United States Patent

[11] 3,604,051

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[54] **POWERED SWEEPING MACHINE**
9 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **15/340,** 15/83, 15/352
[51] **Int. Cl.** **E01h 1/04**
[50] **Field of Search** 15/83–87, 320, 340, 352

[56] **References Cited**

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Primary Examiner—Edward L. Roberts
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ABSTRACT: A powered sweeping machine having a sweeping brush and a dust receptacle to receive swept material and including lifting arms to raise the dust receptacle from a working position to position wherein it clears high obstacles for dumping. A forward curb brush is raised with the receptacle so that it is not in the way during the dumping operation. The dust receptacle is divided into an upper filter compartment and a lower compartment. A door arrangement for the dividing wall between compartments is utilized to permit dumping material from the upper compartment into the lower compartment. Clamshell-type doors on the main opening of the receptacle are used to close the opening when the receptacle is raised to its high listed position to prevent material from being discharged until the receptacle is in proper dumping position. The curb-brush mounting to the receptacle includes structure to permit it to move in several different directions and to swing out of the way of obstructions. The sweeping machine is powered through the use of a hydraulic motor with the wheel mounted directly on the shaft for the hydraulic motor to simplify mounting construction.

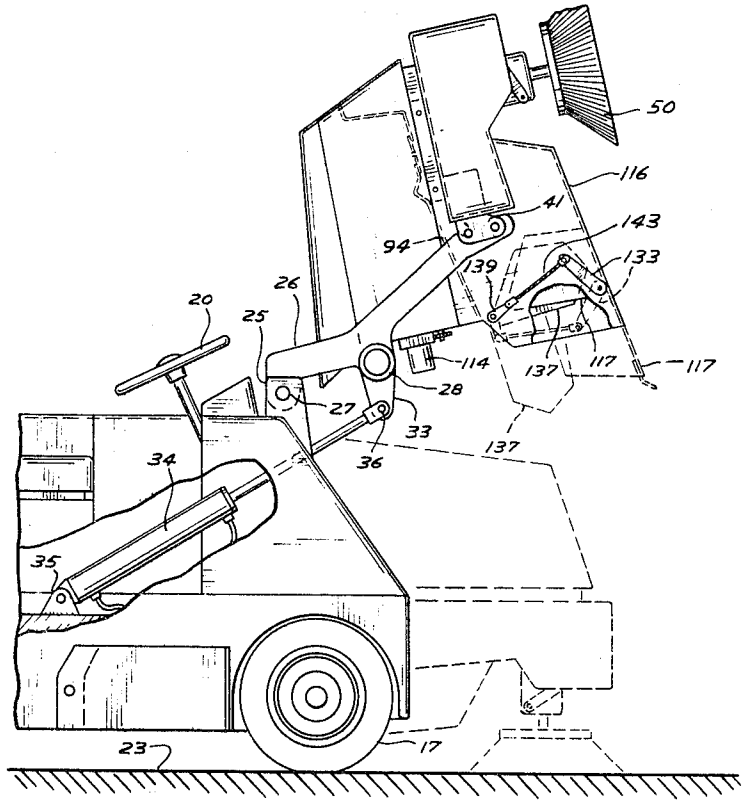

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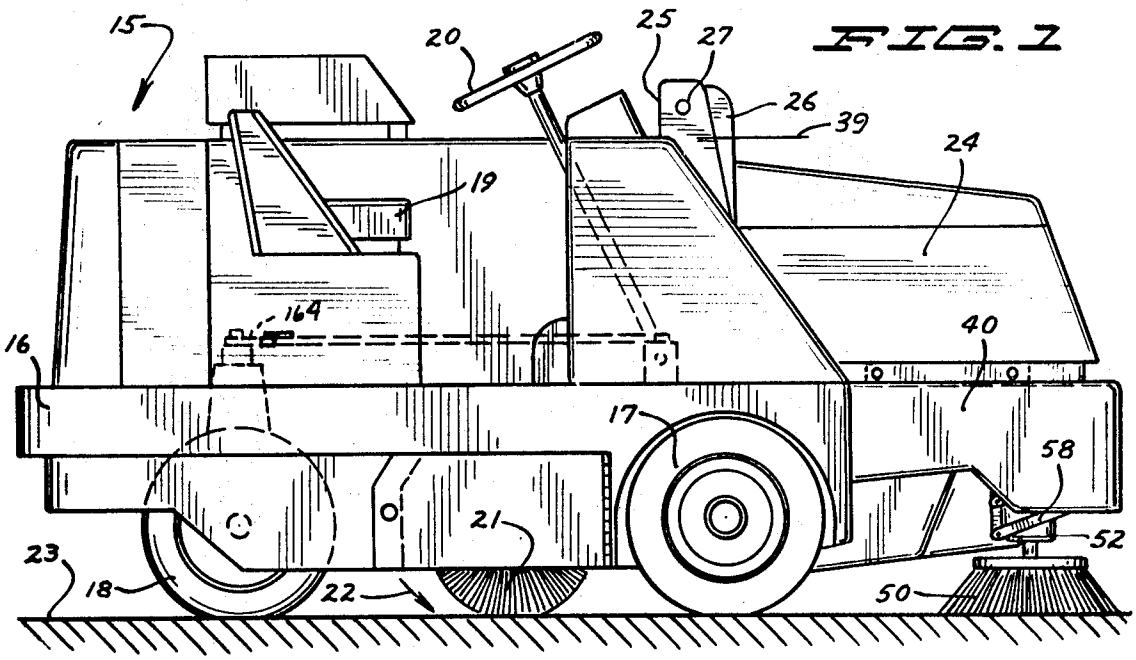
FIG. 1



