Jan. 27, 1970 F. D. DOLAN ET AL 3,491,399

VACUUM CLEANER

Filed June 27, 1966 5 Sheets-Sheet 1

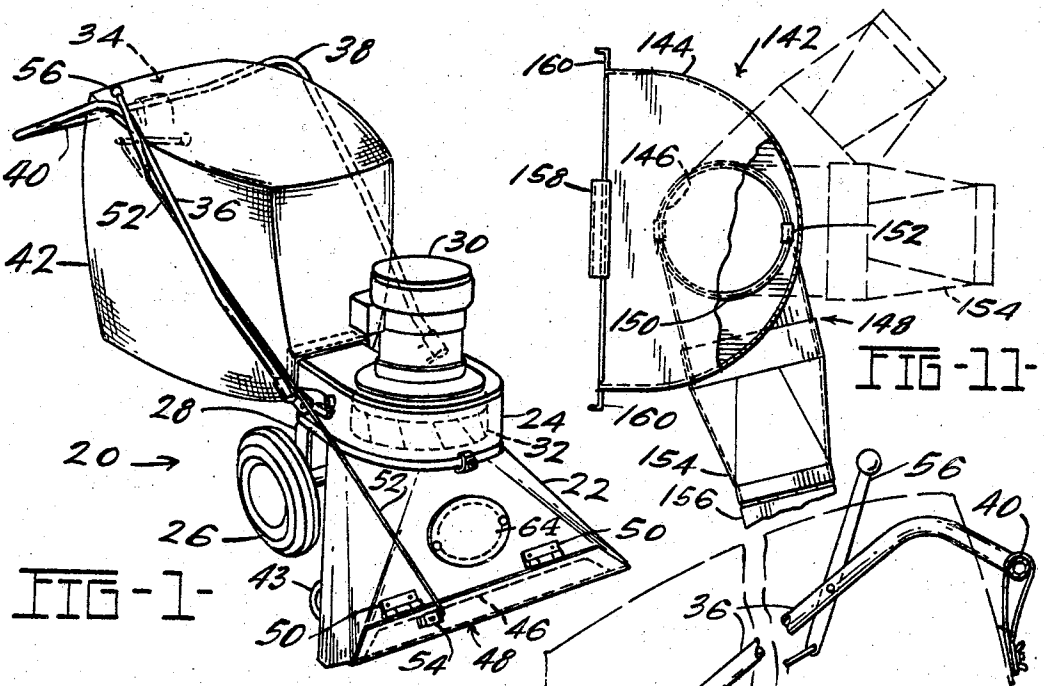


FIG-1-

FIG-11-

