United States Patent [19]

Rinker

[11] **3,813,725**

[45] **June 4, 1974**

[54] **VACUUM CLEANER CONSTRUCTION**

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[52] **U.S. Cl.** **15/347,** 15/337, 15/359

[51] **Int. Cl.** **A47l 9/10**

[58] **Field of Search** 15/328, 334, 337, 347, 15/354, 359

[56] **References Cited**

UNITED STATES PATENTS

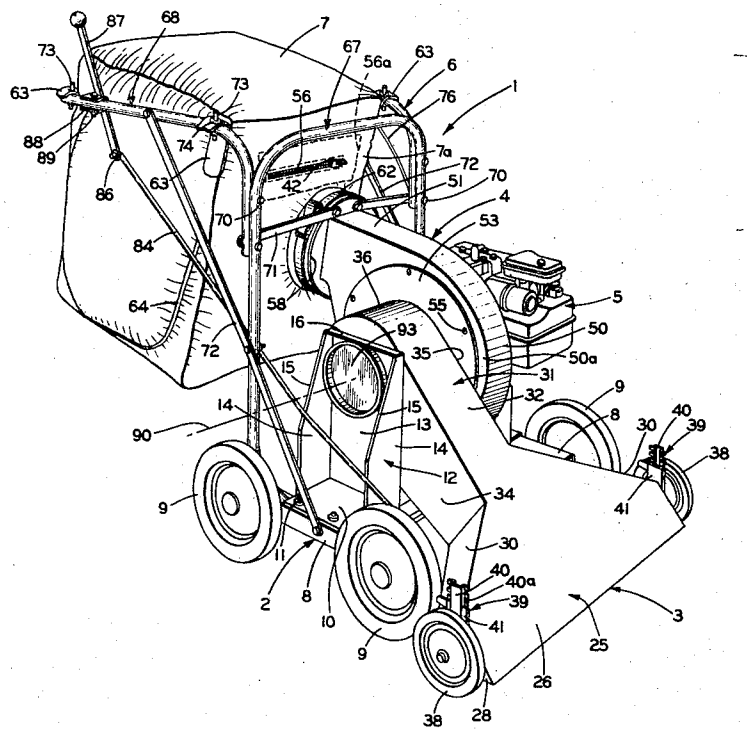
1,461,173	7/1923	Bennett	15/359 X
2,458,258	1/1949	Furr	15/359 X
2,898,621	8/1959	Vance	15/359 X
3,203,022	8/1965	Clarke	15/354 X
3,300,807	1/1967	Berkowitz	15/328 X
3,406,424	10/1968	Rush	15/347 X

Primary Examiner—Harvey C. Hornsby
Assistant Examiner—C. K. Moore
Attorney, Agent, or Firm—Frease & Bishop

[57] **ABSTRACT**

A vacuum cleaner having a longitudinally extending nozzle pivotally mounted on a movable carriage. An annular fan housing is mounted on the carriage containing a fan driven by an engine for developing an air flow through the nozzle and fan housing. A tangentially-disposed fan housing discharge or exhaust port communicates with a bag which is suspended from a handle mounted on the rear of the carriage to receive and store debris collected by the nozzle. The engine is mounted on the carriage at one side of the fan housing and the engine shaft extends laterally of the carriage into the fan housing, and the fan is mounted on the shaft within the housing. The exhaust end of the nozzle is pivotally mounted on a vertical carriage bracket and on the other side of the fan housing for limited pivotal movement vertically about a laterally extending axis. The front or inlet end of the nozzle is roller supported by a pair of wheels. A roller is pivotally mounted on the front end of the carriage beneath the nozzle and is actuated by a lever mounted on the handle for controlling the vertical position of the nozzle inlet end and opening with respect to a surface being cleaned. A self-propelling driving mechanism engageable with the rear carriage wheels may be incorporated in the cleaner construction.

