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Rhodes et al.

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[54] **SWEEPER ASSEMBLY**

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[52] **U.S. Cl.** **15/79,** 15/83

[51] **Int. Cl.** **E01h 1/04**

[58] **Field of Search** ..... 15/49 C, 79, 83, 55

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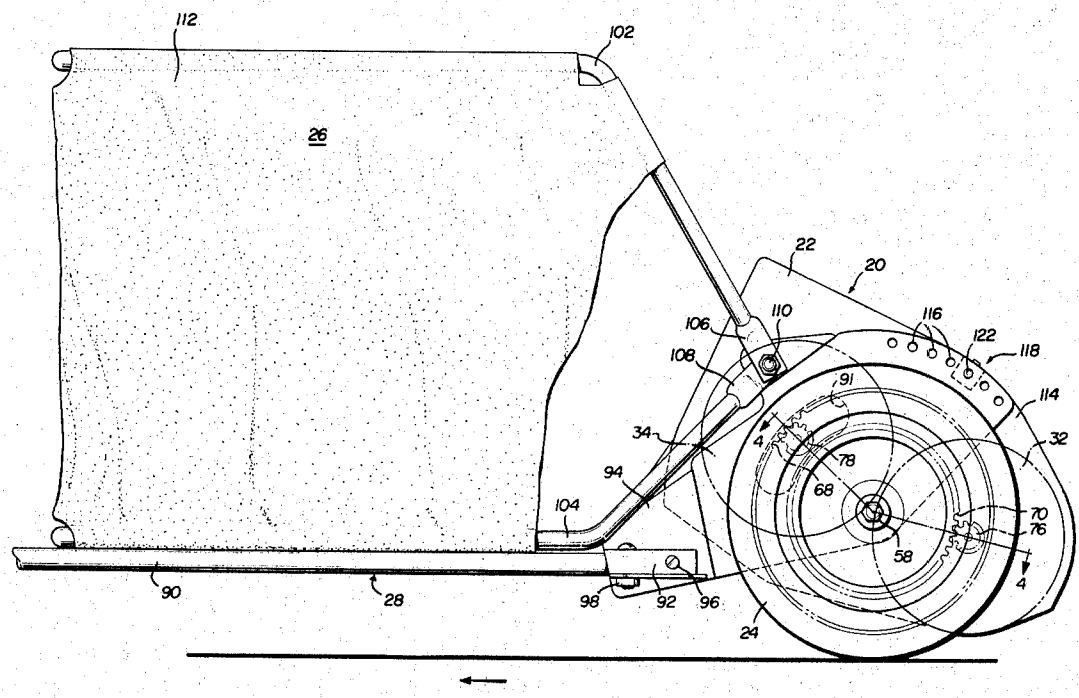
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Primary Examiner—Edward L. Roberts

[57] **ABSTRACT**

This disclosure relates to a positive drive sweeper, such as a lawn sweeper, which permits elevation of the ground sweeping brush without disturbing the load in the hopper. The positive drive includes internal and external planetary bears within the wheel hub which drive the two brushes of the sweeper in opposite directions. The housing is pivotally mounted on the ground engaging wheel axis and the brushes are rotatably connected to the housing, whereby the ground sweeping brush may be raised for hauling by pivoting the housing about the wheel axis, without disturbing the load in the hopper.

