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(54) **Improved motor sweeper with elastic regulation of the brush pressure**

(57) A motor sweeper comprising a wheeled frame (1) for supporting a height-adjustable brush (2) of horizontal axis, and a rearward-lying dirt collection bin, said brush being rotated by a motor, there being provided means for measuring a quantity indicative of the pressure exerted by the brush on the surface to be cleaned, and mechanical means (100) for adjusting the height of

said brush; elastic means (200) are associated with said mechanical means (100) in such a manner that the height of the brush is adjusted by the mechanical means (100) if the value of the quantity indicative of the pressure exerted by the brush on the surface lies outside a predetermined range, and by the elastic means (200) if the value of said indicative quantity lies within said range.

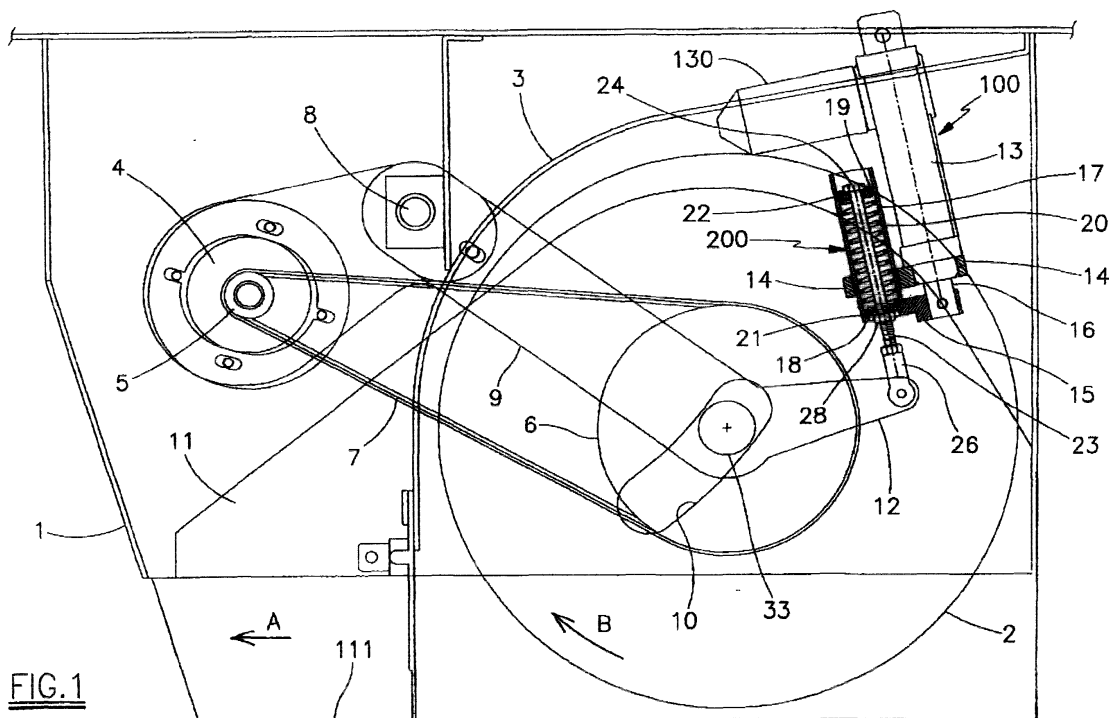


FIG. 1

Description

[0001] This invention relates to improvements in motor sweepers used for cleaning indoor and outdoor surfaces and floors in general.

[0002] For such purposes, motor sweepers have been widely used for some time, they comprising essentially a frame with a driver compartment below which there are provided at least one front lateral conical brush, a steerable wheel to the rear thereof, a rearwardly transverse horizontal cylindrical brush, two drive wheels to the rear thereof, and a rear collection bin for the dirt collected by the cylindrical brush.

[0003] In particular, said cylindrical brush is rotated by an electric motor supported by the machine frame, and is rotatably mounted on a support structure which is hinged to said frame in such a manner as to swing parallel to the longitudinal vertical plane of symmetry of the machine between an inactive position in which it maintains the cylindrical brush raised from the ground, and an active position in which it positions said brush in contact with the ground.

[0004] Said raising and lowering movement is achieved by a lever system controlled by the operator, constant contact between the cylindrical brush and the surface to be cleaned being achieved by the overall weight of the brush and its accessories.

[0005] Again, in most modern motor sweepers elastic means are provided which act together with said overall weight in forcing the brush downwards.