10 Claims, 13 Drawing Figures



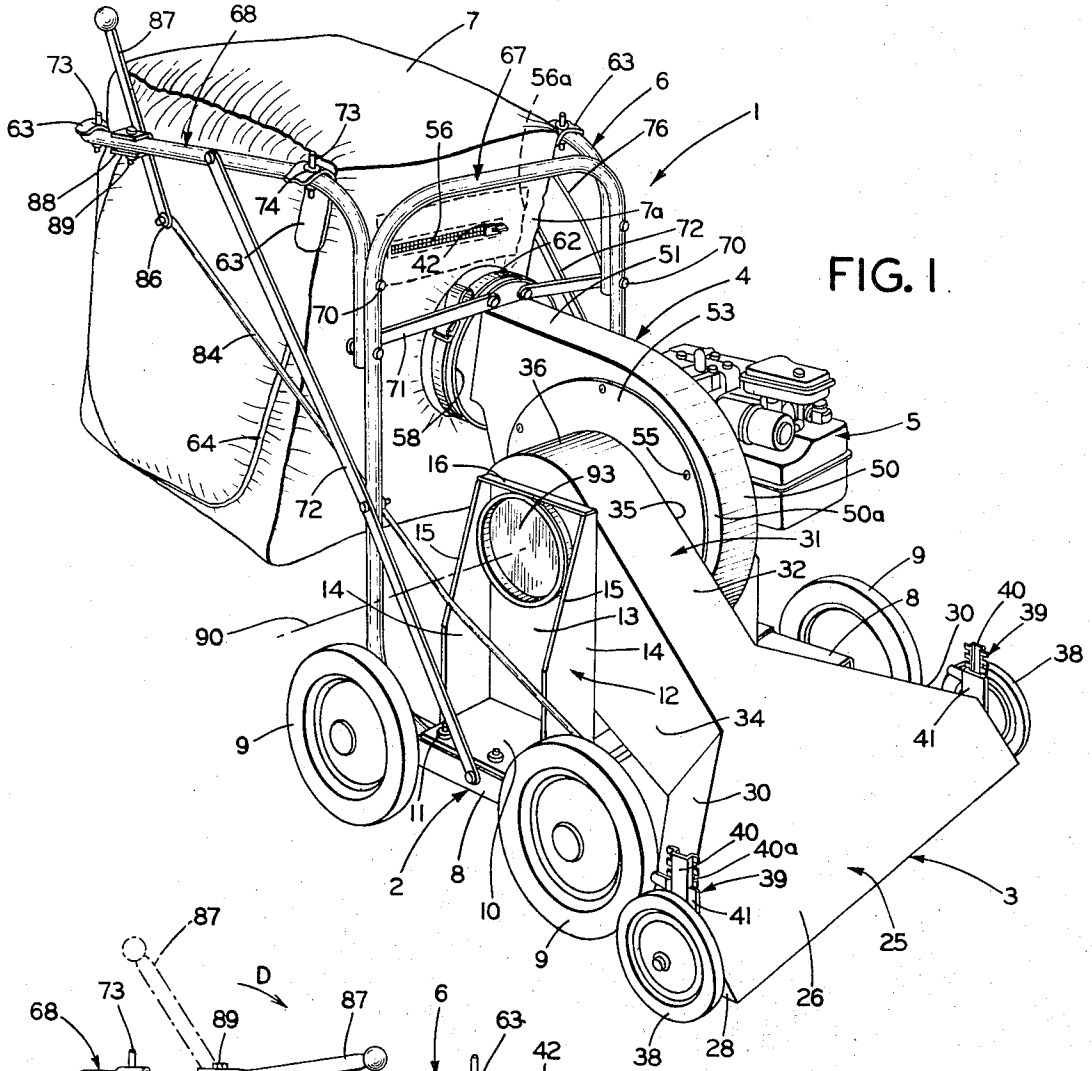

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FIG. 1

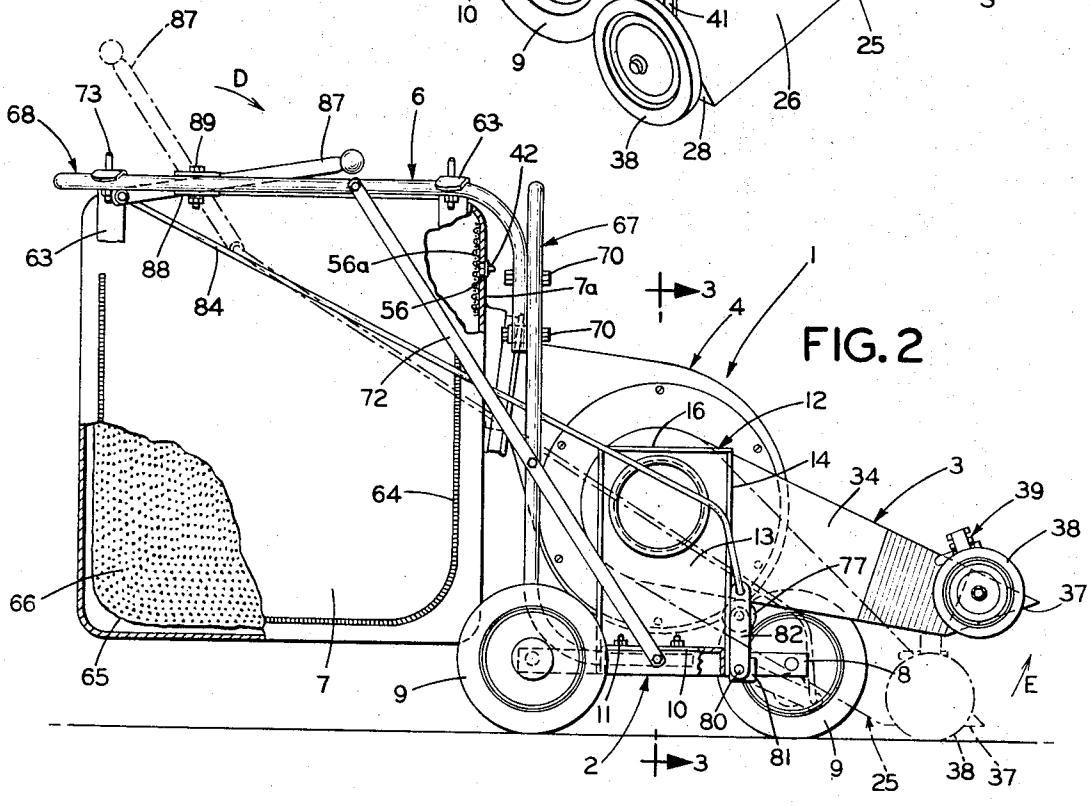
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FIG. 2

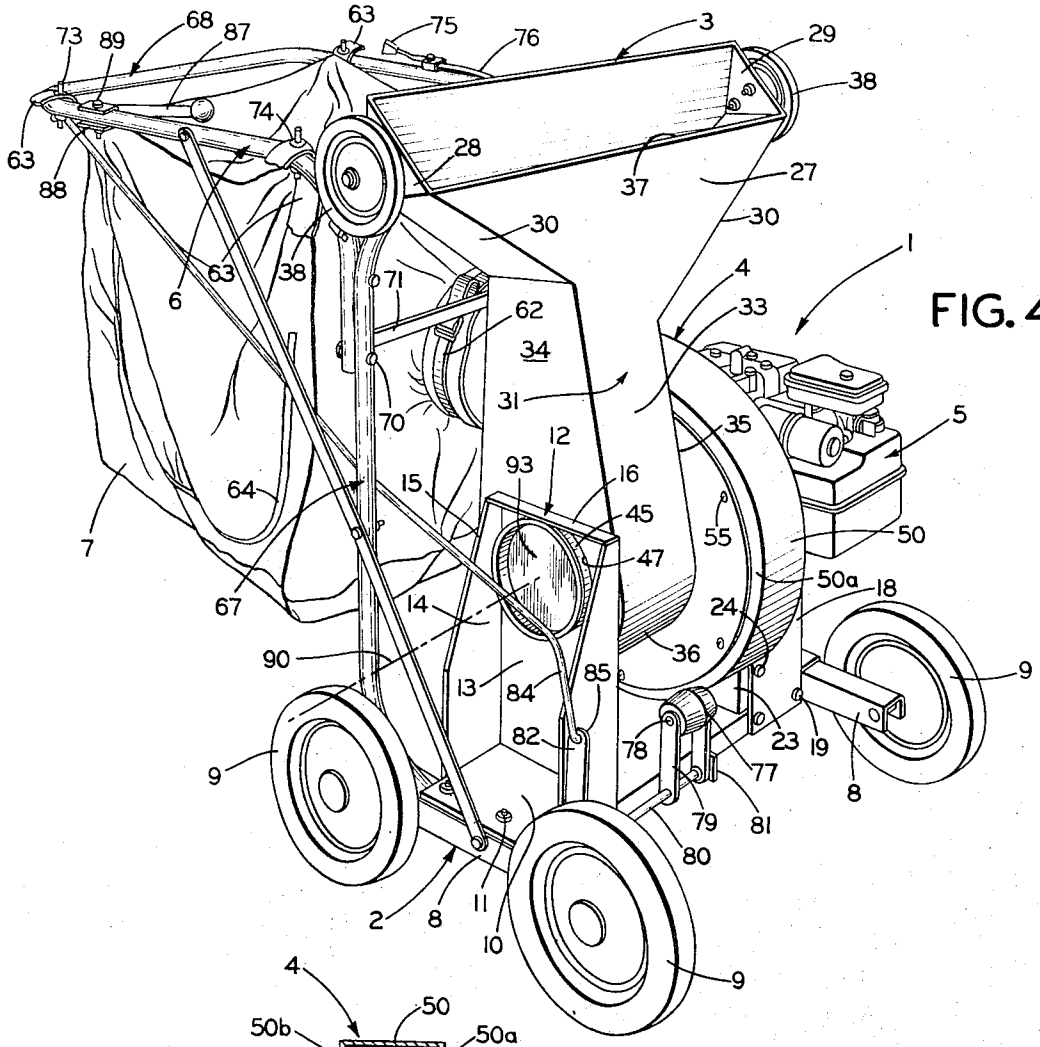
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FIG. 4

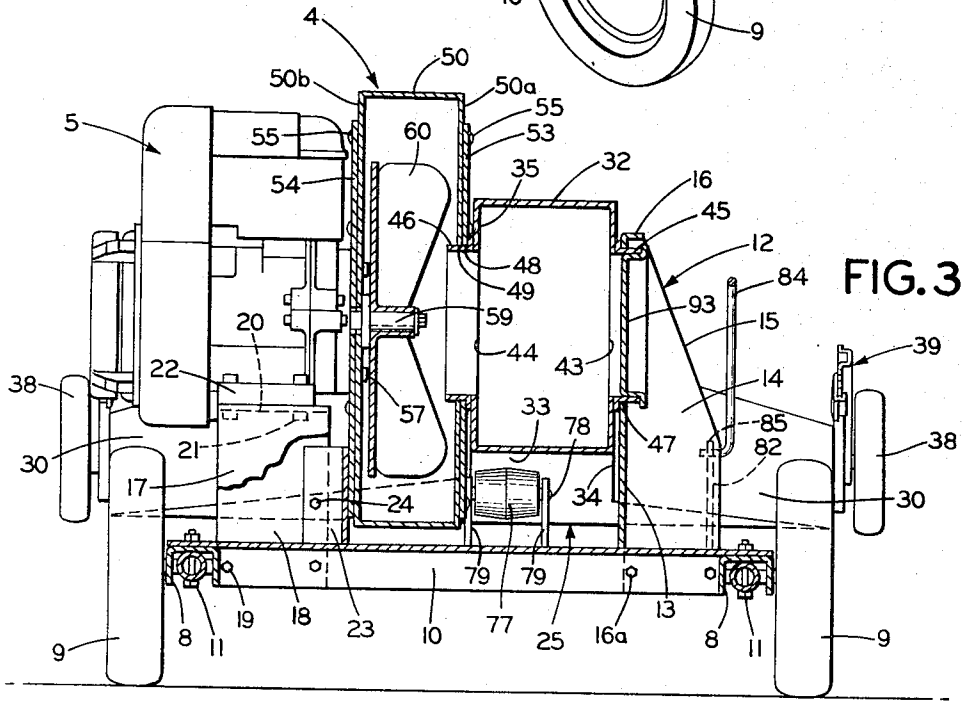
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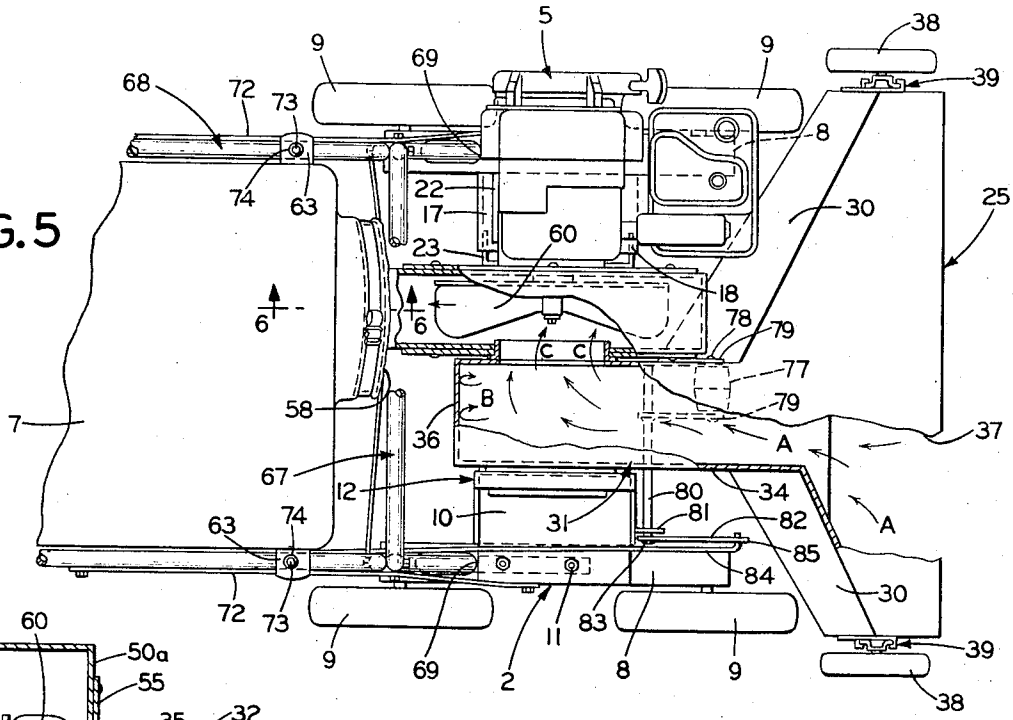
FIG. 3