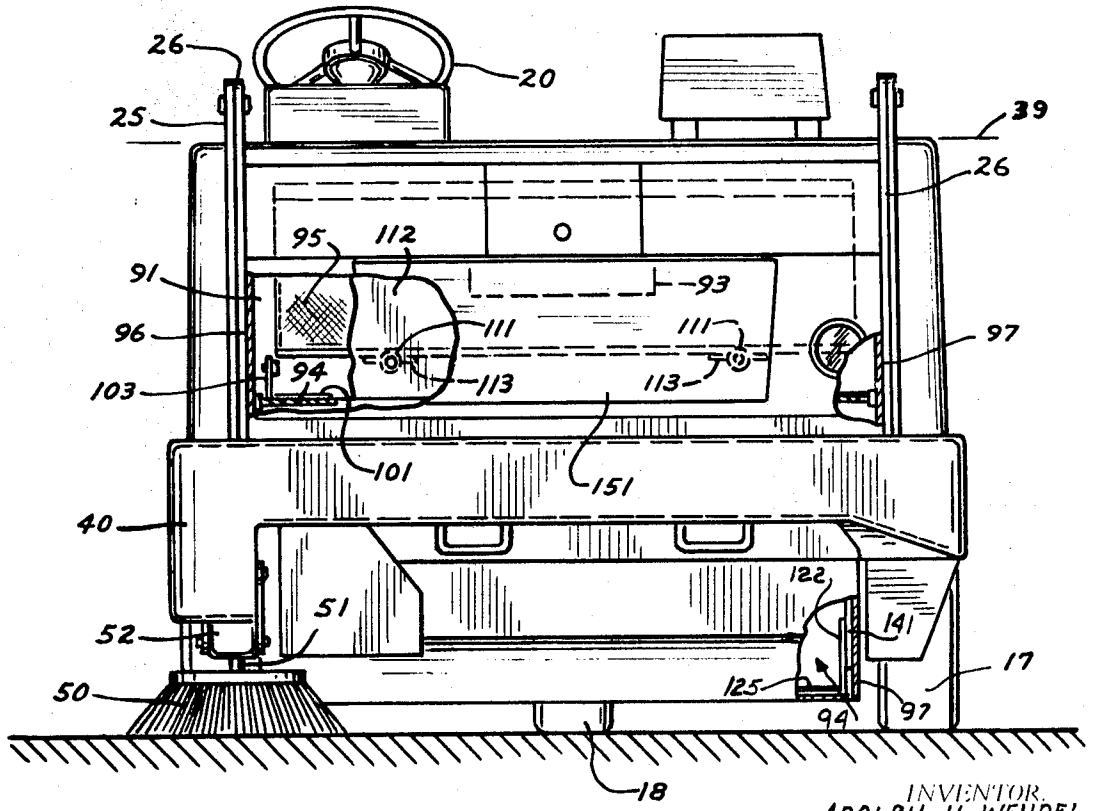


FIG. 2

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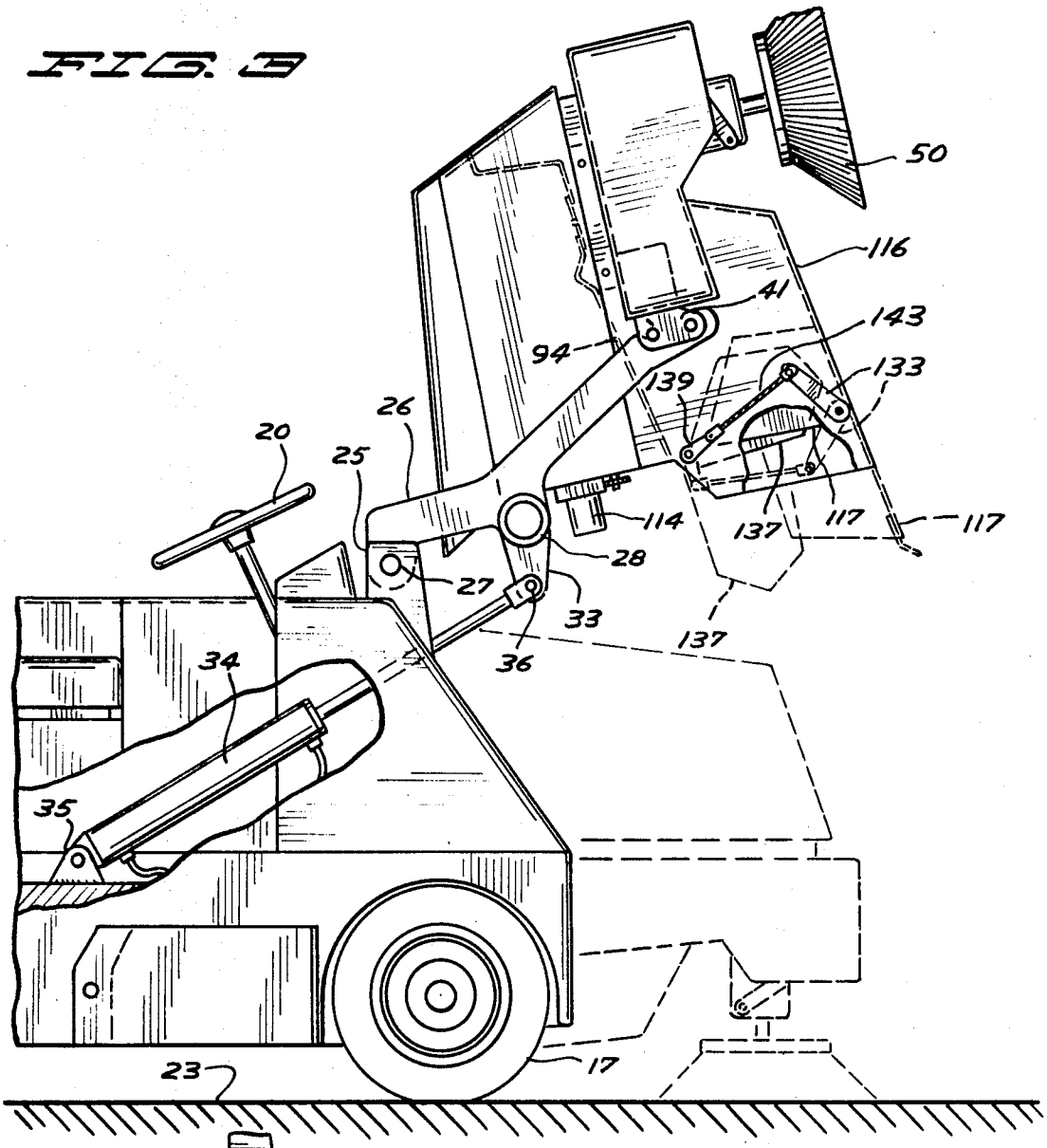
FIG. 3



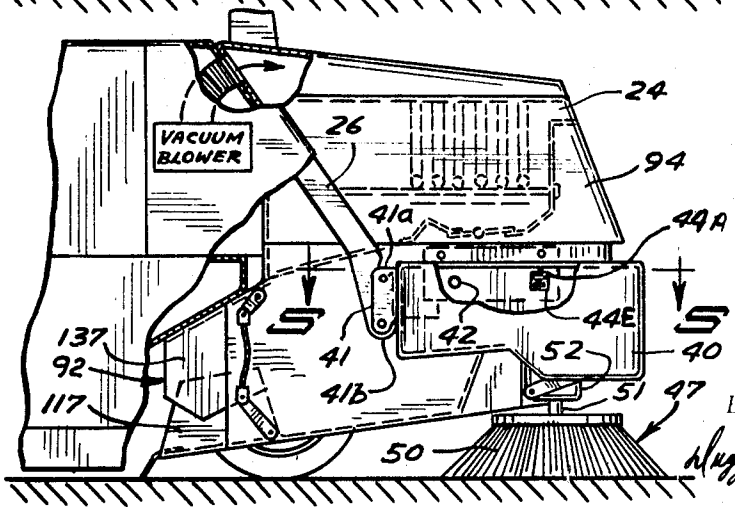


FIG. 4

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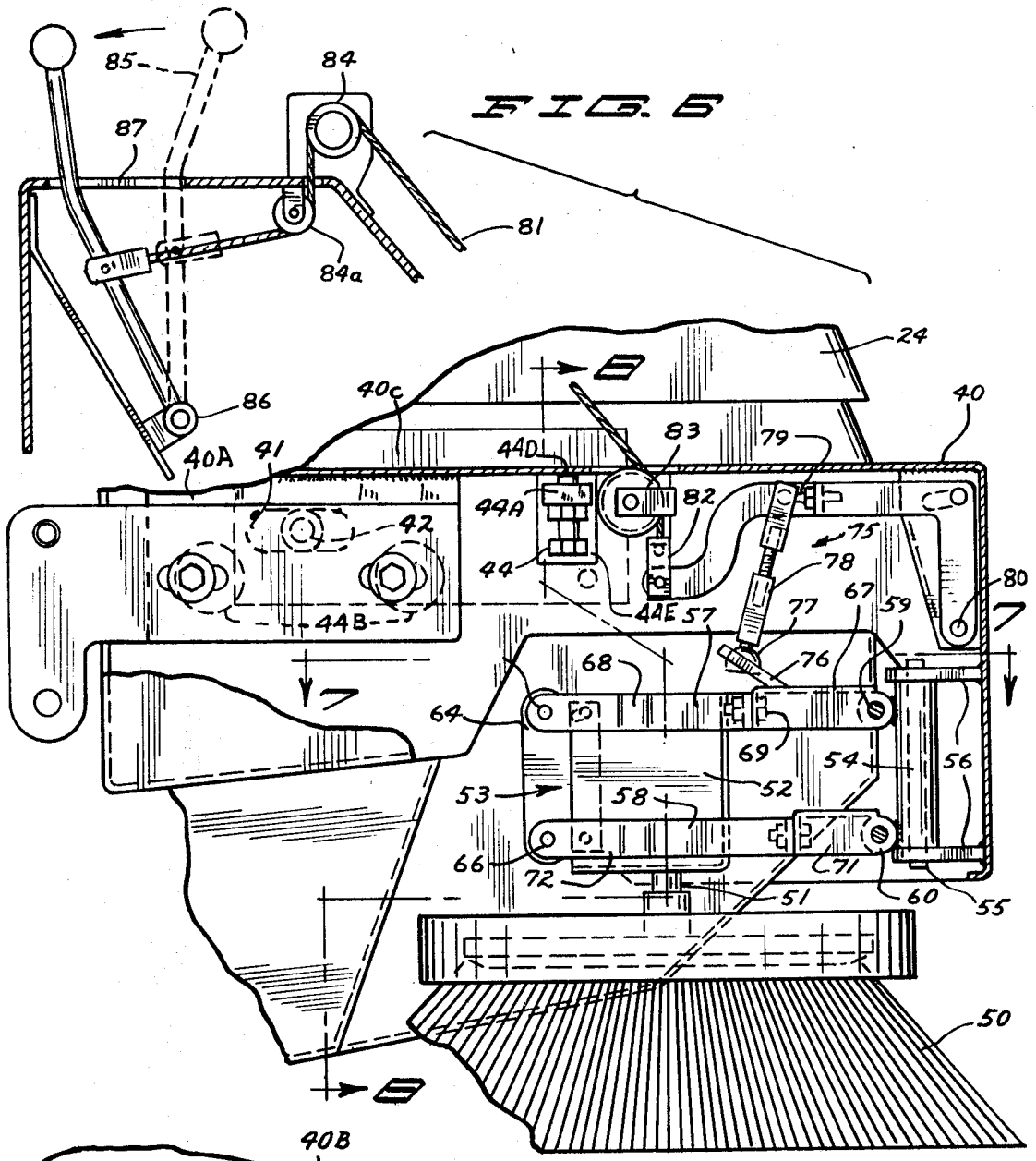
FIG. 6