16 Claims, 5 Drawing Figures



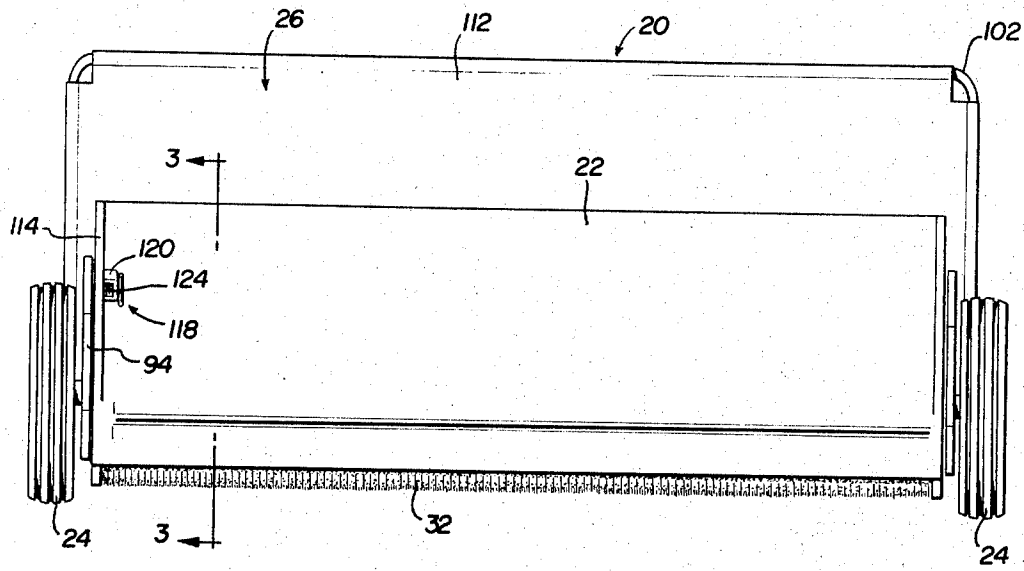
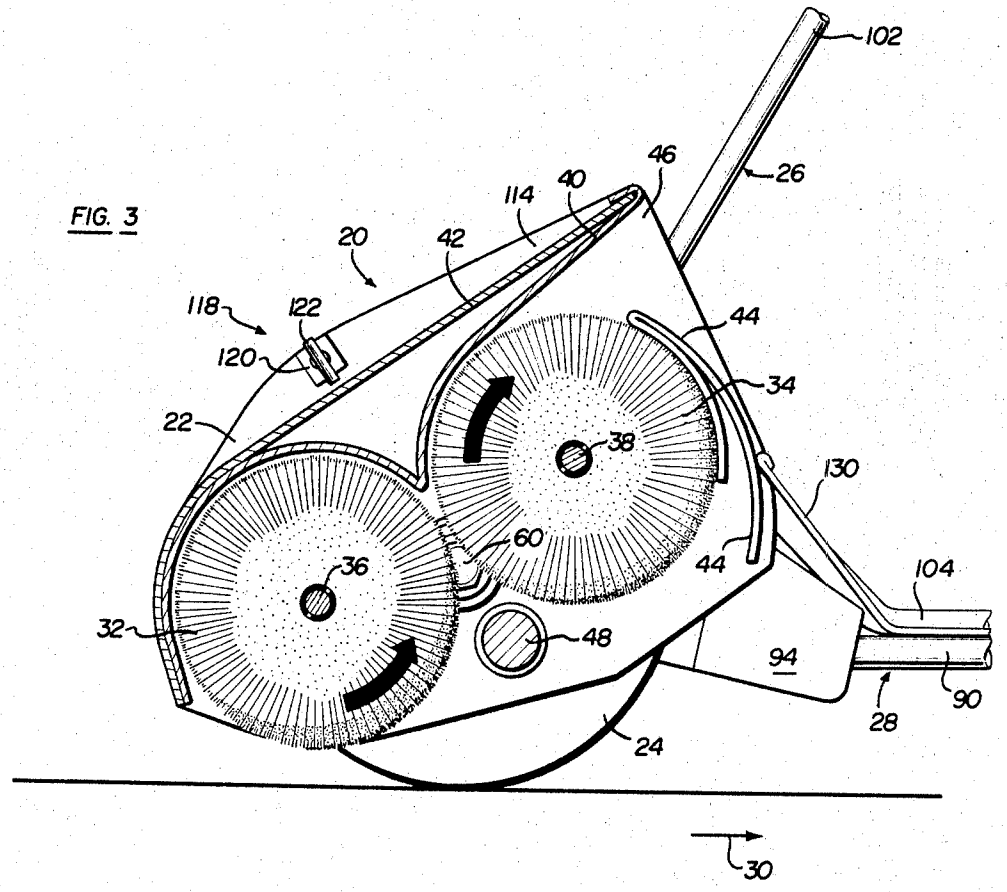