FIG. 5



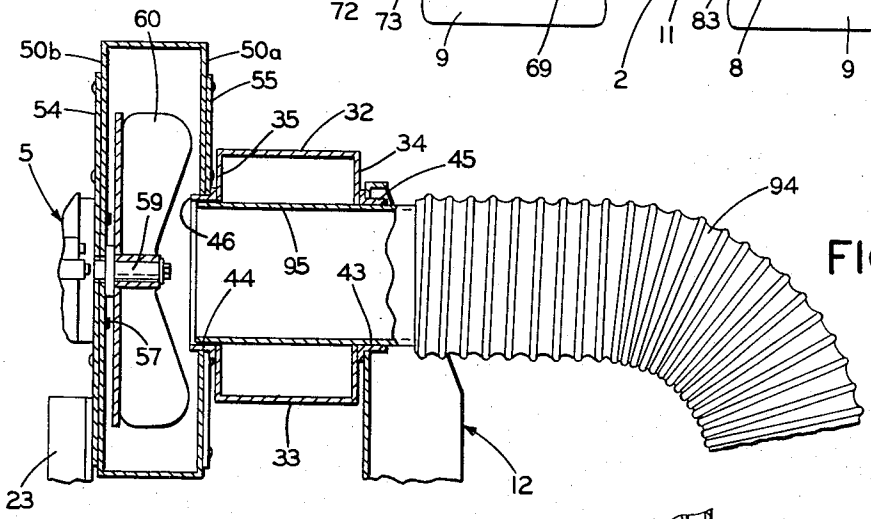


FIG. 7

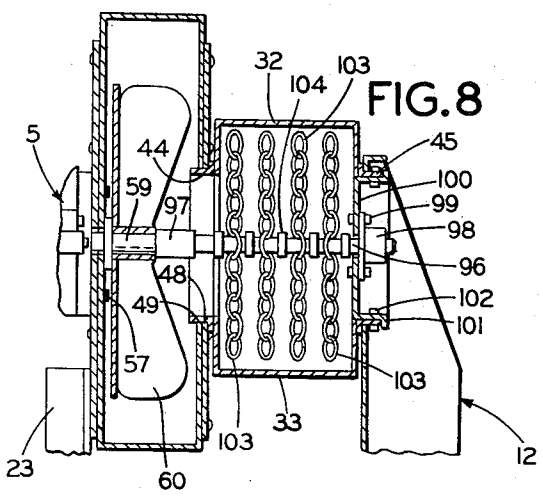
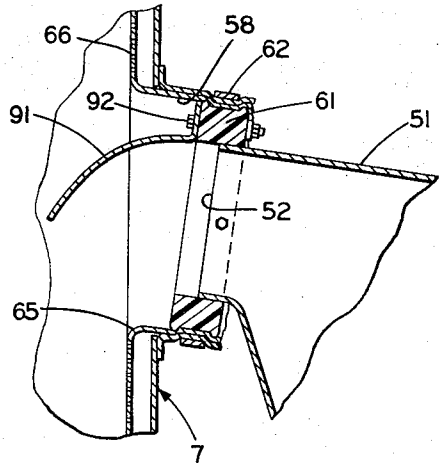


FIG. 8



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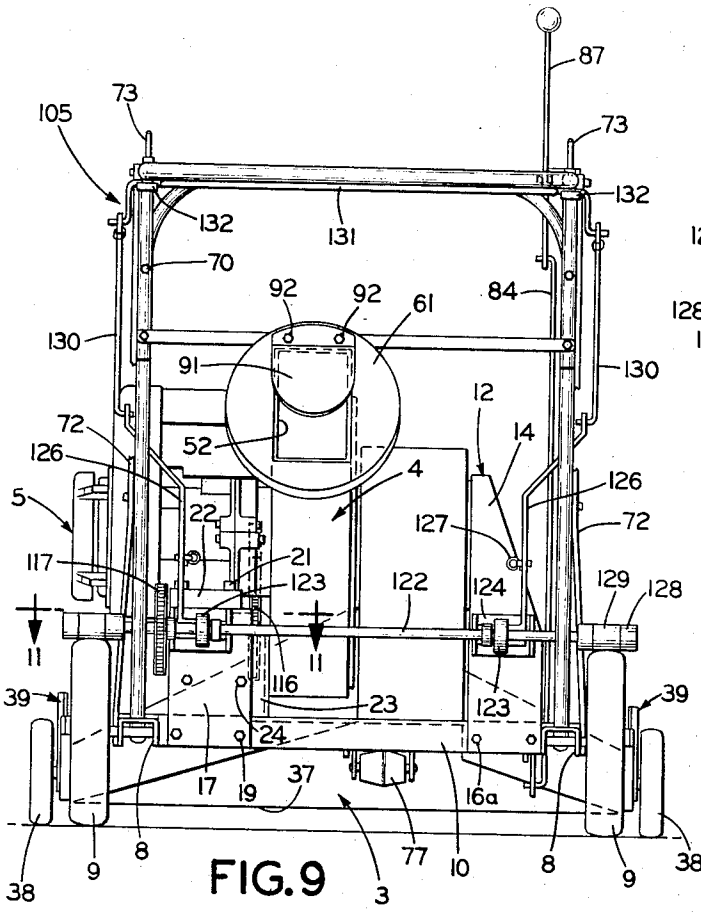