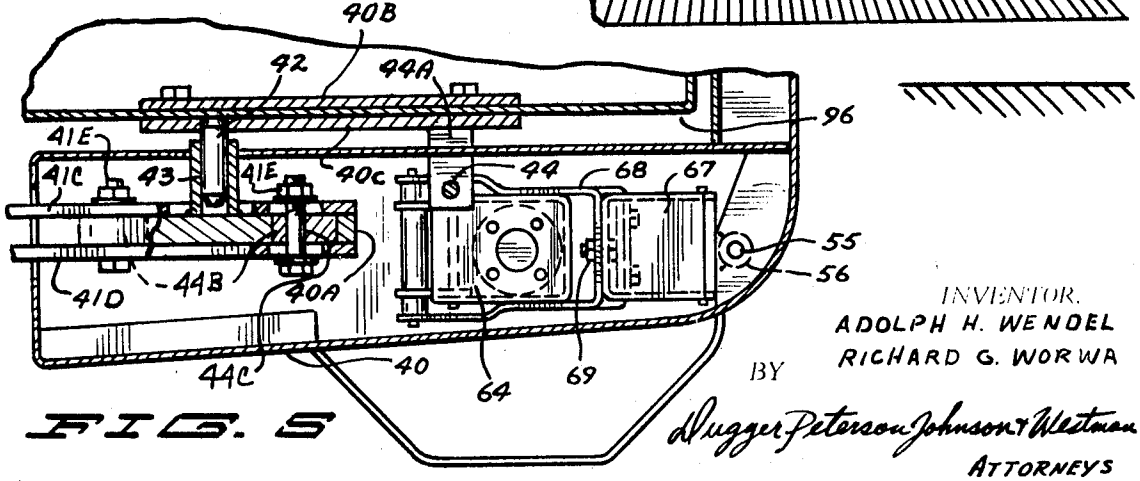


FIG. 5

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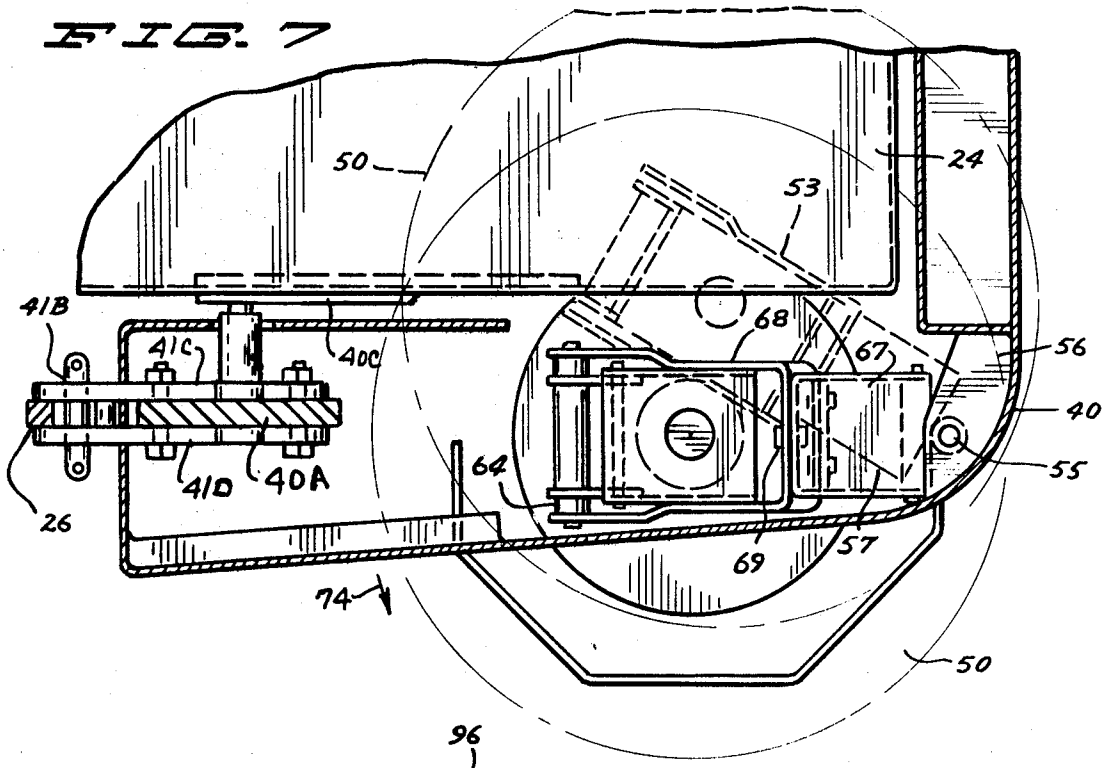
FIG. 7