26
112
20
102
3
22
114
120
124
118
94
24
3
32
24

FIG. 1

FIG. 3


102
46
26
114
40
20
42
118
122
120
44
34
22
38
130
60
44
104
36
32
48
94
28
90
24
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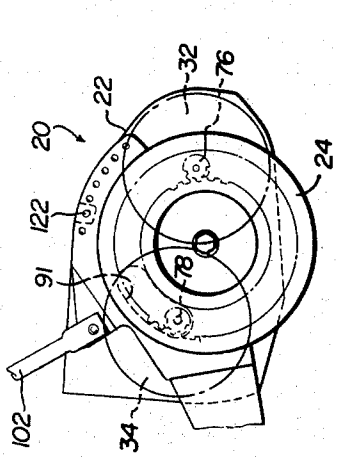
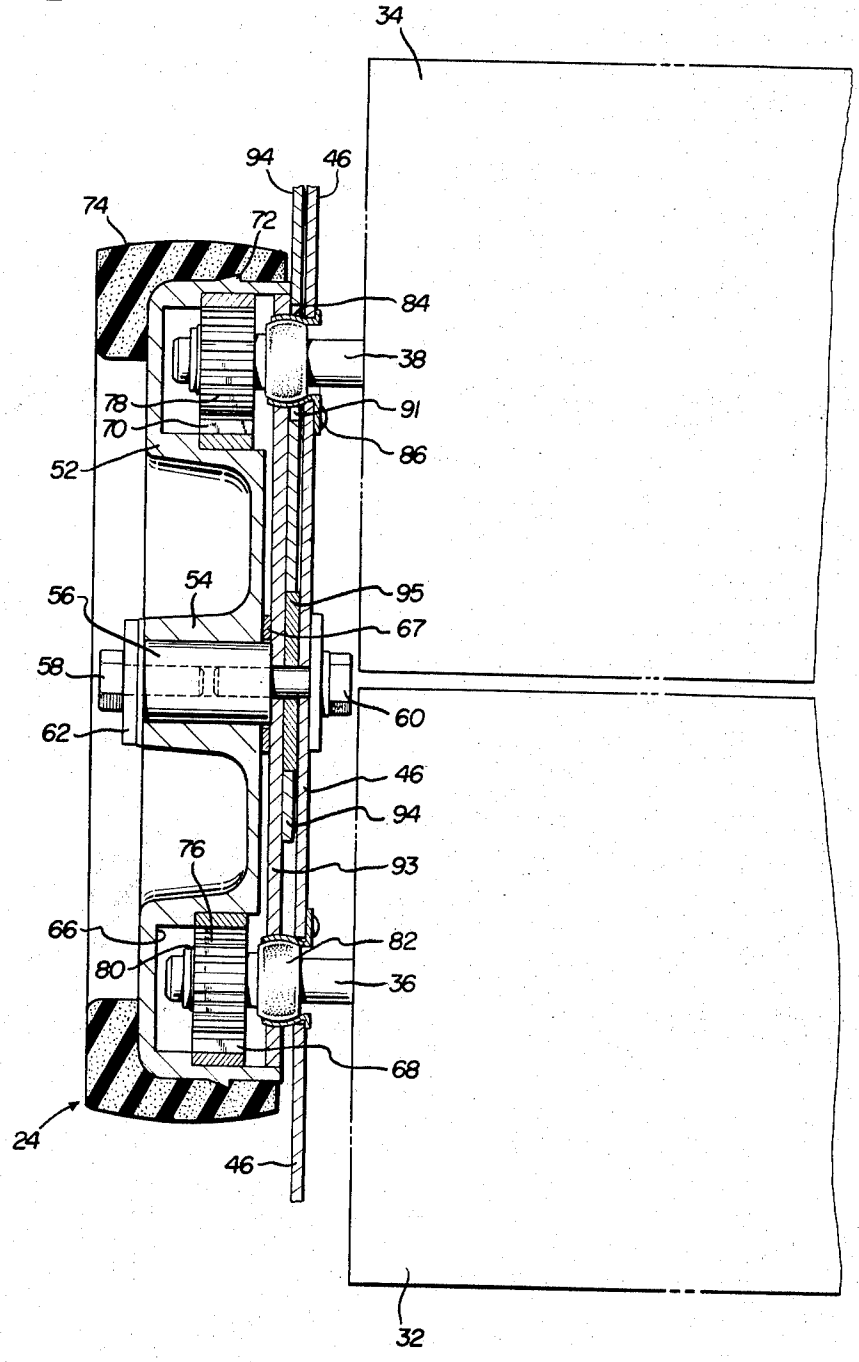