FIG. 9

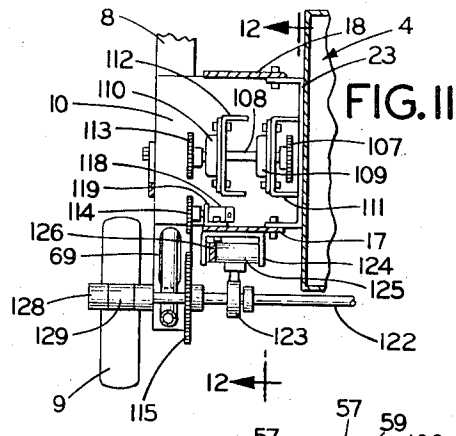

FIG. 11

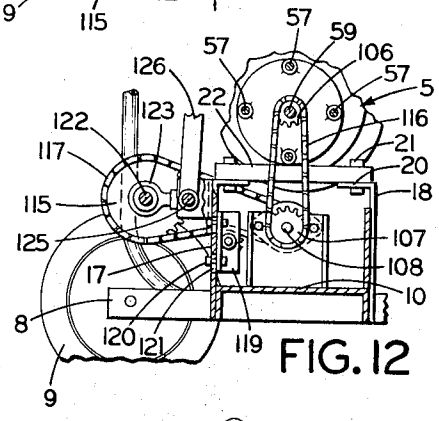

FIG. 12

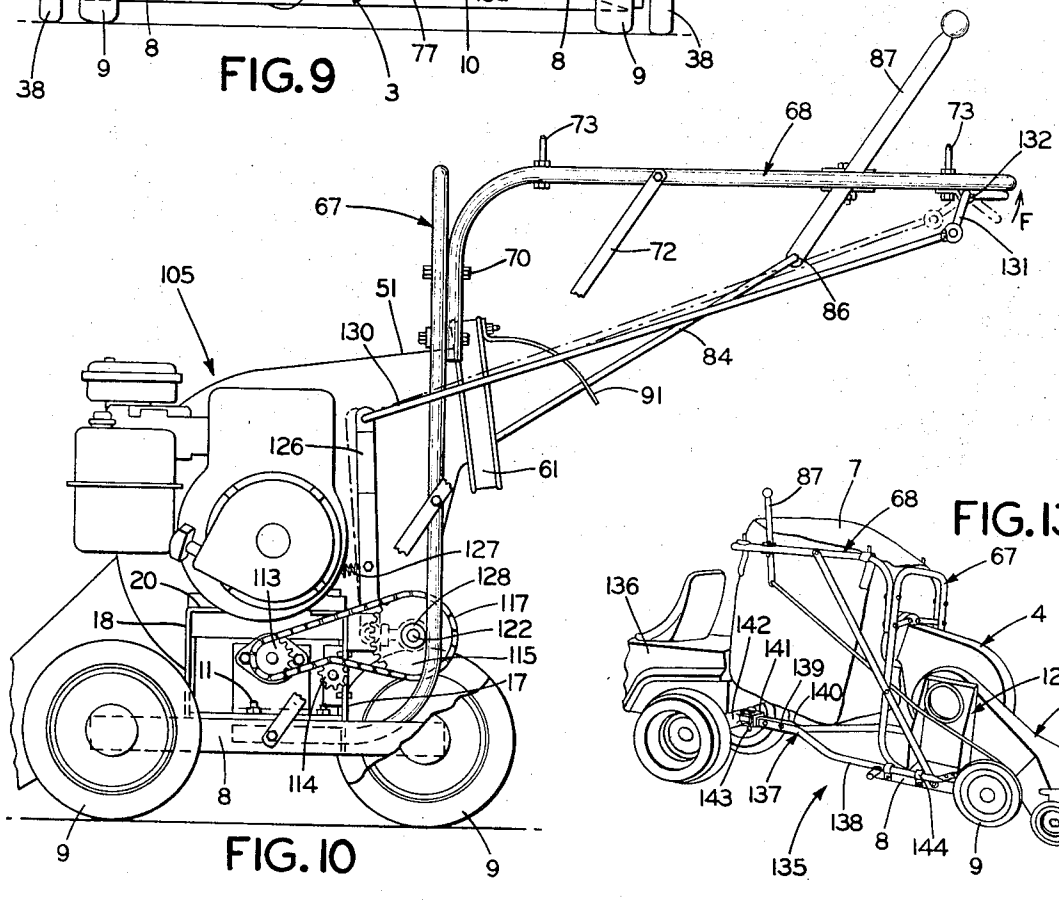

FIG. 10

FIG. 13

VACUUM CLEANER CONSTRUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to vacuum cleaners and in particular to large, wheeled-type vacuum cleaners for gathering debris from lawns, and for use at commercial and industrial sites. More particularly, the invention relates to a vacuum cleaner construction having a pivotally mounted nozzle for vertically adjusting the location of the nozzle mouth with respect to the surface being cleaned.

2. Description of the Prior Art

Large vacuum cleaners of the wheeled-type have had various constructions, nozzle configurations and mounting arrangements, and attachments for picking up debris such as grass clippings, leaves, twigs, etc. from lawns, and for picking up paper, cans bottles, dirt, etc. from commercial and industrial sites. Examples of prior cleaner constructions intended for such cleaning operations are shown in U.S. Pat. Nos. 2,824,335, 2,918,694, 3,089,178, 3,112,511, 3,126,571, 3,358,316, 3,491,399 and 3,618,157.

Most known vacuum cleaners of this type do not provide means for readily adjusting the location of the nozzle mouth from the ground being cleaned except by pivoting the entire cleaner on its rear wheels to raise the nozzle mouth. Such adjustment is difficult due to the weight of the cleaners. Some cleaners, such as shown in U.S. Pat. Nos. 3,089,178 and 3,491,399 have pivotally mounted flaps or doors on the front of the nozzle to enable large sized debris and objects to be readily drawn into the nozzle. Such doors, however, do not permit the cleaner nozzle to pass over large objects, such as rocks, which are not intended to be picked up.

The debric picked up by most prior cleaners must pass through numerous bends and flexible hose before being discharged into a debris collector. Such bends and hose are susceptible to plugging when collected debris becomes lodged in the bend areas.

Prior cleaner nozzles usually are rigidly mounted on a cleaner frame or carriage, and wheels support the carriage for movement across an area to be cleaned. Such arrangements are suitable for level surface use, but when used out of doors on uneven ground, the nozzle must follow the path of the cleaner carriage. Thus, the nozzle rises or falls as the carriage wheels move over bumps on and depressions in the ground. This results in changing location of the nozzle mouth with respect to the ground, which affects the suction efficiency.

Even in those cleaner constructions having a nozzle mounted on a separate pair of wheels, varying suction is experienced since the movement of the cleaner carriage still changes the location of the nozzle mouth with respect to the ground due to the nozzle being rigidly mounted on the carriage.

Another known means of adjusting the nozzle location with respect to the ground is by manual movement of nozzle mounting bolts, such as shown in Pat. Nos. 2,824,335 and 3,358,316. Such adjustment is time consuming, and once adjusted, the nozzle remains in the adjusted position, until the operator stops the machine and manually readjusts the mounting bolts.

Known cleaners have no means for conveniently connecting a flexible hose to the cleaner for reaching areas inaccessible to the nozzle, such as behind shrubbery, under work benches, etc. Known connection means require removal of bolted plates, baffles, etc. on the cleaner, and the subsequent installation of other plates, baffles, etc. to connect the hose to the cleaner and to divert the suction air through the connected hose.

Another problem existing with known cleaners is that the cleaner engine which drives the fan blade to provide suction, usually is mounted centrally of the cleaner and has either a horizontally longitudinally extending fan shaft or a vertically extending fan shaft. The engine in such arrangements is mounted adjacent the collection bag, which usually is formed of a porous material, thereby permitting dust laden air around the bag to be drawn into the engine cooling means. This results in a hotter running, less efficient, and shorter lived engine, than if clean cooling air is drawn into the engine.

Such engine shaft arrangements in prior vacuum cleaners, require additional mechanism for connecting the power train mechanisms between the engine shaft and the cleaner carriage axle for self-propelling means, then that required where the engine shaft extends horizontally laterally and parallel with the cleaner carriage axles.

Thus, there exists a need for a vacuum cleaner construction which solves the problems and eliminates the difficulties encountered with the described prior cleaner constructions, in an efficient, simple and relatively inexpensive manner.

SUMMARY OF THE INVENTION

Objectives of the invention include providing a vacuum cleaner construction for picking up large quantities of debris from outside areas such as lawns, parking lots, parks, etc. and from inside areas such as industrial and commercial work areas, warehouses, shops, etc.; providing a vacuum cleaner construction having a nozzle pivotally mounted on a horizontal axis on a movable carriage, whereby the nozzle may follow closely the contour of the ground being cleaned appreciably unaffected by the up and down movement of the carriage, and in which the front of the nozzle is supported by a pair of adjustable wheels; providing a vacuum cleaner construction having lever means mounted on the cleaner handle for easy and rapid manipulation by an operator for readily adjusting the height of the nozzle mouth with respect to the ground to enable the nozzle to pass over obstacles and to pick up large pieces of debris, and in which the lever has a lower operating position and an intermediate raised operating position in which the nozzle and lever will remain until released by the operator; providing a vacuum cleaner construction in which the pivotally mounted nozzle can be raised to an upper vertical position whereby debris can be fed at the top into the nozzle mouth from a conveyor belt, table or the like for shredding and collection in the attached refuse bag; providing a vacuum cleaner construction which has its engine mounted on one side of the cleaner carriage whereby the engine shaft extends horizontally laterally with respect to the cleaner to facilitate connection of a self-propelled drive unit on the cleaner, and to remove the engine from immediate proximity to the collection bag to thereby eliminate large quantities of dust and dirt being drawn into the engine cooling system; providing a vacuum cleaner

construction in which large debris drawn into the nozzle first strikes the rear of the nozzle prior to moving through the fan for compacting or shredding and discharge into a collection bag, thereby reducing possible damage to the fan blades, and in which shredding chains or blades may be mounted in the nozzle for initial compacting and shredding of the debris before movement of the debris past the fan blades; providing a vacuum cleaner construction having an auxiliary side nozzle opening for insertion of a hose for cleaning areas inaccessible to the nozzle, which hose can be attached by the simple removal of a snap-on cover plate and without installing and removing extra baffles; providing a vacuum cleaner construction in which the debris is discharged directly from the fan housing into the top portion of the collection bag, eliminating the passage of the discharged debris through flexible hose and around tube bends, and eliminating the pushing and lifting of the previously collected debris by the newly discharged debris as it enters the bag from the housing; providing a vacuum cleaner construction which can be adapted easily for drawbar connection to the front or rear of a tractor; and providing a vacuum cleaner construction which requires a minimum number of movable parts, thereby reducing construction and maintenance costs, which is simple in operation, and which solves problems, satisfies needs, and obtains new results in the art.