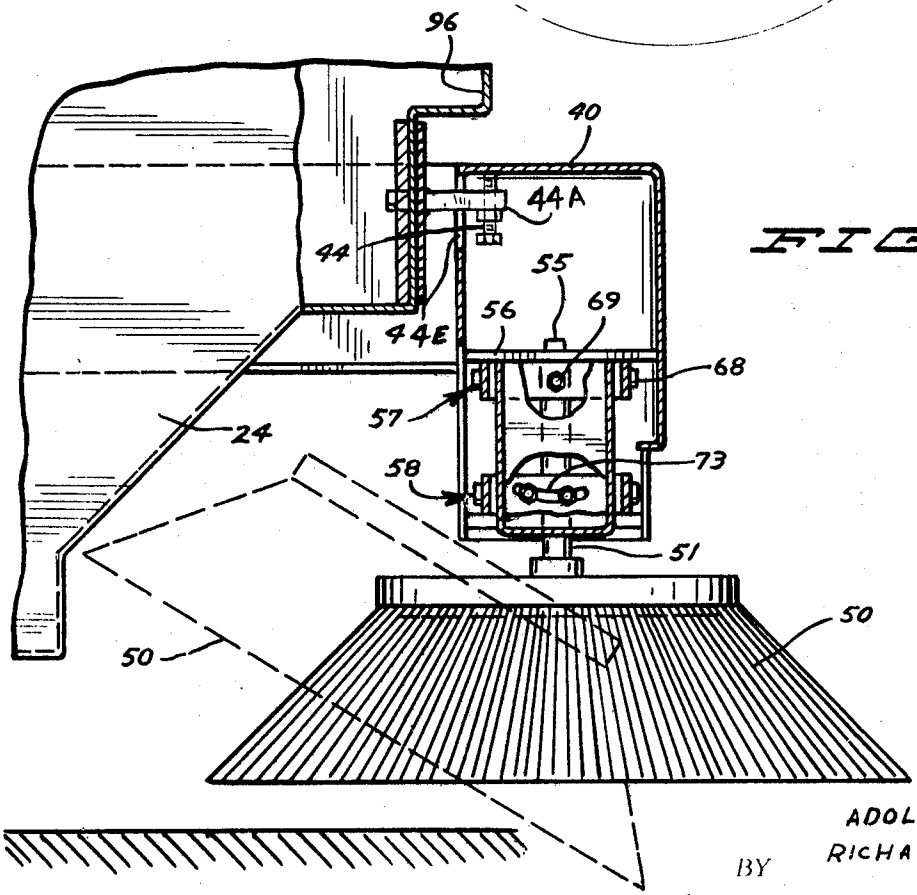


FIG. 8

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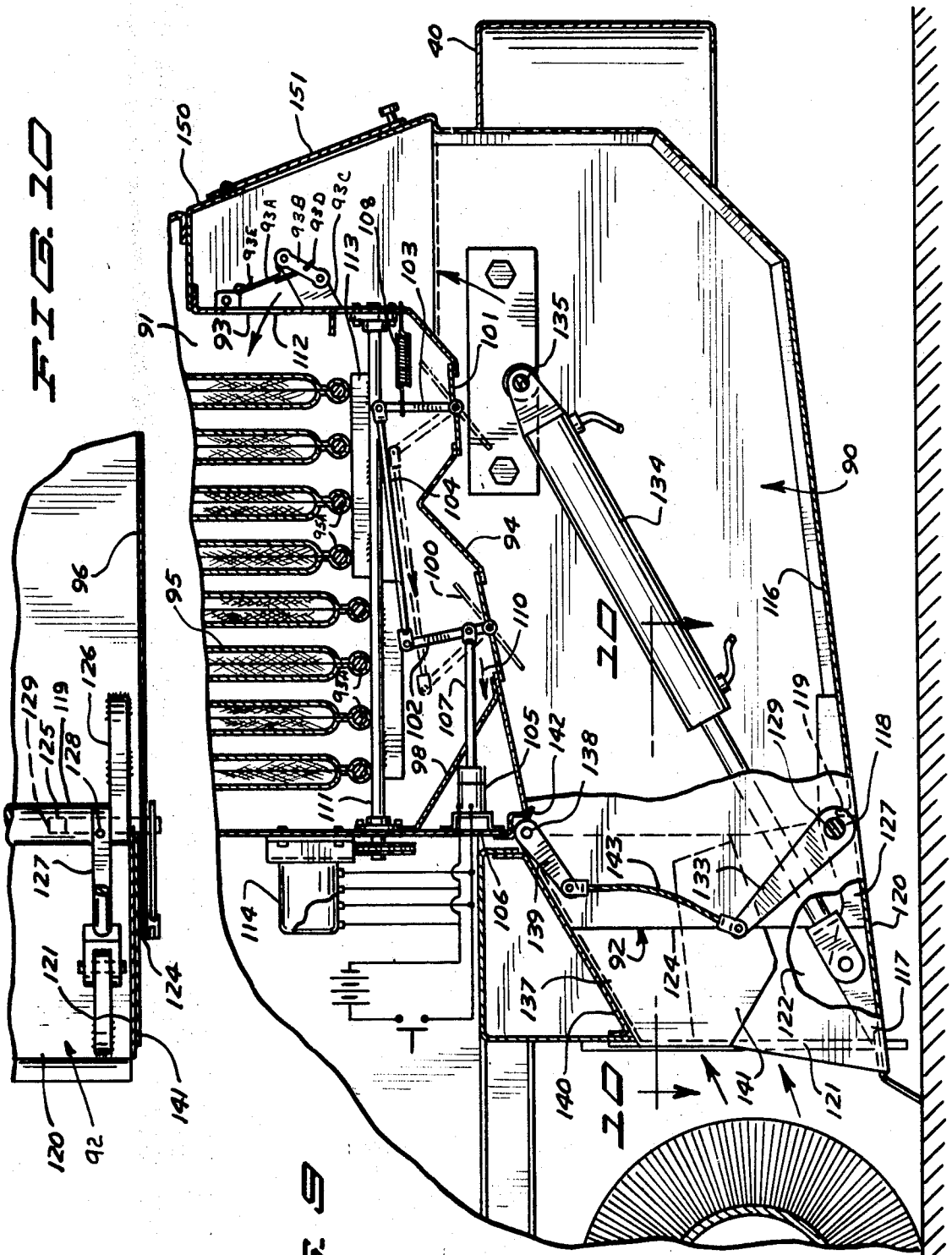

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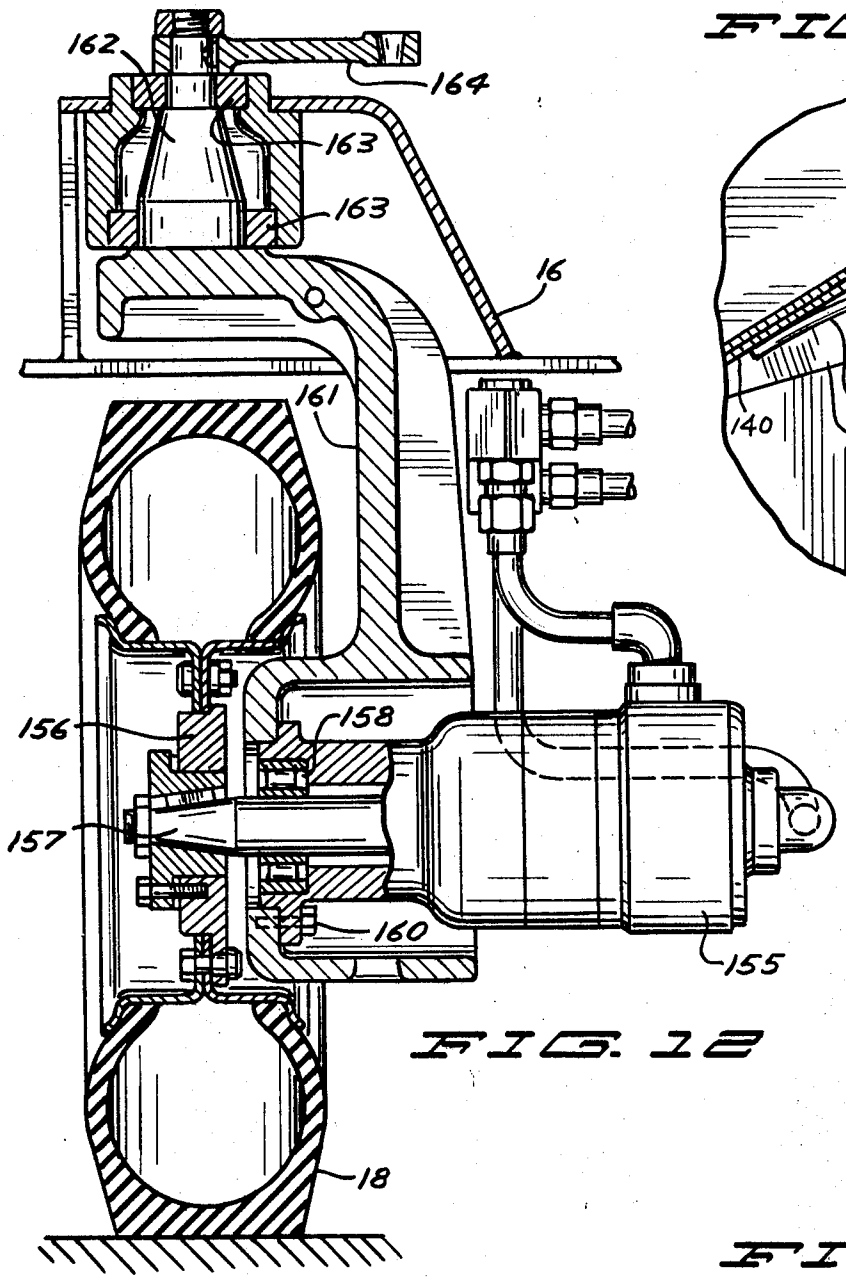