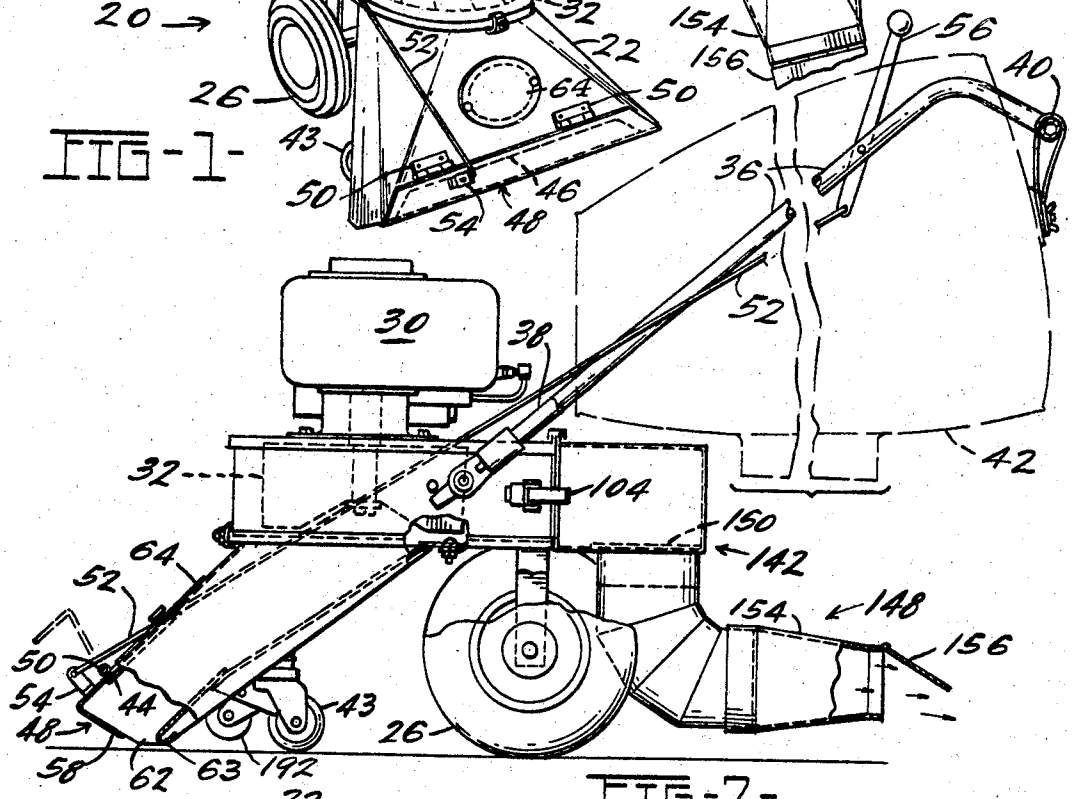


FIG-2-

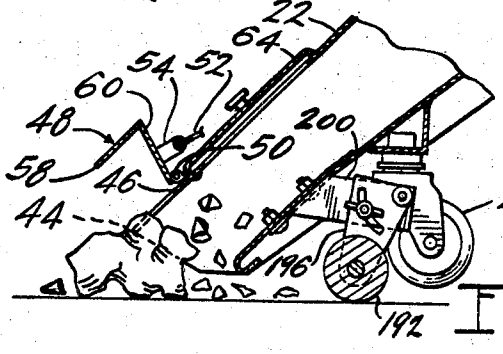


FIG-3-

INVENTORS:
FRANCIS D. DOLAN.
BY JACK L. BURGOON.
Owen & Owen
ATT'YS.