20
22
32
76
24
122
91
78
102
34

FIG. 5

114
32
118
70
76
4
122
116
58
20
91
78
68
22
110
4
24
106
108
96
92
34
94
98
102
104
28
26
112
90

FIG. 2

FIG. 4


34
94
46
74
72
84
38
78
91
70
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52
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62
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76
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24
46
32

SWEEPER ASSEMBLY

FIELD OF THE INVENTION

The disclosed invention relates generally to rotary brush sweepers, such as lawn sweepers, which may be pulled or towed by a vehicle or drawn by hand. More specifically, the sweeper assembly of this invention has two rotary brushes and a positive drive assembly which rotates the brushes in opposite directions.

DESCRIPTION OF THE PRIOR ART

The sweepers disclosed by the prior art generally include a ground sweeping brush which may be driven by the rotation of the supporting wheels or the sweeper brush may be driven by an auxiliary power source, such as a tractor or the like. A second brush or an impeller may be provided, adjacent and above the sweeper brush, to propel the leaves, grass or other debris from the sweeper brush into a hopper, normally located opposite the second brush. The second brush or impeller is preferably rotated at a faster speed than the sweeper brush to prevent build-up of debris between the brushes and to propel the debris into the hopper. The second brush or impeller may also be driven in the opposite direction to the sweeper brush. Examples of multiple stage sweepers include U.S. Pat. Nos. 517,709, 1,177,561, 1,332,429 and 3,591,883, French Patent 501,386, published Apr. 13, 1920 and Canadian Patent 454,105, issued Jan. 18, 1949.

In the multiple stage lawn sweepers disclosed in the prior art, at least one of the brushes or impellers are driven by a belt or chain which is subject to slippage and accidental removal. Another problem with the small prior art lawn sweepers is that the entire frame, including the hopper, must be raised to lift the sweeper brush for transporting the sweeper assembly. The preferred embodiment of the sweeper assembly of this invention includes a positive drive for both of the brushes and the sweeper brush may be lifted or adjusted without disturbing the hopper load. Another important advantage of the disclosed sweeper brush is the simplicity of the positive drive assembly, which is described more fully hereinbelow.

SUMMARY OF THE INVENTION

The sweeper assembly of this invention includes an enclosed housing pivotally supported at the opposed sides on the axis of the ground engaging wheels. A pair of rotary brushes are mounted within the housing to the opposed housing sides and the assembly includes a positive drive rotating the brushes in opposite directions. The brushes include a rotary ground engaging brush which collects leaves and other debris and a second rotary brush having an axis of rotation adjacent and above the ground engaging brush. The second rotary brush transfers and propels the debris collected by the ground engaging brush into a hopper.

In the preferred embodiment of the sweeper assembly, at least one of the wheels includes internal and external planetary gears concentric with the axis of the wheels. The rotary brush shafts have pinion gears meshing with one of the planetary gears, driving the brushes in opposite directions. The pinion gear of the ground engaging brush in the disclosed embodiment meshes with the external rotary gear and the pinion gear of the second rotary brush meshes with the internal planetary gear, such that the second rotary brush is

driven at a greater speed than the ground engaging brush to propel the debris lifted by the ground engaging brush into the hopper and preventing backup of the debris within the housing. In the disclosed embodiment, the wheel includes a hub having an annular channel concentric with the wheel axis. The planetary gears are provided on the radially spaced opposed sides of the channel with the internal planetary gear surrounding the external planetary gear.

As described above, in the preferred embodiment of the sweeper assembly, the ground engaging brush may be raised from the ground, without disturbing the hopper load. In the disclosed embodiment, the housing is tiltably mounted on the axis of the wheels and the brushes are rotatably mounted on the housing, such that the ground engaging brush may be raised by tilting the housing about the wheel axis. In the disclosed embodiment, the housing includes a releasable lock retaining the housing in a predetermined angular position, which sets the position of the ground engaging brush. The housing position lock is preferably adapted to retain the housing in a plurality of positions about the wheel axis, permitting adjustment of the position of the ground engaging brush, depending upon the application of the sweeper and raising of the ground engaging brush to transport the sweeper assembly, all without disturbing the load in the hopper.

