiliary brush, which is installed on a proper articulated moving device controlled by the electronic system, in such a manner as to ensure that the pressure exerted by the brush is kept substantially constant. Such a solution, although rather complicated from a construction point of view, can be advantageously applied to a disc-shaped brush that can be simply adjusted in its height, in a rectilinear manner, without affecting the overall operation of the machine,

However, it is not suitable for adjusting the brush roller of a motor-sweeper in a similar manner.

Such a brush roller of a motor-sweeper, in fact, cannot be simply adjusted in its height, since it is at the same time necessary, for the dirt to be effectively transferred towards the collection bin, for the cross-section area of the channel defined between the brush roller and the adjacent shaped casing to be kept substantially constant. For instance, if the brush roller is simply lowered in order to keep its operating pressure constant with respect to the floor when the same brush wears down (ie. when the diameter thereof becomes smaller), the cross-section area of the surrounding channel can easily turn out to be excessively large, to such an extent that it is practically impossible for the dirt to be effectively conveyed towards the collection bin.

Usually, therefore, it is a preferred practice to have the position and setting of the axis of the brush roller adjusted manually in the most appropriate manner. It will anyway be appreciated that such a manual adjustment can only be carried out when the machine is standing still, since it involves an intervention to be done on the mechanical devices supporting the brush roller. It therefore ensues that this operation turns out to be undesirably time consuming and complex, to such an extent that the action of qualified personnel is required. In addition, this system fails to effectively solve the problem associated with the need for the operating pressure of the brush roller to be kept substantially constant on the floor even in those cases in which the motor-sweeper meets with abrupt, sudden changes in the slope of the floor, such as for instance a hump or a bump, so that the operation of the machine may prove quite unsatisfactory under such circumstances.

It therefore is a main purpose of the present invention to provide a motor-sweeper which, apart from being particularly simple and reliable, is capable of automatically keeping the operating pressure of its brush roller constant under substantially any operating condition thereof, while at the same time ensuring an effective action of the same brush roller in collecting and transferring the dirt towards the collection bin.

More particularly, it is a purpose of the present invention to provide a motor-sweeper of the above cited kind in which the wear-off effect which the brush roller is subject to is compensated for automatically, without this affecting the functionality of the dirt conveyance channel defined between the brush roller itself and the adjacent enclosing casing to any significant extent.

According to the present invention, these aims are reached in a motor-sweeper embodying the features and characteristics as recited in the appended claims.

Anyway, the advantages and the characteristics of the present invention will be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawing which is a schematical, partial view of a motor-sweeper according to a preferred embodiment of the

present invention.

The general structure of the motor-sweeper is of a substantially traditional kind, as this is illustrated for instance in the afore mentioned IT-A-1 207 081. The machine essentially comprises a chassis 1 provided with wheels (not shown) and a bottom flatbed 2 in correspondence of which there is provided an intake aperture 6 of a channel conveying the dirt from the floor 4 towards a collection bin 5 situated in a rear position. The aperture 6 is substantially communicating with the floor 4 through appropriate baffles 8, which are known also as flaps.

The channel comprises a curvilinear portion 7, which is defined between a brush roller 3, arranged with a substantially horizontal axis in correspondence of the aperture 6, and an adjacent curvilinear front wall 9 provided integrally with the chassis 1.

At least one of its ends, said axis 10 of the brush roller 3 is hinged on to a support lever 11, which is preferably, but not exclusively, a first class lever and has its fulcrum at 12 on the chassis of the machine. In the example being described, the brush roller 3 is hinged on to an end portion 13 of the lever 11, on the opposite end portion 14 of which there is mounted an electric motor 15 controlled by an output 16 of electronic control means 17. These means preferably comprise a micro-processor which may for instance be of the type Texas TMS370C742ANT.

The motor 15 is adapted to rotatably drive the brush roller 3, via appropriate motion transmission means 18, in such a manner that the portion of the brush roller 3 which is in contact with the floor rotates in a direction (in an anti-clockwise direction in the Figure) that is opposite to the direction in which the motor-sweeper is progressing, ie. moving (to the right in the Figure).

In a position that is preferably adjacent to the axis 10 of the brush roller there is hinged at 27 the drive shaft 19 of at least an electric actuator means 20, which may be of a per se known type and comprise a worm-screw type mechanism capable of being driven in a controlled manner by an electric motor so as to correspondingly vary the axial position of the shaft 19. Said actuator means 20 may for instance be of the type A0.01 marketed by SIR S.r.l. In a preferred manner, the longitudinal axis of the shaft 19 is inclined downwards with respect to the front portion of the machine.

The electric motor 15, provided to drive the brush roller, correspondingly drives the input 21 of said electronic control means 17 with a signal that is representative of the electric input of the same motor 15. For instance, such a signal may correspond to the current input of the motor 15. Said electronic control means 17 are then in turn adapted to supply power in a controlled manner to the actuator means 17, via an output that is illustrated schematically at 22 in the Figure, as this will be described in greater detail further on.

At least two micro-switches 23 and 24, or similar devices, are furthermore provided, which are adapted to

drive respective inputs 25 and 26 of the electronic control means 17 with signals that are representative of respective opposite end-of-stroke positions (ie. raised position and lowered position, respectively) of the lever 11 and, therefore, of the brush roller 3.

The electronic control means 17 are programmed so as to be adapted to drive the actuator means 20, when the machine is turned off and standing still, to retract the drive shaft axially in such a manner as to keep the brush roller 3 in a position that is raised with respect to the floor 4 (lever 11 rotated in a clockwise direction in the Figure), so as this is determined by the switch 23 when the latter comes into contact with the lever 11. Under these conditions, the output 16 of the control means 17 preferably keeps the motor 15 inactive.