[0006] The still unsolved problem with such motor sweepers derives precisely from the excessive force with which, during cleaning, the cylindrical brush sometimes contacts the surface to be cleaned.

[0007] This gives rise to various drawbacks, such as relatively rapid wear of the cylindrical brush, and excessive heating of its electric drive motor. In addition the excessive force with which the brush sometimes contacts the surface to be cleaned can cause damage to the surface itself, and can be the cause of irregular cleaning of the surface.

[0008] The drawbacks encountered are more serious the greater the irregularity of the surfaces to be cleaned, for example if they present more or less marked undulations and relatively sharp level variations.

[0009] To obviate the aforesaid drawbacks, manufacturers have produced motor sweepers in which the adjustment in brush height is obtained by an electrical actuator, and is effected on the basis of the current absorbed by the electric motor which drives the rotary brush. In particular, when the electric motor absorbs an electric current greater than a predetermined value, the actuator raises the rotary brush by an amount sufficient to reduce the motor current below the predetermined value.

[0010] However, this solution also presents certain drawbacks. In fact the brush height adjustment lags behind the obstacle which it is required to overcome, be-

cause of irregular surface cleaning. Moreover, if the surface is not completely flat, the actuator continuously adjusts the brush height, causing premature wear of the actuator, which tends to fracture.

[0011] The object of this invention is to overcome the drawbacks of the known art within the framework of a rational and reliable solution.

[0012] The invention achieves said object by providing a motor sweeper in which the height is adjusted by mechanical means or elastic means on the basis of a quantity indicative of the pressure exerted by the brush on the surface to be cleaned.

[0013] Specifically, according to the invention, the brush height is adjusted by the mechanical means if the value of the quantity indicative of the pressure exerted by the brush on the surface lies outside a predetermined range, and by the elastic means if the value of said indicative quantity lies within said range.

[0014] In a preferred embodiment, the motor which rotates the brush is an electric motor, for which the value of the electric current absorbed by the motor can be used as the quantity indicative of the pressure exerted by the brush on the surface to be cleaned.

[0015] The special characteristics of the invention are defined in the claims.

[0016] The constructional characteristics and merits of the invention will be apparent from the ensuing detailed description, given with reference to the figures of the accompanying drawings, which illustrate a particular preferred embodiment thereof by way of non-limiting example.

[0017] Figure 1 is a transparent partial side view showing a motor sweeper of the invention, in which the cylindrical brush is shown in its raised or rest position.

[0018] Figure 2 shows a part of Figure 1 on an enlarged scale.

[0019] Figure 3 is a view similar to that of Figure 1, in which the brush is shown in its lowered or working position.

[0020] Said figures, and in particular Figures 1 and 3, show the machine frame 1, above which there is mounted the driver compartment (not shown), and below which a transverse horizontal cylindrical brush 2 and the other elements stated in the introduction are positioned.

[0021] The brush 2 lies between two lateral plates 11 each provided with an arched slot 10 traversed by the respective end part of the shaft 33 of the brush 2.

[0022] External to said plates 11 there are two inclined arms 9, on the lower ends of which the ends of said shaft 33 are mounted, whereas their upper ends are pivoted to the frame 1 on the transverse horizontal axis indicated by 8.

[0023] The brush 2 is rotated in the opposite direction B to the machine advancement direction A by a belt 7 extending endlessly about a driven pulley 6 and a drive pulley 5 rotated by the electric motor 4 fixed to the frame 1.

[0024] Finally, the reference numeral 3 indicates a

curved guide wall which lies between said plates 11, its purpose being to convey the dirt pushed by the brush 2 towards a rear collection bin, not visible in the figures.

[0025] According to the invention, one of said arms 9 is prolonged towards the rear region of the brush 2 by a holed flange 12 which is connected to the frame 1 by the means which enable the brush 2 to be adjusted in height, and which will now be described.

[0026] As shown in Figure 3, these comprise means of mechanical type 100 with which means of elastic type 200 are associated. The means of mechanical type 100 comprise an actuator 13, the casing of which is positioned upwards and is hinged to the frame 1, and which in the illustrated example comprises an electric motor 130.

[0027] A guide bush 14 is projectingly fixed to the body of said actuator 13, a bracket 15 being fixed to the rod 16 of the actuator 13.

[0028] The means 200 of elastic type are contained in said bush 14. In particular, the bush 14 receives, as a free-sliding fit, a hollow cylindrical body 17 which is fixed at its base to said bracket 15.