These objectives and advantages are obtained by the vacuum cleaner construction, the general nature of which may be stated as including a carriage; wheels rotatably mounted on the carriage; an annular fan housing having a tangentially-disposed rear exhaust or discharge opening and a concentric side inlet opening mounted on the carriage; a longitudinally extending nozzle having a lateral inlet mouth and an exhaust end, means pivotally mounting the nozzle exhaust end on the fan housing for movement of the nozzle vertically about a laterally extending axis, the nozzle exhaust end being formed with an exhaust opening coinciding with the fan housing side inlet port; fan means mounted within the fan housing for inducing air flow through the nozzle and fan housing; engine means having a laterally extending drive shaft mounted on the carriage, the drive shaft extending into the fan housing and rotatably mounting the fan means, with the axis of the drive shaft generally coinciding with the nozzle pivot axis, wheel means mounted on the nozzle inlet mouth for roller supporting the mouth above a surface being cleaned; handle means mounted on the rear of the carriage; means mounted on the carriage and handle means for generally vertically adjusting the position of the nozzle mouth with respect to the surface being cleaned; the nozzle adjustment means including roller means pivotally mounted on the carriage beneath the nozzle, and lever means mounted on the handle means and connected to the roller means for pivoting the roller means into engagement with the nozzle to pivotally raise and lower the nozzle mouth; and bag means mounted on the handle means and communicating with the fan housing exhaust port for receiving and storing debris collected through the nozzle and discharged from the fan housing.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention - illustrative of the best modes in which applicant has contemplated applying the principles - are set forth in the following description and shown in the drawings and are particularly and distinctly pointed out and set forth in the appended claims.

FIG. **1** is a perspective view of the improved vacuum cleaner construction with the debris collection bag inflated and with the nozzle in the lower operating position;

FIG. **2** is a side elevation of the improved vacuum cleaner, with portions broken away and in section, and with the intermediate nozzle position shown in solid lines and the lower nozzle position shown in dot-dash lines;

FIG. **3** is an enlarged sectional view taken on line **3—3**, FIG. **2**;

FIG. **4** is a perspective view of the improved vacuum cleaner construction, similar to FIG. **1**, with the trash collection bag deflated and with the nozzle shown in maximum raised vertical position;

FIG. **5** is a fragmentary top plan view of the vacuum cleaner as shown in FIG. **1**, with portions broken away and in section, showing the air-flow path between the nozzle inlet mouth and the debris collection bag;

FIG. **6** is an enlarged fragmentary sectional view taken on line **6—6**, FIG. **5**, showing the fan housing exhaust port;

FIG. **7** is a fragmentary sectional view of the fan housing and nozzle discharge end, showing an auxiliary hose connected to the fan housing;

FIG. **8** is a sectional view of a modified construction of the fan housing and nozzle discharge end, showing an auxiliary shredding mill mounted within the nozzle discharge end;

FIG. **9** is an end elevation of a modified form of the improved vacuum cleaner construction with the collection bag removed, showing a self-propelled operating mechanism mounted on the improved vacuum cleaner;

FIG. **10** is a fragmentary side elevation of the self-propelled vacuum cleaner construction shown in FIG. **9**;

FIG. **11** is a fragmentary sectional view taken on line **11—11**, FIG. **9**, showing the drive sprocket arrangement with the drive chains removed;

FIG. **12** is a fragmentary sectional view taken on line **12—12**, FIG. **11**; and

FIG. **13** is a diagrammatic perspective view of the vacuum cleaner construction shown in FIGS. **1–5** having a draw bar mounted thereon and being pulled by a tractor.

Similar numerals refer to similar parts throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

The improved vacuum cleaner construction is indicated generally at **1** (FIGS. **1–5**) and includes as main components a carriage assembly **2**, a nozzle **3**, a fan housing **4**, an engine **5**, a handle assembly **6** and a debris collection bag **7**.

Carriage assembly **2** has a pair of spaced parallel, longitudinally extending channels **8**, with wheels **9** rotatably mounted on the ends of channels **8** for moving cleaner **1** across the ground or a surface to be cleaned. A laterally extending channel plate **10** is connected to channels **8** by bolts **11**, and supports a vertically ex-

tending nozzle mounting bracket 12 at one end thereof.

Bracket 12 preferably is a U-shaped channel having a web 13 and sides 14, with the upper portion of sides 14 being tapered at 15. The top of web 13 is formed in an outwardly extending flange 16 to provide strength and rigidity to bracket 12. Bracket 12 is attached to plate 10 by suitable fastening means, such as bolts 16*a* (FIG. 3).

A pair of spaced engine mounting brackets 17 and 18 (FIGS. 3 and 5) is connected to the end of plate 10 opposite bracket 12, by bolts 19. Brackets 17 and 18 extend vertically upwardly from plate 10 and terminate in top flanges 20. Engine 5 is mounted on flanges 20 by bolts 21 which connect engine mounting blocks 22 to flanges 20. A longitudinally extending reinforcing channel 23 extends between and is bolted at 24 to the bottom portion of engine brackets 17 and 18.

Nozzle 3 includes a flared inlet front mouth 25 formed by top and bottom walls 26 and 27, end walls 28 and 29, and inwardly tapered side walls 30. Nozzle mouth 25 extends forwardly from and is formed integrally with a generally box-like nozzle discharge housing section indicated at 31. Housing 31 forms the nozzle discharge end and includes top and bottom walls 32 and 33, and side walls 34 and 35, all of which terminate in a rounded rear exhaust port 36.

Nozzle mouth 25 forms a rectangular mouth opening 37 (FIG. 4) through which the debris and trash is picked up prior to passing through nozzle 3.

A pair of wheels 38 is mounted on nozzle end walls 28 and 29 by usual adjusting mechanisms 39. Mechanisms 39 include fixed vertically extending notched channels 40 fixed to end walls 28 and 29. Wheels 38 are mounted on slide frames 41 which move along channels 40 and selectively engage notches 40*a* formed in channels 40. Mechanisms 39 permit wheels 38 to be adjusted with respect to nozzle 3 to provide adjustment of the vertical location of nozzle 37 above a surface being cleaned, with front end 25 of nozzle 3 supported by wheels 38.

A pair of laterally aligned openings 43 and 44 is formed in nozzle housing side walls 34 and 35 adjacent rear exhaust port 36 (FIG. 3). A pair of outwardly extending annular flanges 45 and 46 are formed integrally with side walls 34 and 35 around openings 43 and 44. Flange 45 extends through an opening 47 formed in web 13 of bracket 12, and flange 46 extends through a pair of openings 48 and 49 in fan housing 4. The telescopic engagement of flanges 45 and 46 in openings 47, and openings 48 and 49, respectively, forms the pivotal mounting for nozzle 3 between bracket 12 and fan housing 4.

Fan housing 4 has a generally cylindrical shape and is formed by an annular outer casing 50 and side walls 50a and 50b. Housing 4 includes a tangentially-disposed air discharge or exhaust port 51 formed with an end opening 52 (FIGS. 1 and 6). Disc-shaped reinforcing plates 53 and 54 are bolted at 55 to sides 50*a* and 50*b* of housing 4 for mounting housing 4 on carriage 2.

Housing plate 53 and sidewall 50*a* are formed with the aligned openings 48 and 49, respectively, through which nozzle flange 46 extends (FIG. 3) for pivotally mounted nozzle 3 to fan housing 4. Housing plate 54 is connected to carriage channel 23, and is bolted at 57 to engine 5 to rigidly mount fan housing 4 on carriage 2 and to space housing 4 above carriage channel plate 10.