FIG. 12

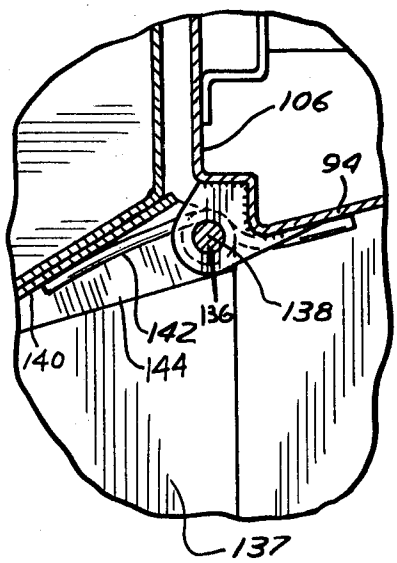
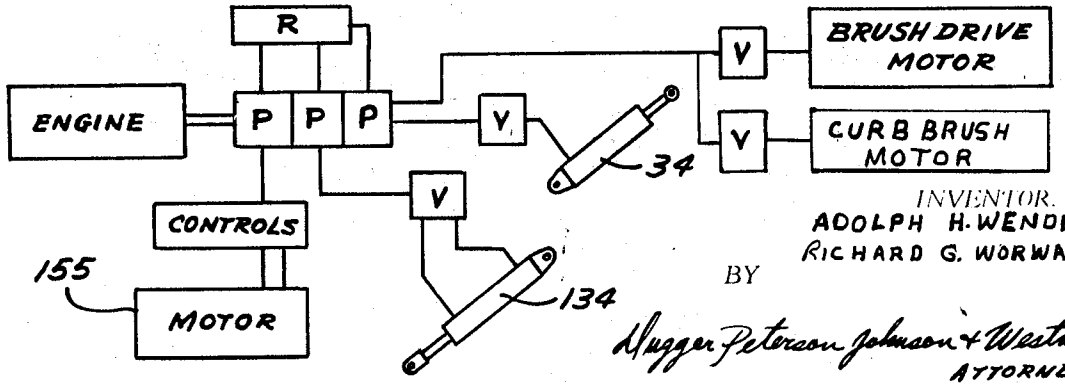


FIG. 11

FIG. 13



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POWERED SWEEPING MACHINE

SUMMARY OF THE INVENTION

The present invention relates to a powered sweeping machining having a high lift system for raising a debris receptacle for emptying, and including unique means for mounting the debris receptacle onto the lift arms and for mounting a curb brush so that the curb brush is raised with the debris receptacle. Additionally, the invention comprises features of the debris receptacle itself including a door arrangement made so the receptacle can be closed when it is raised to its dumping position. The receptacle is divided and made so that an upper receptacle can be selectively dumped into the lower receptacle, and at the same time filter bags in the upper receptacle can be shaken to remove dust clinging to the outside of the bags.

To simplify propulsion, the drive wheel for the machine is mounted directly onto the output shaft for a hydraulic motor used to drive the wheel.

Another feature includes the use of a heavy frame to mount the debris receptacle, and pivotally mount the receptacle to this frame.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a sweeping machine made according to the present invention;

FIG. 2 is a front elevational view of the device of FIG. 1;

FIG. 3 is a fragmentary side elevational view of the device of FIG. 1 showing the debris receptacle in its raised dumping position;

FIG. 4 is a fragmentary side elevational view showing the mounting between lift arms and the debris receptacle of the device of FIG. 1;

FIG. 5 is a fragmentary sectional view taken as on line 5—5 of FIG. 4;

FIG. 6 is an enlarged side elevational view showing the curb-brush mounting of the device of FIG. 1;

FIG. 7 is a sectional view taken as on line 7—7 of FIG. 6;

FIG. 8 is a sectional view taken as on line 8—8 in FIG. 6;

FIG. 9 is a fragmentary vertical sectional view of the debris receptacle made according to the present invention;

FIG. 10 is a sectional view taken as on line 10—10 in FIG. 9;

FIG. 11 is a fragmentary enlarged sectional view of a mounting for an upper door used with the hopper of FIG. 9;

FIG. 12 is a vertical sectional view of a single drive and steerable wheel used with the machine of the present invention; and

FIG. 13 is a schematic representation of a hydraulic circuit used to drive the components of the machine of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A sweeping machine illustrated generally at 15 comprises a frame member 16 mounting a pair of spaced-apart idler wheels 17 at the forward portions of the machine, and a single center steering and drive wheel 18 at the rear portions of the machine. An operator seat 19 is provided as is a steering wheel 20 for steering the wheel 18 about a vertical axis through a suitable linkage. The steering gear is of the automotive type and controls a drag link which in turn controls the position of the wheel 18 about its vertical axis. A cylindrical sweeping brush 21 is rotatably mounted about a transverse axis and is powered from a suitable engine (shown schematically in FIG. 13) so that it rotates in direction as indicated by the arrow 22 to move dust and debris from a surface 23 toward and into a debris collector and filter hopper assembly 24. The brush is powered with a hydraulic motor 29 also shown schematically in FIG. 13.

The frame member 16 has a pair of upright supports 25, 25 spaced apart on opposite sides of the machine and forming supports to which lift arms 26, 26 are pivotally mounted as at

27. Lift arms 26 are joined together with a cross tube 28 and an actuator arm 33 is attached to the tube 28. A hydraulic cylinder piston assembly 34 is used for controlling raising and lowering of the arms 26 about the pivot 27. The cylinder assembly 34 is attached to a bracket 35 at the base end thereof, and the bracket 35 in turn is attached to the frame 16 of the machine. The rod end of the cylinder is attached as at 36 to the arm 33. The hydraulic cylinder piston assembly 34 is controlled in the usual manner with a valve controlling flow from a pressure source so that upon extension, the lift arms 26 will be raised and upon release of the valve, the lift arms will lower to working position.

The lift arms in turn support a U-shaped frame assembly 40 through brackets 41 at the outer ends of the arms. The frame assembly 40 is made so that it extends around the sides and front of the hopper 24.

The hopper assembly 24 is mounted to the frame assembly 40 with a pivot pin 42 on each side of the hopper. The pivot pins 42 are fastened to plates 40C which are each clamped onto the sidewalls of the hopper with an interior plate 40B. The pins 42 are rotatably mounted in bosses 43 which are fixed to plate 40A. The plates 40A are fixed to the top wall of frame 40 so that the hopper can tilt about this pivot pin during use. A hopper-tilt-limiting feature is provided in the form of an extension 44A on plate 40C and in which an adjusting screw 44 is threadably fastened. The tilting of the hopper is controlled by screwing screw 44 in or out and locking it in position by tightening a locking nut provided.

When the frame 40 is lifted by the arms 26, the hopper will also be lifted. The hopper will not pivot about the pins 42 an unlimited amount due to the restrictive action of screw 44 in extension 44A striking the top wall of frame 40, as at 44D in FIG. 6 on one hand and extension 44A being restricted by contact with the bottom edge of the slot 44E on the inner wall of frame 40 on the other hand.