The sweeper assembly housing normally includes internal baffles which direct the debris lifted by the ground engaging brush to the second rotary brush and directs the debris propelled by the second rotary brush into the enclosed hopper. In the disclosed embodiment, the housing includes an integral baffle located between the second rotary brush and the hopper defining an opening to the hopper between the top of the housing and the baffle. Because the housing is adapted to be rotated or tilted on the wheel axis, the rearward baffle does not enclose the lower portion of the housing and must be separate from the hopper. In the preferred embodiment, the hopper includes a flexible sealing flap, which is continuous with the bottom wall of the hopper, to prevent debris from escaping from the hopper. The seal is normally biased against the rearward baffle, enclosing the housing chamber. The disclosed embodiment includes a separate draw bar assembly including a fixed frame member connected to the wheel axes to pull or draw the sweeper assembly. The hopper is preferably rotatably connected to the fixed frame members of the draw bar assembly, such that the load in the hopper is not disturbed by movement of the housing, as described above, and the hopper may be unloaded by rotating the hopper about the fixed frame members, preferably over the housing.

Other advantages and meritoreous features of the disclosed sweeper assembly will be more fully understood from the following description of the preferred embodiment, the drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end view of one embodiment of the sweeper assembly of this invention;

FIG. 2 is a side view of the sweeper assembly shown in FIG. 1;

FIG. 3 is a cross-sectional side view of the sweeper assembly shown in FIG. 1, in the direction of view arrows 3—3;

FIG. 4 is a top cross-sectional view of the direct drive for the sweeper assembly shown in FIG. 2, in the direction of view arrows 4—4; and

FIG. 5 is a partial side view of the sweeper assembly, similar to FIG. 2, showing the raised position of the ground engaging brush.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The disclosed embodiment of the sweeper assembly 20 includes an enclosed housing 22, ground traversing or engaging wheels 24, a hopper 26 and a draw bar assembly 28. As shown in FIG. 3, the assembly includes a rotary ground engaging or sweeper brush 32 and a second rotary brush 34 located adjacent and above the sweeper brush 32 within the housing. As the sweeper assembly is drawn in the direction of the arrow 30, the brushes are caused to rotate in opposite directions, as shown by the arrows, to lift leaves, grass and other debris, which is propelled in to the hopper 26. The sweeper brush 32 lifts the debris from the ground and the second rotary brush 34 propels the debris into the hopper. The second rotary brush 34 preferably rotates at a greater speed than the ground engaging brush 32, such that the debris picked up by the ground engaging brush does not accumulate between the brushes and the material is propelled into the hopper, as described hereinbelow.

The ground engaging brush 32 includes a central shaft 36 which is parallel to the axis of the wheels 24. The second rotary brush 34 includes a second shaft 38 which is parallel to the axis of the wheels and above the plane of the sweeper brush 32, as shown in FIG. 3. The housing 22 also includes an upper baffle 40 which is secured to the upper wall 42 of the housing and is shaped to propel the debris lifted by the sweeper brush 32 into the hopper. In the disclosed embodiment, the upper baffle includes a semi-circular portion surrounding the sweeper brush 32 and an arcuate porton partially surrounding the second rotary brush and defining an opening between the baffle 40 and the rearward baffle 44. The rearward baffle 44 is preferably integral with the side wall 46 of the housing and includes an arcuate portion which conforms to the shape of the second rotary brush. The baffles thus define a chamber which generally conforms to the external shape of the brushes and serve to direct the debris into the hopper, as described above. In the disclosed embodiment, a reinforcing tie rod 48 is provided between the side walls 46 to provide rigidity to the housing structure. A second function of the tie rod is to act as a recirculating lower baffle for the sweeper brush 32 and a lower baffle for the interchange of debris from the sweeper brush 32 and the second rotary brush 34.