Engine 5 is a usual gasoline engine and is located on one side of cleaner 1. Engine 5 is mounted on brackets 17 and 18 by bolts 21 and is connected to fan housing side wall 50*b* and reinforcing plate 54 by bolts 57. The side mounting of engine 5 enables engine shaft 59 to extend horizontally laterally through wall 50*b* and plate 54 into the interior of fan housing 4.

A multibladed fan 60 is journaled on the end of shaft 59 (FIG. 3) within housing 4 to induce vacuum air movement through the fan housing for picking up debris through nozzle 3 and for discharging the debris through housing exhaust port 51. Fan 60 is spaced sufficiently from the perimeter of outer casing 50 to prevent blockage of fan housing 4 by debris becoming wedged between the ends of the fan blades and casing 50.

A collar 61 is formed at the rear of exhaust port 51 and surrounds exhaust opening 52 (FIG. 6), for attaching collection bag 7 by a strap 62. Bag 7 preferably is made of porous canvas material having a plurality of strap tabs 63 to suspend bag 7 from handle assembly 6 (FIGS. 1 and 4).

Bag 7 is formed with a large side opening 64, a horizontal exhaust opening 56 and an inlet opening 58. Openings 56 and 58 are formed in the front wall 7*a* of bag 7 with exhaust opening 56 being spaced above inlet opening 58. Collar 61 extends into inlet opening 58 for connecting fan housing 4 with bag 7.

A disposable plastic liner bag 65 (FIG. 2) formed with a plurality of perforations 66 may be placed within bag 7 through side opening 64 for easy storage and removal of the collected debris.

A section of flexible screening material 56*a* is secured to the inner surface of bag wall 7a surrounding opening 56 to prevent collected debris from being discharged through exhaust opening 56 (FIGS. 1 and 2). Opening 56 has a closure zipper 42 which enables the size of opening 56 to be regulated.

It has been found that as bag 7 fills with debris, the dust and dirt particles collected with the debris fill the porous openings in bag 7 reducing the air flow through bag 7. This reduced volume of air passing from bag 7 reduces the effective suction at nozzle mouth opening 37, thereby decreasing the efficiency of cleaner 1. Movement of zipper 42 regulates the size of opening 56 and provides the volume of exhausted air necessary to compensate for the filled bag, and to maintain the cleaner's efficiency as bag 7 becomes filled.

Zipper 42 will be closed or nearly closed when bag 7 is nearly empty and is moved to increase the size of opening 56 as the bag fills. The size of opening 56 and the necessity of manipulating zipper 42 depends largely upon the type of debris collected in bag 7 and the cleanliness of the air discharged into bag 7 with the collected debris.

Handle assembly 6 includes a U-shaped tubular frame portion 67 extending vertically upwardly from carriage 2, and a similar tubular frame portion 68 connected to the top of vertical frame 67 and extending horizontally rearwardly therefrom. The bottom ends of tubular portion 67 are bent forwardly and extend through slots 69 formed in carriage channels 8, and are secured to channels 8 by bolts 11 (FIGS. 1, 4 and 5). Horizontal frame 68 is bolted at 70 to vertical frame 67

and includes a horizontal brace **71** and diagonal side braces **72.**

Vertical studs **73** project upwardly from the corners of horizontal frame **68** and extend through grommets **74** in bag tabs **63** to suspend bag **7** from frame **68.**

A usual throttle control lever **75** is mounted on one leg of frame **68** and is connected to engine **5** by a flexible cable **76** for controlling the speed of engine **5.**

In accordance with the invention a roller **77** (FIGS. **2, 4** and **5**) is pivotally mounted on the front of carriage **2** for remotely, vertically adjusting nozzle mouth **37** with respect to a surface being cleaned. Roller **77** is rotatably mounted on a pin **78** which extends between the swinging ends of a pair of links **79.** The opposite ends of links **79** are rigidly connected to a pivot rod **80** which is journaled in a pair of tabs **81** welded to the front end of channel plate **10.**

A control link **82** is welded at **83** to the outer end of rod **80** for rotating rod **80** and links **79.** A control rod **84** is pivotally connected at its lower end to the swinging end **85** of link **82** and extends diagonally upwardly along the side of cleaner **1** for pivoting lever **82** and rod **80.** The top end of control rod **84** is pivotally connected at **86** to a lever **87** which is pivotally mounted on a bracket **88.** Bracket **88** is bolted at **89** to one member of handle frame **68.**

Nozzle **3** usually will be in the lower operating position (FIG. **1** and dot-dash lines, FIG. **2**) when cleaner **1** is used for picking up small particles of dirt and debris, and when collecting grass clippings, leaves and twigs. In this position, nozzle mouth opening **37** will be close to the surface being cleaned, thereby providing strong suction air currents, and nozzle mouth **25** will be supported by wheels **38.** Roller **77** extends generally forwardly downwardly from carriage **2** and disengaged from supporting mouth **25** of nozzle **3.** Control lever **87** normally is pulled rearwardly maintaining roller **77** in its forward downward position through rod **84.**

Debris adjacent nozzle mouth opening **37** will be drawn upwardly into nozzle **3** by the fan suction through mouth opening **37** (arrows A, FIG. **5**). The debris passes through nozzle discharge section **31** with the heavier debris continuing rearwardly and contacting rounded nozzle rear exhaust port **36** (arrows B, FIG. **5**), prior to being drawn laterally through openings **48** and **49** into fan housing **4** (arrows C, FIG. **5**).

The inertia of the heavier debris prevents such debris from being drawn directly into fan housing **4** before striking nozzle exhaust port **36.** Thus, the momentum and impact force of the heavier debris is reduced considerably before it contacts fan **60,** thereby enabling a high suction to be maintained at nozzle opening **37** with a minimum of debris impacting on fan **60.** The possibility of damage to fan **60** and the forces encountered by fan **60** are reduced by this change of direction of movement of the collected debris and by the collision of the heavier debris with the nozzle rear end prior to contacting fan **60.**

The lighter pieces of debris may pass from nozzle **3** directly into fan housing **4** without first striking nozzle exhaust port end **36.** Such debris, however, does not have sufficient momentum or impact to damage fan **60.**

The debris contacts revolving fan **60** upon entering housing **4,** where it will be shredded into smaller pieces before being swirled about housing **4** by the circulating air currents and discharged through discharge opening **52** directly into bag **7.** Large pieces of debris may be deflected laterally, back into nozzle **3** by fan **60** several times until reduced to a smaller size, sufficient to pass between fan **60** and fan housing casing **50.**

When it is desired to pick up larger pieces of debris, such as paper cups, cans, wood, etc., nozzle **3** is raised easily to an intermediate fixed position (as shown in FIG. **1** and in solid lines, FIG. **2**) by manipulation of control lever **87.** Lever **87** is pivoted forwardly in a clockwise direction (arrow D, FIG. **2**) pulling control rod **84** upwardly rearwardly and pivoting links **79** and roller **77** in a counterclockwise direction about pivot rod **80.** As roller **77** pivots upwardly it rolls along bottom wall **33** of nozzle discharge section **31,** pivoting nozzle **3** upwardly in a counterclockwise direction (arrow E, FIG. **2**) on bracket **12** and fan housing **4.**

Roller links **79** will assume a generally vertical position with roller **77** supporting nozzle **3** upon lever **87** reaching its forward position, with lever **87** and roller **77** remaining fixed in such position without an operator holding the lever.

In this intermediate position, the weight of nozzle **3** will be supported largely by roller **77** and links **79,** with the position of nozzle mouth **25** being affected more directly by the movement of carriage **2** over the ground than when nozzle **3** is in the lower position and supported by nozzle wheels **38.**

Nozzle **3** is returned to its lower operating position rapidly and conveniently by pulling lever **87** rearwardly to release it from its forward fixed position. Roller **77** then is forced downwardly by control rod **84** and control link **82,** lowering nozzle **3** until wheels **38** again support nozzle mouth **25.**

Manual movement of lever **87** between the front and rear fixed positions for raising and lowering nozzle **3,** enables nozzle **3** to be quickly and conveniently adjusted according to ground condition. For example, should an obstacle be encountered when nozzle **3** is in the lower position, lever **87** is pushed forwardly only that distance needed to temporarily raise nozzle **3,** to enable the nozzle to pass over the obstacle. After passing over the obstacle pressure can be released from lever **87** and the weight of nozzle **3** is sufficient to return nozzle **3** and lever **87** to their former positions with nozzle mouth **25** being supported by wheels **38.**

Thus, cleaner **1** need not be moved around small obstacles during use, nor does the nozzle have to be set to a fixed vertically adjusted position to enable the nozzle to pass over such objects, thereby reducing the effective suction as heretofore occurred with prior cleaner constructions.