The connection is made with brackets that are adjustably fixed to the frame 40. The brackets each include one stationary pin 41A and a removable pin 41B. The pin 41A fits within a notch in the aligning arm 26 and the pin 41B is passed through an opening in the arm and through openings in the bracket members themselves. The brackets are each made of spaced-apart plates 41C and 41D on opposite sides of plate 40A, and the ends of the arms 26 fit between the bracket plates. The frame 40 is thus securely held onto the arms and will not pivot about either of the pins 41A or 41B. The bracket plates 41C and 41D are attached to the frame 40 by means of bolts 41E through said plates 41C and 41D and anchor plate 40A. Frame 40 adjusting means are built into this assembly by having cams 44B operate within plate 40A through conventional key means 44C between cam-adjusting bolts 41E and the cams. When the cams are rotated the relative position of plates 41C and 41D changes with respect to plate 40A. This arrangement allows for vertical adjustment of frame 40 relative to the arms as well as fore and aft adjustment. When the proper adjustment is realized, the nuts on the adjusting bolts 41E are tightened. This will clamp the bracket plates 41C and 41D tightly to the plate 40A and leave the pivot pins 42 in a certain location. At this point the hopper can be adjusted to obtain the proper clearance between the edge of lower door 117 most closely adjacent the sweeping brush 21 and the surface over which the machine is moving. Finally the hopper can be adjusted (leveled transversely) by having the hopper in the proper position before tightening the bolts that hold the hopper walls securely between plates 40B and 40C.

The frame assembly 40 thus moves with the arms as they are raised or lowered by the hydraulic cylinder assembly 34. The frame 40 is also used for mounting a curb or front corner brush 47. The front corner brush is used for increasing the effective sweeping width of the machine and for sweeping along vertical walls and gutters and the like.

The curb brush itself is indicated at 50 and is of the conventional design having a hub mounted on and driven by an upright output shaft of a hydraulic motor 52 of usual design.

The motor is mounted into a brush-mounting frame illustrated generally at 53. The mounting frame includes a base member 54 which includes members to pivotally mount it with a pin 55 to aligning bracket members 56 fixed to the frame 40. The bracket members 56 are adjacent one forward corner of the frame 40 and the mounting frame 53 for the brush extends rearwardly behind the pivotal mounting of the pin 55. The base member 54 mounts a pair of independent two-section links. There is a top link assembly 57 and a lower link assembly 58. The top link is pivotally mounted as at 59 to base member 54 and the lower link is mounted as at 60 to base member 54. The two link assemblies 57 and 58 are held together at their outer ends by a bracket 64 pivotally mounted as at 65 to link assembly 57 and as at 66 to link assembly 58. The bracket 64 is used for mounting the hydraulic motor 52. The link assembly 57 has a base section 67 and a bifurcated outer end section 68. The two sections 67 and 68 are bolted together as at 69. The single bolt 69 forms a horizontal pivot about which the outer section 68 will move with respect to the inner section 67.

The lower link assembly 58 is also in two sections, and has an inner section 71 and an outer section 72 which also is bifurcated and is attached to the inner section. The outer section 72 has an arcuate slot 73 therein and a bolt passes through this slot and is fastened to the inner section 71. The outer section of the links, as well as bracket 64 and motor 52, can be pivoted about the bolt 69. The brush can be fixed in different angular positions as shown in FIG. 8 to meet existing circumstances. The brush can thus be cocked at an angle to the surface 23 so that the edge of the brush will work into a groove or corner, or the brush can be made to work on a sloping surface. This adjustment is very easy to make. The entire brush-mounting assembly moves from side to side about pin 55. It normally urges itself toward the outside of the machine as indicated by the arrow 74 because of the forces on it as it rotates under power from the motor 52 and also due to spring means (not shown). A stop member is provided to limit its outward travel. When an obstruction is encountered, the brush can swing inwardly as shown in dotted lines in FIG. 7 to avoid the obstruction. The brush will float upwardly over obstructions as well, through the parallel link assemblies 57 and 58. The brush moves up or down parallel to its initial position because of the parallel links.

The brush 50 can also be lifted out or working position through a link assembly shown generally at 75. A bracket 76 is attached to the top link assembly 57 and a ball joint connection 77 is used between the bracket and a lift link 78. The lift link in turn is attached to an arm 79 through a ball joint. The arm 79 is pivotally mounted as at 80 to a bracket on the frame assembly 40. The outer end of the arm 79 is connected to a cable 81 with a clip 82. The cable passes over pulleys 83, 84 and 84A to a control-handle assembly 85 mounted on the machine frame. The control-handle assembly is pivotally mounted as at 86 to the frame and it extends through a lock slot 87 of the usual type so that the handle can be locked in its raised position shown in solid lines with the brush 50 raised, or can be moved to position shown in dotted lines with the brush 50 in working position. The brush can thus be lifted or lowered as desired for working.

The link 78 is adjustable in length to make for proper adjustment of the assembly, and also the ball joint connections for the link permit the unit to slide to the side as shown in dotted lines in FIG. 7 to avoid obstructions without damaging the link 78. The connection between link 78 and arm 79 is sufficiently flexible to permit this type of movement.

The hopper assembly or dirt receptacle 24 is divided into two sections as shown in FIG. 9. The hopper has a lower debris-receiving section 90 and upper filter-housing section 91 formed by a dividing wall 94. The machine also utilizes a vacuum blower of the type shown in U.S. Letters Patent No. 3,160,908 which connects through a port as shown in FIG. 9 of that patent to the upper section 91 (see FIG. 4 for schematic showing). When the vacuum blower is operating air flows into the main hopper opening 92, and forwardly through the lower section 90 and passes through an opening 93 which is formed in an upright portion 112 of the divider wall 94. Air will then pass through filter bags 95 positioned in the upper compartment or section 91 and out through the vacuum opening. The filter bags 95 are depending pockets as shown in U.S. Letters Patent No. 3,160,908 and separate the finer dust carried by the air flow and which is not dropped directly into the lower section 90. A door 93A for opening 93 is held open through a fusible link 93B which will melt if fire occurs. A torsion spring 93E is provided to urge the door 93A closed if the link melts. The link is held in a suitable bracket 93C and a hook 93D attached to the door contacts the link. Closing off the door prevents fire from spreading to the filter bags. This door arrangement is shown in greater detail in U.S. Letters Patent No. 3,304,572.

The hopper assembly 24 includes a pair of sidewalls 96, 97 which are spaced apart as shown. The divider wall 94 forming a barrier wall between the upper and lower sections or compartments extends between these sidewalls and is fixed thereto. The barrier wall 94 has a lower irregular portion, and an upright portion 112 through which the opening 93 extends. At the rear portions of the hopper, a sloping shield member 98 is provided. The barrier wall as shown is divided in several sections which are inclined with respect to a horizontal line when the hopper is in lowered position. This is so that dust dropping from the exterior of filter bags 95 will slide along these inclined sections toward one of a pair of transversely extending butterfly-type doors 100 and 101 respectively. The doors 100, 101 are pivotally mounted at their centers to the opposite sidewalls 96, 97, respectively, on suitable bushings. The doors are made so that they will pivot about a center axis extending transversely of the hopper.

The door 100 has a first arm 102 attached thereto and the door 101 has an arm 103 attached thereto. The arms 102, 103 act as control arms for controlling the pivoting of the doors 100, 101. A link 104 connects the upper ends of arms 102, 103. The link 104 is pivotally mounted to the ends of the arms. A control solenoid 105 is mounted to the rear wall 106 of the hopper and has an actuator rod 107 extending through a provided aperture in shield 98 and pivotally engaging the arm 102. When the solenoid 105 is actuated, the actuator 107 moves as indicated by the arrow 110 and this will cause arms 102, 103 to be moved pivoting the doors 100 and 101 about their axis to a position as shown in dotted lines in FIG. 9. Then any dust collected on the adjacent portions of the housing will slide through the openings into the lower portion 90 of the hopper. A spring 108 extends between wall 112 and arm 103 and urges the doors to closed position.