The preferred embodiment of the sweeper assembly includes a positive drive for the brushes, as described above. The drive assembly is best shown in FIG. 4. In the disclosed embodiment, the wheel 24 includes a hub 52 having a central portion 54 encircling the axis of the wheel. The central portion 54 is rotatably mounted on a sleeve 56, which is internally threaded for securement of the hub to the side wall 46 of the housing. Bolts 58 and 60 retain the hub to the side wall 46 of the housing and washers 62 and 64 may be provided, as shown, to provide bearing support for the hub. In the disclosed embodiment, the hub includes an annular channel 66, as shown in FIG. 4, which is concentric with the axis of the wheel. The radial outer wall of the channel includes an internal planetary gear 68 and the radial inner wall of the channel includes an external planetary gear 70. The hub is retained on the tire portion 74 of the wheel by a plurality of radial barbs 72.

In the disclosed embodiment, the shaft 36 of the sweeper brush 32 includes a pinion gear 76, near the distal end of the shaft, which is received within the channel 66 and meshes with the external planetary gear 70 to provide a positive drive for the sweeper brush 32. Similarly, the shaft 38 of the second rotary brush includes a pinion gear 78 which is received within the annular channel 66 and meshes with the internal planetary gear 68. The planetary gears therefore provide a positive drive for both of the brushes. The pinion gears may be secured to the brush shafts by any suitable means, such as the lock rings 80 shown in FIG. 4. In the disclosed embodiment, each of the shafts include a bearing 82, such as a nylon bearing, which is received within a bearing sleeve 84 secured to the side wall of the housing, as by rivet 86. In the preferred embodiment, the pinion gears 76 and 78 are coupled to their respective shafts through a conventional one-way clutch, not shown, which permits the sweeper to be towed without dragging. The one-way clutch may be any conventional design which allows the unit, when towed, to turn without locking or skidding of the wheels.

The drive assembly shown in FIG. 4 thus provides a positive drive for each of the rotary brushes of the sweeper assembly of this invention. The brushes are rotated in opposite directions because the sweeper brush is driven by the external planetary gear 70 and the second rotary brush is driven by the internal planetary gears 68. Further, the second rotary brush 34 is driven at a slightly greater speed than the sweeper brush 32 because the outer wall of the channel 66, including the internal planetary gear, rotates in teeth per second at a slightly greater speed than the external planetary gear 70. It will also be noted that the brushes are rotatably supported on the housing, such that the position of the brushes may be adjusted by rotating or pivoting the housing about the wheel axis, as described hereinbelow.

The draw bar assembly 28, as shown in FIG. 2, includes a pair of draw bars 90, which may be connected to a tractor or other vehicle to pull the sweeper assembly along the ground, as shown by the arrows 30 in FIGS. 2 and 3. In the disclosed embodiment, an angle 92 is secured to each of the draw bars for securement of the draw bar to the wheels 24. A stationary frame 94 is secured to each of the angles, as shown in FIG. 2, by a screw 96 or other suitable means. The draw bar is secured to the angles, in the disclosed embodiment, by threaded fasteners 98. The stationary frame members 94 are each secured to the wheels by bolts 60, as shown in FIG. 4, and spacer 95 is provided between the stationary frame members and the side walls 46 of the housing, as shown.

In the disclosed embodiment, the frame 94 includes an elongated slot 91, as shown in FIGS. 2 and 3, which receives the shaft 38 and bearing 82, as shown in FIG. 4. The frame 94 is preferably thinner than the spacer 95 to permit relative movement of the frame and side wall 46, as described below and shown in FIG. 5. A wheel debris cover 93 may also be provided to protect the gears, as shown. In the assembly, the bearing sleeve

56 is tightly clamped to the cover 93, which is in turn clamped to the spacer 95 and side wall 46 of the housing by bolt 60. A lose thrust washer 67 is provided between the bearing sleeve 56 and the debris cover 93 to reduce frictional wear between the elements.

The hopper 26 may be of any conventional type. In the disclosed embodiment, the hopper 26 includes upper tubular frame members 102, as shown in FIG. 2, lower tubular frame members 104 and a fabric covering 112, such as canvass. The ends 106 and 108, respectively, of the upper frame 102 and the lower frame 104 are flattened, as shown in FIG. 2, and rotatably secured to the stationary frame members by bolts 110. In operation, the hopper may then be rotated from the position shown in FIG. 2, over the housing 22, to empty the hopper, as is known in the prior art.