Another important feature of cleaner **1,** in accordance with the invention, is the ability to manually pivot nozzle **3** to a vertical or upper position (FIG. **4**) with nozzle mouth **25** opening upwardly for receiving debris deposited therein from the top. Cleaner **1** can be moved on wheels **9** to a debris collection location, such as at the end of a conveyor or adjacent a work site, for shredding and storing debris deposited manually or automatically in nozzle **3** through mouth opening **37.**

Nozzle **3** preferably is moved just past true vertical position so that the center of gravity of nozzle **3** will tend to pivot nozzle **3** in a counterclockwise position, retaining nozzle **3** in a generally vertical position resting against handle frame **68,** eliminating the need for additional positioning and retaining members. Cleaner **1,** thus has the advantage of a usual mobile vacuum

cleaner, plus the features of a stationary shredder and refuse collector.

Nozzle 3, due to its pivotal mounting on fan housing 4 and carriage bracket 12, is movable manually vertically between a lower operating position (FIG. 1) and a generally vertical upper position (FIG. 4), about an imaginary laterally extending axis 90 (FIGS. 1 and 4). Likewise, nozzle 3 is movable between the lower position and an intermediate position (FIG. 2) by lever means mounted on the cleaner handle assembly 6.

A downwardly curved, arcuate deflector 91 (FIG. 6) is bolted at 92 to collar 61 and deflects the debris discharged through exhaust opening 52 downwardly into bag 7 and against the previously collected debris. Deflector 91 prevents the possibility of a piece of debris traveling at a high velocity from piercing bag 7 and injuring an operator walking behind cleaner 1.

The particular arrangement of nozzle 3 and fan housing 4 enables cleaner 1 to be adapted easily for cleaning places inaccessible to nozzle 3 by insertion of a flexible hose 94 in nozzle auxiliary opening 43 (FIG. 7).

A plastic disc 93 is slip-fitted within annular flange 45 to close side nozzle opening 43 when nozzle 3 is used for usual cleaning operation. Disc 93 can be removed easily enabling hose 94 to be quickly inserted in opening 43 to provide a remote source of suction at the movable end of hose 94.

The attachment end of hose 94 is formed with a cylindrical metal sleeve 95 having a diameter equal to that of openings 43 and 44, and a length greater than the lateral distance between nozzle side walls 34 and 35 at openings 43 and 44. Sleeve 95 is inserted through openings 43 and 44 and frictionally held therein, terminating within annular flanges 45 and 46. Sleeve 95 forms an air passage between fan housing 4 and hose 94 and effectively seals the nozzle air passage through mouth 37 to the surrounding atmosphere.

No baffles, sealing plates or other components need be disconnected or connected to nozzle 3 by bolts, clips, etc. to divert the air flow through hose 94, heretofore required with prior cleaners. The simple removal of disc 93 frictionally held within flange 45 is all that is required before insertion of hose sleeve 95. Likewise, the position of nozzle 3 need not be changed since hose sleeve 95 engages within nozzle openings 43 and 44 regardless of the pivotal position of nozzle 3.

Second Embodiment

It is desirable for certain cleaning applications where large pieces of debris may be collected, to install additional shredding means within nozzle 3 to reduce the size of the debris before the debris strikes fan 60 (FIG. 8). A shaft extension 96 is connected to engine shaft 59 by a coupling 97 and extends laterally through fan housing openings 48 and 49 and nozzle openings 44 and 43.

Shaft extension 96 preferably has a squared portion and the outer shaft end is journaled in a bearing 98 which is bolted at 99 to a plate 100 which covers auxiliary nozzle side opening 43 and includes an outer annular flange 101 which is bolted at 102 to the nozzle annular flange 45.

A plurality of chains 103 are mounted at spaced intervals along shaft extension 96. Chains 103 shred and break into smaller particles all large debris entering nozzle 3. Shaft extension 96 passes through the center links of chains 103 to form the chain mounting. Spacers 104 are located between adjacent chains 103. thus, no bolts or other means project from shaft extension 96 to which debris can cling and/or build up.

Chains 103 may be replaced with knife blades, metal rods and the like for particular cleaning applications. For example, knife blades may be used when only small branches, twigs, vegetation and soft items may be encountered.

Third Embodiment

A modified form of the improved vacuum cleaner construction is indicated at 105 (FIGS. 9–12) and is similar to cleaner 1 except a self-propelled driving mechanism is incorporated therein. The driving mechanism may be incorporated in cleaner 105 readily and with few components because of the horizontal lateral position of drive shaft 59.

The drive mechanism preferably is chain driven using a sprocket 106 (FIGS. 9 and 12) mounted on shaft 59 between engine 5 and fan housing 4. A second sprocket 107 is mounted below sprocket 106 on the inner end of a stub shaft 108 parallel with shaft 59. Shaft 108 is journalled in a pair of bearings 109 and 110 (FIG. 11) which are bolted to a pair of channel brackets 111 and 112, respectively. Channel bracket 112 is welded to carriage base plate 10, and channel bracket 111 is welded to base plate 10 and reinforcing channel 23.

A third sprocket 113 is mounted on the outer end of stub shaft 108 and is aligned with an intermediate idler sprocket 114 and a fourth drive sprocket 115. A continuous drive chain 116 extends vertically between and engages sprockets 106 and 107, and a similar continuous drive chain 117 extends longitudinally with respect to carriage 2 between and in driving engagement with sprockets 113 and 115.

Idler sprocket 114 is journaled in a bearing 118 welded to bracket 119. Bracket 119 is adjustably mounted on engine mounting bracket 17 by bolts 120 which extend through slots 121 formed in bracket 17. Idler sprocket 114 is mounted below the level of sprockets 113 and 115 and is movable into engagement with chain 117 to tension chain 117.

Sprocket 115 is mounted on a drive shaft 122 which extends horizontally laterally across the rear of carriage 2 and is located above rear carriage wheels 9. Shaft 122 is journaled in a pair of spaced bearings 123 which are pivotally mounted on channels 124 by pins 125 (FIG. 11). Channels 124 are welded to nozzle bracket side wall 14 and to engine bracket 17.

Levers 126 are welded to pins 125 and extend vertically upwardly therefrom (FIG. 10) on both sides of cleaner 105. Springs 127 are connected between levers 126 and engine 5 and carriage bracket 12, biasing levers 126 and drive shaft 122 in a counterclockwise direction about pins 125.

Sleeves 128 are mounted on each end of drive shaft 122 for frictionally engaging rear wheels 9 to transmit the driving torque from engine shaft 59 to wheels 9. Bands 129 of frictional material, such as rubber, cover shaft sleeves 128 to reduce slippage between wheels 9 and shaft 122.

Control rods 130 extend from the upper ends of levers 126 to a drive actuating bar 131 mounted on handle frame portion 68 by brackets 132.

The self-propelling drive mechanism is actuated by the operator pivoting bar 131 upwardly (arrow F, FIG. 10) to move control rods 130 upwardly rearwardly, as indicated by dot-dash lines, FIG. 10. Levers 126 pivot in a clockwise direction moving drive shaft 122 down-

wardly until sleeves **128** contact wheels **9.** The greater the pressure applied to bar **131,** the greater is the force applied to rear wheels **9** by drive shaft **122** resulting in faster speeds for moving cleaner **105** across the surface being cleaned.

Springs **127** bias levers **126** counterclockwise moving drive shaft **122** out of engagement with wheels **9,** automatically upon release of pressure from bar **131.**

The parallel alignment of drive shaft **122** with engine shaft **59** permits the use of drive chains extending directly between engine shaft **59** and drive shaft **122.** Prior cleaner constructions having fan shafts extending horizontally longitudinally or vertically with respect to the cleaner carriage require additional parts, since a change in direction is required between the chain sprockets. Drive sprockets **106, 107, 113** and **115** are aligned and are parallel with each other, as best seen in FIGS. **11** and **12** permitting such direct chain connection between engine shaft **59** and drive shaft **122.**

Flexible belts are used to achieve such direction change in prior machines. Belts, however, do not provide the positive drive and power transmission, as do continuous drive chain and sprocket assemblies. Thus, the use of drive chains achieves maximum machine power drive efficiency.