[0029] At the lower end of the body 17 there is provided a first internal circular rim 18, a second internal circular rim 19 being located in the top end of said body 17.

[0030] The body 17 internally houses a spring 20 compressed between a lower ring 21 and an upper ring 22, these being prevented from escaping from said body by the circular rims 18 and 19 with which the body 17 is provided.

[0031] The rings 21 and 22 are contained as an exact fit in the body 17, through said rings there being inserted as an exact fit a rod 23, of which the upper end carries an enlarged head 24 to prevent escape of the rod 23, and to the lower end there is fixed a nut 28 (with locking nut), which enables the spring 20 to be preloaded, said nut 28 having transverse dimensions less than the inner dimension of the rim 18, as illustrated in the figures.

[0032] The invention is also provided with an electronic system, not shown because of usual type, for controlling the height of the brush 2. Said system comprises an electronic card connected to a sensor able to measure the instantaneous electric current absorbed by the electric motor 4 and to adjust the height of the brush on the basis of the measured current. In particular, according to the invention said control system intervenes only when the electric current absorbed by the motor is outside a determined range. Within said electric current range, the brush height is adjusted only by the elastic means 200.

[0033] The invention operates in the following manner.

[0034] Starting from the situation shown in Figure 1, in which the motor sweeper has its brush raised, the operator starts the machine and activates the lowering of the brush so that it reaches its operating position.

[0035] The actuator 13 operated by the electric motor 130 lowers the brush; specifically, the electric motor 130

completely extends the rod to which the body 17 is fixed. The electronic control system with which the invention is provided measures the current absorbed by the electric motor 130. If said current is less than a predetermined minimum value, this signifies that the brush is not exerting correct pressure on the surface, indicating that the brush is worn. In this case an alarm signal informs the operator of the need to replace the brush. Instead, if the current absorbed by the motor 130 exceeds the predefined minimum value, the actuator withdraws the brush by about 15 mm from its bottom-of-travel position and the operator can commence cleaning of the surface by operating the electric motor 4.

[0036] During the cleaning operation, if the current absorbed by the electric motor 4 exceeds the predetermined maximum value, the brush is exerting too much pressure on the surface to be cleaned. In this case the control system intervenes to cause the actuator 13 to raise the brush by predefined amounts until the instantaneous current absorbed by the motor is just above the predefined minimum value.

[0037] In contrast, if the electric current absorbed by the motor is less than the predetermined minimum value, the control system causes the brush to lower its height.

[0038] The minimum and maximum values of the electric current absorbed by the electric motor 4, these values defining the range within which the brush height is adjusted exclusively by the elastic means, depend essentially on the brush dimensions and the power of the electric motor. In the illustrated example, in which the brush 2 has a length of 80 cm, a diameter of 33 cm and a weight of 5 kg, and the electric motor 4 has a power of 0.5 kW, the end values of said range are 18 A and 30 A respectively.

[0039] Finally, it should be noted that, in certain embodiments of the invention, said spring 20 can be of the variable pitch type. If the surface to be cleaned has a low coefficient of friction, this enables a certain elastic working range to be maintained for the spring, even when the brush is completely lowered.

Claims

1. A motor sweeper comprising a wheeled frame (1) for supporting a height-adjustable brush (2) of horizontal axis, and a rearward-lying dirt collection bin; said brush being rotated by a motor, there being provided means for measuring a quantity indicative of the pressure exerted by the brush on the surface to be cleaned, and mechanical means (100) for adjusting the height of said brush; **characterised in that** elastic means (200) are associated with said mechanical means (100) in such a manner that the height of the brush is adjusted by the mechanical means (100) if the value of the quantity indicative of the pressure exerted by the brush on the surface

lies outside a predetermined range, and by the elastic means (200) if the value of said indicative quantity lies within said range.

2. A motor sweeper as claimed in claim 1, **characterised in that** said motor is an electric motor. 5

3. A motor sweeper as claimed in claims 1 and 2, **characterised in that** the quantity indicative of the pressure exerted by the brush on the surface to be cleaned is the electric current absorbed by the brush operating motor. 10

4. A motor sweeper as claimed in claim 1, **characterised in that** said mechanical means (100) comprise an actuator (13) provided with a fixed element and a movable element, said movable element being operated by an electric motor (130). 15