As described above, the housing 22 may be rotated or pivoted about the wheel axis defined by the bearing sleeve 56 to adjust the position of the sweeper brush and particularly to raise the sweeper brush 32 to transport the sweeper assembly to a disposal area for the debris collected in the hopper 26. It is particularly important that the hopper load is not disturbed during adjustment of the sweeper brush, as required in the prior art, and that the hopper load does not have to be raised for transportation. The upper wall 42 of the housing in the disclosed embodiment includes a vertical flange 114 parallel to the stationary frame 94, as shown in FIGS. 1, 2 and 3. The stationary frame includes a plurality of apertures 116 with the centers of the apertures 116 defined on an arc generated from the axis of the wheels, as shown in FIG. 2. The housing flange 114 includes a locking or latching means 118 to secure the housing to the stationary frame in a plurality of positions, as described below. In the disclosed embodiment, the latching means includes a boss 120 on the housing flange, as shown in FIG. 1, a lock pin 122, best shown in FIG. 3, and a spring 124 retaining the pin in the boss 120 and biasing the pin into the locking position.

The position of the housing and brushes is adjusted by releasing the lock pin 122, manually pivoting or rotating the housing about the wheel axis and releasing the pin, which is lockingly received within one of the apertures 116. For example, the sweeper brush 32 has been raised in the sweeper assembly shown in FIG. 5 by releasing the locking pin, normally in the position shown in FIG. 2, rotating the housing in the direction of the arrow and securing the latching means as shown in FIG. 5. The sweeper assembly may then be transported, without sweeping, because the sweeper brush 32 has been raised from the sweeper position. Further, and most important, the position of the sweeper brush has been adjusted without disturbing the load in the hopper 26 because the housing is not connected to the hopper. In the disclosed embodiment, a flexible sealing flap 130 is secured to the lower frame 104 of the hopper, which is biased against the rearward baffle 44, as shown in FIG. 3. The sealing flap 130 prevents escape of debris collected within the hopper by sealing the space between the bottom wall and the baffle 44. The sealing flap may be formed of any suitable material, including a synthetic rubber or a plastic material, which is preferably flexible.

It is understood that certain modifications may be made to the sweeper assembly disclosed in the drawings without modifying the important features of this invention. For example, a latching means, such as shown at 118 in FIG. 1, may be provided at both sides of the housing to securely retain the position of the housing. The positive drive for the brushes, best illustrated in FIG. 4, may be provided in one wheel or both wheels, depending upon the size and application of the sweeper. The materials of the sweeper assembly are generally known in the art. The brushes 32 and 34 may be natural or synthetic filament and various metals, including steel, may be utilized for the housing, frame, draw bar and wheel hubs.

In operation, the sweeper assembly is normally drawn along the area to be swept, as indicated by the arrow 30 in FIG. 3. The draw bar 90 may be connected to a lawn power mower or tractor or any other suitable vehicle. The rotation of the wheels rotates the brushes in opposite directions to lift the grass, leaves or other debris to be collected and propels the debris into the hopper 26. The planetary gears 68 and 70 provide a positive drive for both of the brushes 32 and 34 and the second rotary brush 34 is driven at a slightly greater speed to propel the debris collected by the sweeper brush 32 into the hopper.

The position of the sweeper brush 32 is adjusted by releasing the latch means 118 and rotating the hopper to the desired position for the brush 32 and locking the latch means. The hopper load is not disturbed in this adjustment because the housing is not secured to the hopper.

We claim:

1. A sweeper assembly, comprising: ground traversing wheels, at least one of said wheels having internal and external planetary gears concentric with the axis of said wheels, a rotary ground engaging brush having an axis of rotation parallel to the axis of said wheels and having a pinion gear meshing with one of said planetary gears, a second rotary brush having an axis of rotation parallel to the axis of said wheels, above the plane of said ground engaging brush and having a pinion gear meshing with the other of said planetary gears, said planetary gears providing said brushes with a positive drive in opposite directions, and a housing enclosing said brushes and directing the debris collected by said brushes to a collection means.

2. The sweeper assembly defined in claim 1, characterized in that said housing is tiltably mounted on the axis of said wheels and said brushes are rotatably mounted on said housing, such that said ground engaging brush may be raised by tilting said housing about said wheel axis.