In order to agitate the filter bags 95, two agitator assemblies are used. These agitator assemblies comprise shafts 111 which are rotatably mounted in suitable bearings in the rear wall 106 and in the upright section 112 of the divider 94. The shafts 111 have radial platelike beater members 113 which will engage cross rods 95A in the bottom portions of the filter pockets 95 (the filter pockets can be cut away so that the beaters actually hit only the rods in the filters to agitate the filters) whenever the shafts 111 are rotated. The shafts 111 are driven with two electric motors 114 (one for each shaft) through suitable chain drives, if necessary to obtain the right speed. The motors 114 are mounted on the rear wall 106.

The circuit is completed so that when the motor switch for motors 114 is turned on, the solenoid 105 will also be energized, and at the same time the bags 95 are being agitated and shaken to remove the dust therefrom the doors 100 and 101 would also be opened to permit the dust to fall down into the bottom part of the hopper assembly. This is shown schematically in FIG. 9. This simultaneous operation of the agitators and doors insures that the dust shaken from the walls of the filter pockets will fall down and will slide along the inclined portions of the bottom divider wall 94 because the agitators will shake the entire hopper sufficiently to keep the dust moving out the doors 100 and 101.

The use of the two transversely spaced shafts **111** with the attached beaters **113** makes the vibrating job much more efficient and rapid, and insures that all of the dust will be removed from the filter bags **95** when they are agitated or vibrated.

The opening **92** to the base part **90** of the hopper extends all the way across the hopper assembly and the hopper is made so that the opening can be closed when the hopper is to be dumped to insure that the dirt and debris in the lower section **90** will not fall out as the hopper is being raised. As shown, the bottom wall **116** of the hopper extends between the sidewalls **96** and **97** to form the lower section **90**. A pair of clamshell like upper and lower doors are used for closing the opening **92** as the hopper is raised. Also, the lower door can be used for flipping paper or light debris forwardly from adjacent the brush to positions more remote from the brush to make sure that the lower part **90** of the hopper gets packed full before it has to be dumped. The clamshell doors include a lower door **117** which is pivotally mounted with a pin about an axis **118** to the main part of the hopper just to the rear of a terminal lip **119** of the lower wall **116**. The lower door **117** comprises a bottom wall **120** and a pair of sidewalls **121** and **122**. The sidewalls **121** and **122** are spaced apart and positioned adjacent the opposite outer edges of the hopper assembly. The sidewalls **121** and **122** extend only part way up along the sidewalls **96** and **97**. The sidewalls **121** and **122** extend rearwardly beyond the rear terminal edge **124** of the sidewalls **96** and **97**. A tube **125** is fixed to the forward end edge of the bottom wall **120** and is positioned to scrape against the terminal lip **119** as it rotates. The bottom wall is held in place by passing pins in from each side of the machine through provided lugs **126** which are fixed to the bottom wall **116**, and then partially into the ends of the tube **125** so that the tube is rotatably mounted on these pins.

The pin **129** on the near side of the machine as viewed in FIGS. **9** and **10** also passes through a lug **127** that is fixed to the bottom wall **120** of the door. A pin **128** passes through the lug **127** and the mounting pin **129** so that the pin **129** rotates in lug **126** whenever the bottom door **117** pivots about its axis **118**. A lever **133** is fixedly attached to the outer end of the pin **129** and is positioned on the outside of the wall **96**. The lever **133** thus also pivots or rotates about axis **118** when the lower door **117** is moved about its axis.

The lower door **117** is moved about its axis **118** with a hydraulic cylinder piston assembly **134**. The cylinder piston assembly **134** is mounted at its first end to a suitable pin **135** on the inside of the sidewall **96**, and the rod end of the cylinder is attached to the lug **127** with a suitable pin. The cylinder **134** is a hydraulic cylinder piston assembly which is actuated with a valve in the conventional manner from a source of fluid under pressure driven by the engine of the vehicle. When the cylinder **134** is retracted so that the rod is shortened, the door **117** will pivot to its closed position about its axis **118**. At the same time the door pivots, the lever **133** also pivots because it is drivably mounted to the pin **129** which rotates with the door.

An upper door **137** is pivotally mounted to the rear wall **106** about an axis **138**. The upper door can be mounted on suitable brackets and pins in the same manner as shown in connection with the lower door (see FIG. **11**).

An arm **139** is drivably connected to a pin **136** on the near side of the machine used for mounting the upper door **137**. The pin **136** is in turn drivably mounted to a bracket **147** which is fixed to the door **117**. The pin will rotate the door **137** about its axis whenever the arm **139** is rotated in the same manner as door **117** and arm **133** move together.

The door **137** extends across the hopper and includes an upper wall **140** and a pair of sidewalls **141**, which fit inside the sidewalls **96** and **97**, but to the outside of the sidewalls **121** and **122** for the lower door **117**. A plurality of torsion springs **142** are provided so that the door **137** is biased toward opened position by the springs **142**. The door is urged toward a more open position from its position when it is in place within the machine. As shown, the upper wall **140** of the top door **137** rests against a surface of the machine to hold it in place, and the springs **142** urge it toward a further opened position.

A cable assembly **143** is used to connect the outer end of arm **133** and end of arm **139**. Suitable clevises are used in the end of the cable assembly. As shown, when the machine is in its normal position for sweeping, the cable **143** is slack.

When the unit is to be dumped, first the filter bags **95** will be agitated and at the same time solenoid **105** will open the doors **100** and **101** so that the dust in the filter bags drops down into the bottom compartment. Then, before the unit is lifted, a suitable valve is used for moving the cylinder **134** to a retracted position. As this is done, the door **117** pivots upwardly toward a closed position.

As the cylinder **134** is retracted, the door **117** will be pivoted upwardly so that the back edge (the edge adjacent the brush) pivots up and at the same time the arm **133** will be moved around the axis **118**. The cable **143** will permit the arm **133** to initially move without affecting the arm **139** at all. However, the arm **133** will soon go over center and as it continues to move, the cable **143** will become tight pulling on the arm **139** and moving it in a counterclockwise direction about its axis **138**. In so doing, it will pull the upper door **137** downwardly. When the cylinder **134** has reached its fully retracted position, the two doors will fold together into a closed position as shown in FIG. **3**. Then the whole hopper assembly can be raised to its high dump position.

Note that the pivot points for the lift arms are above the top portions of the frame and the cylinder **34** for actuating the arms will lift the hopper high enough so that the bottom wall of the hopper assembly actually goes beyond the vertical position and a maximum height is obtained for clearance for dumping the hopper into a receptacle. All the debris in the hopper will be retained in place because of the folded closed doors. When the unit is in proper position over a receptacle, the double-acting cylinder **134** can be reversed to extend the rod, moving the doors to open position. When the cylinder **134** is fully extended and with the hopper still raised, the door **117** will be in position as shown during sweeping position, but the door **137** will be opened wider because the springs **142** will force the door to open as far as possible (see dotted position in FIG. **3**). The only limitation on the opening of the door thus is the cable **143**. However, it can be seen that the top door and the bottom door open wide to permit all of the debris to drop out of the hopper into a provided receptacle if desired. The top wall **140** of door **137** opens so it is at least coplanar with the rear portion of divider wall **94**.

Also, note that the curb or front-corner brush is raised with the machine so it is out of the way, and the whole sweeping machine can be driven right up adjacent a receptacle so that the opening to the hopper is directly above the receptacle and there is no danger of dumping the material beside the receptacle rather than in it.