Fourth Embodiment

A further modification of the improved vacuum cleaner construction is indicated generally at **135** (FIG. **13**), in which the cleaner is pulled by a tractor **136.** Cleaner **1** can be adapted easily to a towed cleaner **135** pulled behind a usual garden tractor **136** by a drawbar assembly **137.**

Drawbar assembly **137** includes two rearwardly extending tubular members **138** which are bent inwardly at their rear ends where they are joined together by bolts **139.** An attachment bar **140** having a clevis **141** is secured between the joined rear ends of members **138** by the bolts **139.** Clevis **141** is connected to a usual rear hitch bar **142** of tractor **136** by pin **143.**

The front ends of tubular members **138** are connected to carriage channels **8** by clamps **144.** Rear carriage wheels **9** preferably are removed from carriage **2** and the cleaner **135** is supported by front wheels **9** and tractor hitch bar **142.** Nozzle mouth **25** is supported by nozzle wheels **38** enabling mouth opening **37** to retain its location with respect to the surface being cleaned without being appreciably affected by the movement of tractor **136** and front carriage wheels **9** over uneven ground.

The tractor operator may adjust nozzle **3** between its lower and intermediate operating positions by movement of lever **87** positioned just behind the operator, in the same manner as when the operator is walking behind the cleaner.

A drawbar attachment similar to tubular members **138** may be attached to carriage **2** and extending forwardly therefrom for pulling cleaner **1** forwardly in its usual operating direction. The front carriage wheels **9** preferably are removed to permit connection of members **138.** Nozzle **3** may be secured in the upper vertical position, as shown in FIG. **4,** and hose **94** inserted in auxiliary nozzle opening **43.**

Nose **94** extends forwardly and is attached to a usual discharge chute mounted on the tractor. The cut grass, leaves, etc. discharged from the tractor cutter or rake are pulled through hose **94** by the suction created by fan **60** and pass through fan housing **4** into bag **7.**

Thus, cleaner **1** can be adapted easily for attachment to a tractor for picking up debris through nozzle **3** or for receiving and gathering debris discharged from the tractor discharge chute.

IN GENERAL

In each of the embodiments of the invention illustrated in the drawings and described above, the cleaner nozzle is pivotally mounted at its exhaust end to the fan housing with the nozzle mouth supported on wheels separate from the carriage so that the nozzle mouth "floats" over rough terrain appreciably unaffected by the up and down movement of the carriage. The nozzle mouth can be raised and lowered to pass over obstacles and to pick up trash of various sizes by a lever located remote from the nozzle at the operator's station. The nozzle also can be raised to an upper vertical position to receive trash deposited directly into the upturned nozzle mouth.

Accordingly, the improved vacuum cleaner construction provides a pivotally mounted nozzle, movable vertically about a laterally extending axis enabling the location of the nozzle mouth from the surface being cleaned to be readily adjusted; provides a cleaner construction having a nozzle, the extended front inlet end of which is supported on wheels separate from the main carriage wheels; provides a cleaner construction in which the heavier collected debris contacts the rear exhaust port of the nozzle lessening its momentum and impact force before the debris passes into the fan housing and contacts the revolving fan; provides a cleaner construction in which the engine shaft extends horizontally laterally with respect to the cleaner nozzle and carriage enabling a self-propelling mechanism to be incorporated into the cleaner with fewer parts than heretofore required; providing a cleaner construction in which shredding and pulverizing chains or bars may be mounted within the nozzle exhaust port, and in which an auxiliary hose can be connected to the cleaner for cleaning areas inaccessible to the nozzle mouth; and provides structures and arrangements which are very simplified, which eliminate difficulties existing in the art, and which achieve the stated objectives and solve problems that have existed in the art.

In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are used for descriptive purposes and are intended to be braodly construed.

Moreover, the description and illustration of the invention is by way of example, and the scope of the invention is not limited to the exact details shown or described.

Having now described the features, discoveries, and principles of the invention, the manner in which the vacuum cleaner construction is constructed an used, the characteristics of the new construction, and the advantageous, new and useful results obtained; the new and useful structures, devices, elements, arrangements, parts, and combinations, are set forth in the appended claims.

I claim:

1. Vacuum cleaner construction including a carriage; handle means mounted on the carriage; wheels rotatably mounted on the carriage for movement of the carriage across a surface to be cleaned; a nozzle extending

longitudinally with respect to the carriage and having a laterally extending inlet mouth at one end and an exhaust port at the other end; means mounting the nozzle exhaust port on the carriage for pivotal movement of the nozzle vertically about a laterally extending axis; a fan housing communicating with the nozzle exhaust port; inlet and exhaust openings formed in the fan housing; the fan housing having a generally cylindrical shape with inner and outer laterally spaced side walls and a tangentially-disposed air exhaust port, said exhaust port extending longitudinally rearwardly from the fan housing and terminating in and forming the fan housing exhaust opening, and said fan housing inlet opening being formed in the inner fan housing side wall concentrically with respect to the laterally extending pivotal axis; means communicating with the fan housing exhaust opening for receiving and storing debris discharged from the fan housing exhaust opening; fan means mounted within the fan housing for developing an air flow through the nozzle and fan housing and into the debris collection means; engine means drivingly connected to the fan means; and wheel means mounted on the nozzle supporting said nozzle mouth above a surface being cleaned.

2. The construction defined in claim **1** in which the debris collection means includes a porous cloth bag formed with an inlet opening in the upper portion thereof, in which clamp means releasably connects the bag to the air exhaust port, and in which the fan housing exhaust opening communicates directly with the bag inlet opening, whereby the debris discharged from the fan housing enters directly into the bag in a general straight-line path from the fan housing air exhaust port.

3. The construction defined in claim **2** in which downwardly extending arcuate deflector means is mounted on the fan housing air exhaust port, and in which said deflector extends through the bag inlet opening and deflects debris discharged through the fan housing air exhaust port downwardly toward the bottom of the bag.

4. The construction defined in claim **2** in which a disposable plastic liner is located within the cloth bag, in which the liner is formed with a plurality of perforations to permit air flow through the bag, and in which the fan housing air exhaust port communicates with the liner for discharging debris from the fan housing into the liner.

5. The construction defined in claim **2** in which an air exhaust opening is formed in the upper portion of the bag, in which means are mounted on the bag and communicate with the bag air exhaust opening to regulate the amount of air escaping from the bag through said opening, and in which a screen covers the bag air exhaust opening permitting the passage of air through said opening and preventing the passage of debris through said opening.

6. Vacuum cleaner construction including a carriage having a vertically extending bracket formed with a circular top opening; handle means mounted on the carriage; wheels rotatably mounted on the carriage for movement of the carriage across a surface to be cleaned; a nozzle extending longitudinally with respect to the carriage and having a laterally extending inlet mouth at one end and an exhaust port at the other end; said nozzle exhaust port having laterally spaced inner and outer side walls; means mounting the nozzle exhaust port on the carriage for pivotal movement of the nozzle vertically about a laterally extending axis; a fan housing communicating with the nozzle exhaust port; the fan housing including a pair of laterally spaced inner and outer side walls; inlet and exhaust openings formed in the fan housing; said fan housing inlet opening being circular and formed in the fan housing inner side wall laterally horizontally aligned with the carriage bracket opening; the nozzle exhaust port pivotal mounting means including a pair of outwardly extending annular flanges formed on the nozzle exhaust port inner and outer side walls, said outer side wall flange extending through the carriage bracket opening and said inner side wall flange extending through the fan housing inlet opening; means communicating with the fan housing exhaust opening for receiving and storing debris discharged from the fan housing exhaust opening; fan means mounted within the fan housing for developing an air flow through the nozzle and fan housing and into the debris collection means; engine means drivingly connected to the fan means; and wheel means mounted on the nozzle supporting said nozzle mouth above a surface being cleaned.

7. The construction defined in claim **6** in which the inner nozzle flange surrounds a nozzle exhaust opening formed in the nozzle inner wall.

8. The construction defined in claim **7** in which the outer nozzle flange surrounds an auxiliary opening formed in the nozzle outer wall, and in which cover means seals said auxiliary opening to the atmosphere when the air flow enters through the nozzle mouth.

9. The construction defined in claim **6** in which the engine means include a shaft, said shaft extending horizontally laterally with respect to the carriage, in which the engine shaft extends through an opening formed in the fan housing outer wall and connects to the fan means, and in which the axis of the engine shaft is laterally aligned with the fan housing inlet opening and with the nozzle exhaust opening.

10. The construction defined in claim **1** in which the nozzle includes a box-like section extending longitudinally between the nozzle mouth and the nozzle exhaust port, in which the nozzle mouth includes flared top and bottom walls and laterally spaced end walls, said walls forming a laterally extending nozzle mouth opening, and in which the nozzle mouth support wheel means includes wheels mounted on the laterally spaced end walls.

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