3. The sweeper assembly defined in claim 2, characterized in that said housing includes a releasable locking means retaining said housing in a predetermined position and setting the position of said ground engaging brush, said locking means adapted to retain said housing in a plurality of positions about said wheel axis to set said brushes in a predetermined position.

4. The sweeper assembly defined in claim 1, characterized in that said housing includes a baffle located between said second rotary brush and said collection means defining an opening above said second rotary brush and said sweeper assembly including a flexible seal normally biased against said baffle and continuous with the bottom wall of said collection means, retaining debris within said collection means.

5. The sweeper assembly defined in claim 4, characterized in that said collection means is an enclosed hopper and said sweeper assembly includes a draw bar and

stationary frame assembly connected to said draw bar, said hopper pivotally connected to said frame assembly to permit removal of the debris collected within said hopper by pivoting said hopper about said frame assembly.

6. A sweeper assembly, comprising, in combination, a pair of ground engaging wheels, at least one of said wheels having a hub, said hub having internal and external planetary gears concentric with the axis of said wheel, a rotary ground engaging brush on a shaft parallel to said wheel axis, said shaft having a gear meshing with said external planetary gear, a secondary rotary brush on a second shaft parallel to said wheel axis and above the axis of said ground engaging brush, said brushes in close proximity, said second brush shaft having a gear meshing with said internal planetary gear, said planetary gears positively driving said brushes in opposite directions upon rotation of said wheel, whereby debris sweep by said ground engaging brush is transferred by said second rotary brush to a hopper, and a housing enclosing said brushes.

7. The sweeper assembly defined in claim **6,** characterized in that said hub includes an annular channel concentric with said wheel axis receiving said brush gears, said planetary gears defined on opposed radially spaced faces of said channel.

8. The sweeper assembly defined in claim **7,** characterized in that said internal planetary gear surrounds said external planetary gear, such that said second brush is rotated at a greater speed than said ground engaging brush.

9. The sweeper assembly defined in claim **6,** characterized in that said housing is pivotally mounted about an axis concentric with the axis of said wheels and said axels are rotatably connected at opposite ends to said housing, whereby said ground engaging brush may be raised by pivoting said housing about said wheel axis.

10. The sweeper assembly defined in claim **9,** characterized in that said housing includes a releasable stop means retaining said housing in a predetermined position about said wheel axis.

11. A sweeper assembly, comprising: an enclosed, downwardly opening housing having a top wall and side walls, said housing pivotally connected at opposed sides to the axis of a pair of ground engaging wheels, a ground engaging brush within said housing rotatably connected to said opposed housing sides, a second brush within said housing rotatably connected to said opposed housing sides, having an axis of rotation adjacent and above said ground engaging brush, a positive drive means rotating said brushes in opposite directions, whereby debris collected by said ground engaging brush is transferred and propelled by said second rotary brush to a hopper, and an adjustable stop means retaining said hopper in selected predetermined positions about said wheel axis, retaining said brushes in selected positions and permitting raising of said ground engaging brush for transfer of said sweeper assembly.

12. The sweeper assembly defined in claim **11,** characterized in that said sweeper assembly includes a draw bar assembly connected to said wheel axis and said hopper is pivotally connected to said draw bar assembly, whereby said housing may be pivoted about said wheel axis to raise said ground engaging brush without changing the position of said hopper.

13. The sweeper assembly defined in claim **11,** characterized in that said positive drive assembly comprises internal and external planetary gears concentric with said wheel axis and said brushes each including a pinion gear meshing with one of said planetary gears, rotating said brushes in opposite directions.

14. The sweeper assembly defined in claim **13,** characterized in that at least one of said wheels includes a hub assembly having said planetary gears, said internal planetary gear surrounding said external planetary gear.

15. The sweeper assembly defined in claim **14,** characterized in that the pinion gear of said ground engaging brush meshes with said external planetary gear and the pinion gear of said second rotary brush meshes with said internal planetary gear, whereby said second brush is rotated at a greater speed than said ground engaging brush.

16. The sweeper assembly defined in claim **11,** characterized in that said housing includes integral baffle means directing the debris propelled by said brushes to said hopper and defining an opening in said housing to said hopper and a flexible sealing flap continuous with the bottom wall of said hopper and normally biased against said baffle means preventing the escape of debris from said hopper.

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