Furthermore, the control means 17 are programmed in such a manner as to be adapted to drive the actuator means 20, when the machine is started, so as to extend the drive shaft 19 axially in such a manner as to bring the brush roller 3 into a lowered position (lever 11 rotated in an anti-clockwise direction in the Figure) in which it is able to exert a pre-determined operating pressure on the floor surface 4. Under these conditions, the output 16 of the control means 17 drives the motor 15 so as to enable it to rotatably drive the brush roller 3.

Since the above mentioned operating pressure is substantially proportional to the electric input of the motor 15, the latter drives the input 21 of the control means 17 with a corresponding signal, as this has already been said above, that is then compared by the control means 17 with a programmed reference value (which is representative of the desired pressure and is preferably adjustable). The output 22 of the control means 17 drives the actuator means 20 with a resulting error signal in such a manner as to displace the shaft 19 axially (and therefore displace the brush roller 3 accordingly) into such a position as to keep the afore mentioned operating pressure of the same brush roller substantially constant.

Conclusively, the brush roller 3 is automatically displaced by the actuator means 20, under the action of the control means 17, along the arc (indicated at A in the Figure) of a circle having its centre in correspondence of the fulcrum 12 of the lever 11, in such a manner as to ensure that the programmed operating pressure of said brush roller is exerted constantly on the floor surface 4. This occurs as a function of the possible variations in the electric input of the motor 15 as detected by the control means 17.

As a result, in the operation of the motor-sweeper:

a) when the brush roller 3 of the motor-sweeper meets with a bump or a hump on the floor 4, the same brush roller is automatically raised or lowered, respectively, in order to compensate for the corresponding variations in the operating pressure;

b) in any case, even when the floor 4 is flat and smooth, the operating pressure of the brush roller 3 is regulated automatically in the afore described manner in view of compensating for the unavoidable wear-off of the bristles of the same brush roller.

The automatic compensation of the wear-off of the brush roller 3 implies a gradual lowering of the axis 10 thereof, along the afore mentioned arc of a circle A, down to an end-of-stroke point where the brush roller must eventually be replaced. Said end-of-stroke position is determined by the actuation of the micro-switch 24 by the lever 11 when the latter reaches a corresponding angular position. The corresponding signal of the micro-switch 24 drives the input 26 of the control means 17 which in turn react in the most appropriate manner, for instance by alerting the operator, through an appropriate coded indication flashed on an associated display unit provided on the control board of the machine, on the fact that the brush roller 3 is completely worn off.

Upon replacing the brush roller 3, the operation of the motor-sweeper according to the invention can be resumed in the afore described manner.

It should be noticed that the self-regulated displacement of the axis 10 of the brush roller 3 along the arc of a circle A (or in a similar direction having an inclination corresponding to the one of the drive shaft 19, ie. also onward) towards the curvilinear wall 9 of the chassis 1 enables at the same time also the cross-section area of the channel 6, 7 to be automatically kept substantially constant. As a result, not only the mechanical scrubbing action performed by the brush roller 3 on the floor 4, but also the conveyance of the thereby collected dirt towards the collection bin 5 turn out to be substantially constant, ie. substantially unaffected by either the presence of bumps or humps on the same floor or the wear-off effect that the brush roller 3 unavoidably undergoes in use.

It will of course be appreciated that the above described motor-sweeper may be the subject of a number of modifications without departing from the scope of the invention.

For instance, the input 21 of the control means 17 may similarly be driven by any other quantity or parameter that is representative of the operating pressure exerted by the brush roller 3 on the floor 4.

It will also be appreciated that the machine may also include at least an auxiliary brush of the traditional disc-shaped type (not shown), arranged preferably in an advanced position with respect to the brush roller and adapted to convey towards such a brush roller the dirt being collected from the floor.

Claims

1. Motor-sweeper comprising at least a brush roller adapted to be driven by an electric motor to rotate,

in contact with the floor, about a substantially horizontal axis so as to collect the dirt from said floor and convey it to a collecting bin along a channel defined between the same brush roller and a fixed wall, **characterized in that** said brush roller (3) is hinged on to moving support means (11) adapted to be actuated by electric actuator means (20) so as to vary the position of said axis (10) in a direction (A) which is substantially inclined downwards frontally, said motor-sweeper further comprising control means (17) adapted to detect a quantity that is representative of the operating pressure exerted by the brush roller (3) on the floor (4), compare said operating pressure with a corresponding programmed reference value, and drive the actuator means (20) with a resulting error signal, in such a manner as to keep both said operating pressure of the brush roller (3) and the cross-section area of said channel (6, 7) substantially constant.

2. Motor-sweeper according to claim 1, **characterized in that** said quantity representative of the operating pressure of the brush roller (3) is related to the electrical input of the motor (15) driving the brush roller (3).

3. Motor-sweeper according to claim 1, **characterized in that** said actuator means comprise at least an electric actuator (20) driven by the control means (17) with said error signal and adapted to correspondingly vary the axial position of a drive shaft (19) connected to said support means (11).

4. Motor-sweeper according to claim 1, **characterized in that** said support means comprise a lever (11) connected to said actuator means (20) so as to displace the axis (10) of the brush roller along an arc of a circle (A) constituting said inclined direction.

5. Motor-sweeper according to claim 1, **characterized in that** it comprises a micro-switch (23), or similar device, adapted to drive the control means (17) so as to cause the actuator means (20) to be inactivated when the brush roller (3) is in its raised end-of-stroke position.

4. Motor-sweeper according to claim 1, **characterized in that** it comprises a micro-switch (24), or similar device, adapted to drive the control means (17) with a corresponding signal when the brush roller (3) is in its lowered end-of-stroke position.