As a further feature, the forward wall **150** of the hopper assembly is provided with a door **151** that is movable about a horizontal hinge at the top side of the door so that it can be opened and access is gained immediately to the opening **93** and to the forward portions of the hopper assembly so that if there are obstructions or other problems adjacent the front of the hopper, an operator can easily get into the front of the hopper to clean it out or to service the forward portions of the hopper. In addition, oversize, unsweepable objects may be loaded into the hopper through this door. The link for door **93A** can be replaced through door **151**.

Referring to FIG. **12**, it is shown that the sweeping machine is driven through the use of a hydraulic motor **155**. The motor **155** is controlled through a control valve which gives variable speed, forward and reverse, if desired. Fluid under pressure is supplied from a pump driven from the main engine for the sweeper. The drive and steerable wheel **18** is mounted onto a wheel hub **156** which is drivably mounted directly onto the output shaft shaft **157** of the motor **155**. A heavy duty bearing **158** is used to support the shaft **157** within a housing neck **159**. The neck has a flange **160** that is bolted directly to a

generally L-shaped support **161**. The support **161** has a shaft **162** at an upper end thereof that is mounted in bearings **163** which in turn are attached to the machine frame **16**. The shaft **162** is mounted for movement about a vertical axis and is controlled through an arm **164**. The arm **164** in turn is controlled with a link from the steering gear, which is controlled by steering wheel **20**. The vehicle is thus steered by moving the support **161** about its axis to turn the wheel **18**.

The hydraulic hoses used for motor **155** have enough slack to permit the wheel **18** to move. The mounting of the wheel **18** directly onto the motor shaft simplifies the wheel mounting. The housing neck **159** and bearing **158** have to be large enough to carry the weight of the vehicle at its normal speeds and loads.

Note that the support **161** has a neck portion that the flange **160** bolts to. A portion of the wheel surrounds this neck to get the load on the shaft **157** as close to bearing **158** as possible. The wheel hub **156** is locked onto the tapered shaft **157** in any conventional manner. The internal driving element for shaft **157** can be of any preferred design, for example, an "Orbit Motor" made by Char Lynn Co., Minneapolis, Minn.

Thus, by driving motor **155** under fluid pressure, the wheel **18** is rotated directly to provide propulsion for the sweeping machine.

The schematic diagram of FIG. **13** is to show the various drive components of the machine. The machine is operated largely through hydraulic power.

The use of the heavy U-shaped frame attached solidly to the lift arms protects the hopper from damage. The frame acts as a bumper and thereby transfers force directly to the main frame of the machine. Where the pivotal connection was made from the hopper directly to the arms, the pivot pins had to carry the shock load if the sweeping machine collided with anything. Here the pivot pins do not carry such load but the U-shaped frame transfers the load through solid, strong connections to the main frame.

The filter bags **95** form a barrier in the upper compartment of the housing and air drawn through the hopper by the vacuum blower passes through the filter barrier. Thus, dust carried by the air is separated out on the exterior of the filter bags and clean air passes to the vacuum blower itself.

The supports for the lift arms protrude above the body portion of the machine so the pivot axis therefore is raised above the body of the machine to give the high lift action. In this instance, the body portion of the machine is considered to be the main sheet metal parts forming the major upper surface plane of the machine and excluding the instrument panel, engine cover, steering wheel. The body portion of the machine is considered to terminate along a plane indicated at **39**.

What is claimed is:

1. A cleaning machine having a vehicle frame and a body portion and means to propel said cleaning machine for movement along a surface, a cleaning means mounted on said vehicle frame to clean the surface over which the machine is passing, and a hopper for receiving material from said cleaning means, said hopper being positioned ahead of said cleaning means in the normal direction of movement of said machine, characterized in that there are provided means for mounting said hopper including a pair of lift arms means, support means to pivotally mount said lift arm means to said vehicle frame, said support means extending above the body of the machine, the lift arm means being pivotally connected to said support means at position spaced above the body of the machine, means to mount said hopper to lower ends of said lift arm means, and power means to move said lift arm means to raise said hopper, said hopper and lift arm means being moved by said power means so that said hopper is above a horizontal plane passing through the pivotal axis of said lift arm means when the lift arm means are in raised position, said means to mount said hopper to said lift arm means includes a hopper frame member carried by said lift arm means, means to pivotally mount said hopper to said hopper frame member, and stop means between the hopper frame member and the hopper to limit the pivotal movement of said hopper with respect to the hopper frame member in both directions of pivoting.

2. The machine as specified in claim **1** wherein said hopper has a transverse debris opening adjacent said cleaning means in position to receive material from the cleaning means, and door means for closing said debris opening, said door means including an upper section and a lower section, said upper section being pivotally mounted about a transverse pivot at an upper edge of said debris opening, said lower section being pivotally mounted to the hopper about a transverse pivot and forming an extension of a bottom wall of said hopper most closely adjacent said cleaning means, and means to move said upper and lower door sections into a closed position wherein they together substantially close off the debris opening to said hopper.

3. In a sweeping machine having a frame, means to propel and steer said frame, a sweeping brush, and a hopper for receiving material and dirt swept by said brush, the improvement comprising means for mounting said hopper including lift arm means pivotally mounted on said frame for movement about a substantially horizontal pivot axis, power means to move said arms from a lowered to a raised position, a U-shaped member fixedly mounted with respect to said lift arm means and movable therewith, said U-shaped member extending along the sides of said hopper and across the front of said hopper, means to pivotally mount said hopper to said U-shaped member at opposite sides thereof, and stop means to limit pivotal movement of said hopper with respect to said U-shaped member, a curb brush, means to vertically pivotally mount said curb brush to said U-shaped member adjacent a forward corner thereof, said curb brush thereby being lifted with said U-shaped member whenever said lift arm means are moved.

4. The combination as specified in claim **3** wherein said hopper has a transverse debris opening adjacent said sweeping brush in position to receive material swept by said brush, and upper and lower door sections for closing said debris opening, said upper door section being pivotally mounted about a transverse pivot adjacent an upper edge of said debris opening, and means to move said upper and lower door sections into a closed position wherein they together substantially close off the opening to said hopper, said lift arm means moves said hopper to position wherein the bottom wall thereof passes through a vertical plane and moves past said vertical plane as said lift arms move to said raised position.

5. The combination as specified in claim **3** wherein said hopper is divided into upper and lower compartments by a divider wall spaced upwardly from the bottom of said hopper, an opening defined is said divider wall and positioned to permit dust to fall under gravity from the upper compartment to the lower compartment, door means for said opening in said divider wall and movable from a closed position wherein the opening in said divider wall is closed to an open position wherein said opening is open, and means to move said door means between said open and closed positions.

6. The combination as specified in claim **3** wherein said curb brush is positioned adjacent a forward corner of said hopper frame member, and wherein said curb brush has a normal sweeping position, and means associated with such upright pivot to permit said curb brush to move toward the center of said machine about said upright pivot from said normal sweeping position upon encountering an obstruction.

7. The machine of claim **1** wherein means to propel said cleaning machine comprises a fluid motor having an output shaft, means to mount said fluid motor on said vehicle frame, a drive wheel for said cleaning machine, and means to mount said drive wheel directly on said fluid motor shaft whereby the wheel is supported and driven by said shaft.

8. The combination as specified in claim **5**, filter bags mounted in said upper compartment for filtering swept material from air flowing through the upper compartment, and agitator means for shaking said filter bags, electric power

means for running said agitator means, and solenoid means for controlling movement of said door means to its open position, said electric power means and said solenoid means being connected in circuit means wherein said electric power means and said solenoid means operate simultaneously.

9. The combination as specified in claim 5 wherein said divider wall includes a section extending substantially upright adjacent the front wall of said hopper and spaced therefrom, a second opening being defined in said upright section, an opening in said front wall of said hopper to permit access to the interior of said hopper, and second door means covering said opening in the front wall of said hopper.