5. A motor sweeper as claimed in claim 1, **characterised in that** said elastic means (200) comprise a body (17) the interior of which contains as an exact fit two rings (21, 22) between which a spring (20) is interposed, said rings being traversed by a rod (23), of which one end carries an enlarged head (24) preventing withdrawal of the rod (23) from the upper ring (22), and the other end passes through the lower ring (21) to emerge from said body and be fixed to the brush support flange (12). 20
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6. A motor sweeper as claimed in claims 4 and 5, **characterised in that** said body (17) is secured to the movable element of the actuator (13). 30

7. A motor sweeper as claimed in claim 5, **characterised in that** said spring (20) is of fixed pitch type. 35

8. A motor sweeper as claimed in claim 5, **characterised in that** said spring (20) is of variable pitch type. 40

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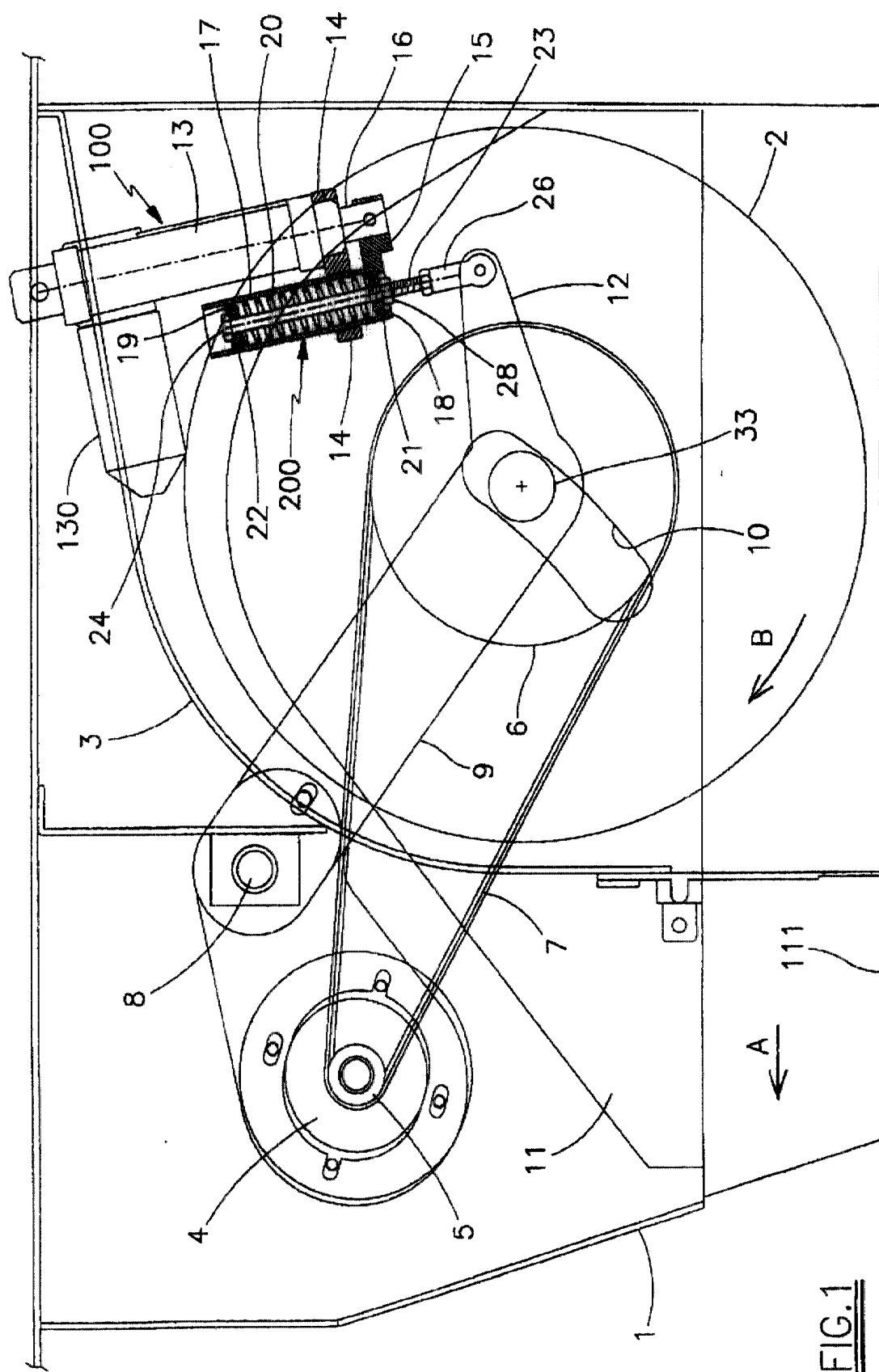


FIG.2