Jan. 27, 1970 F. D. DOLAN ET AL 3,491,399

VACUUM CLEANER

Filed June 27, 1966 5 Sheets-Sheet 2

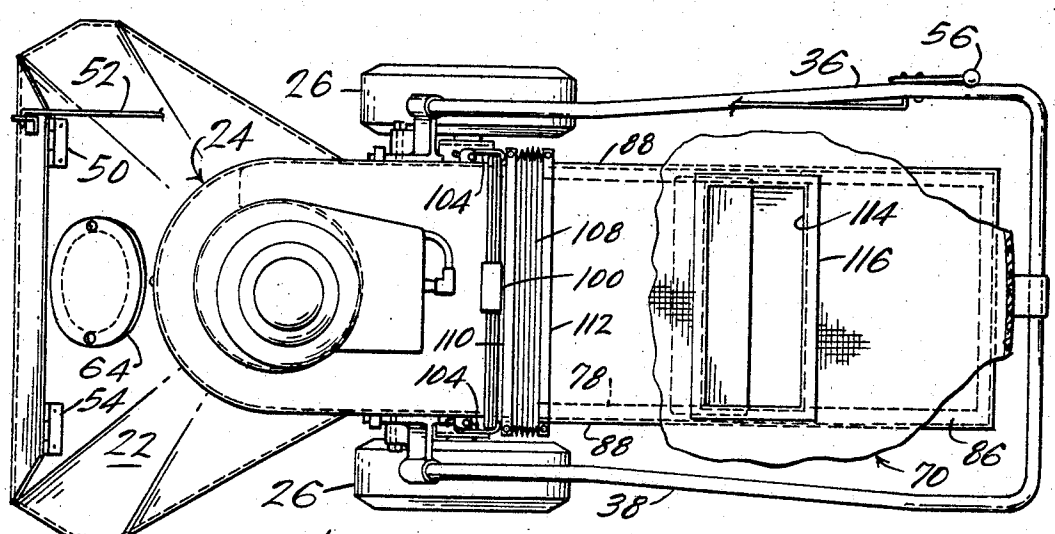


FIG-4-

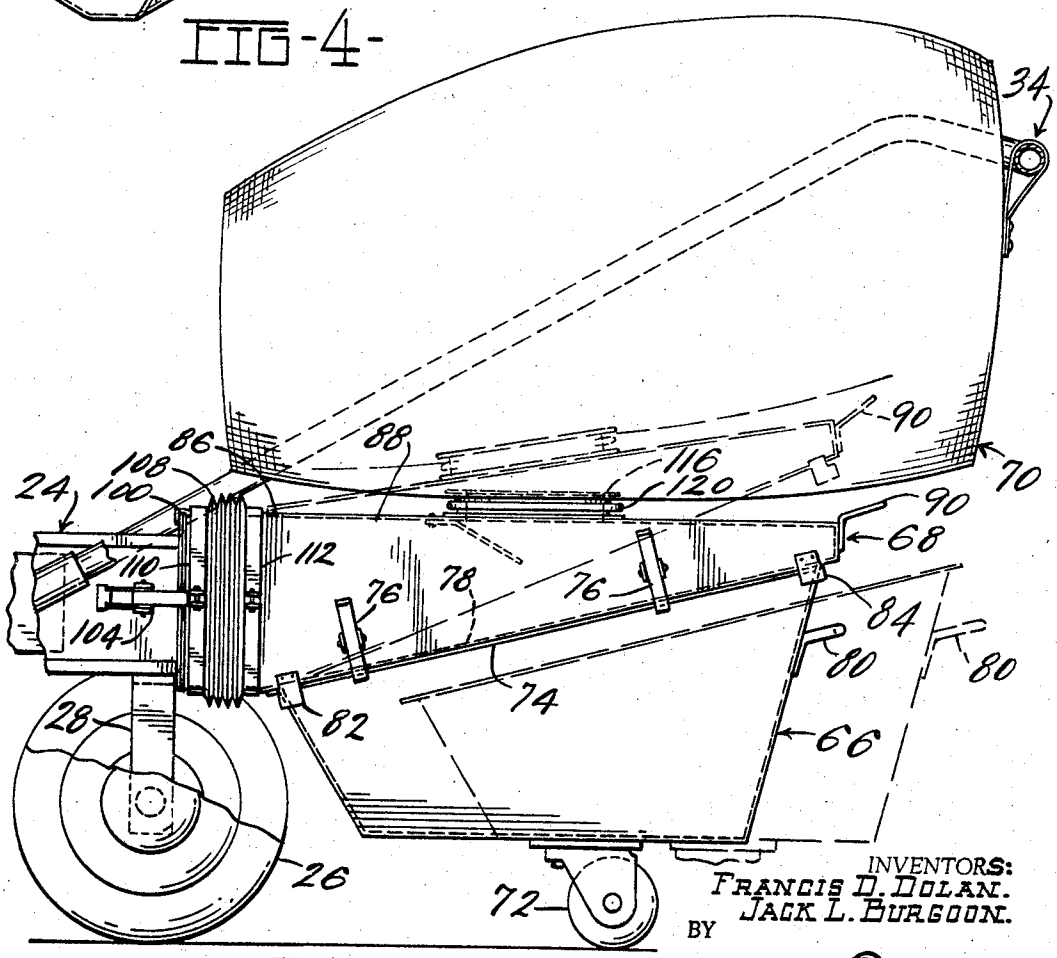


FIG-5-

INVENTORS:
FRANCIS D. DOLAN.
JACK L. BURGOON.
BY
Owen & Owen
ATT'YS

Jan. 27, 1970 F. D. DOLAN ET AL 3,491,399

VACUUM CLEANER

Filed June 27, 1966 5 Sheets-Sheet 3

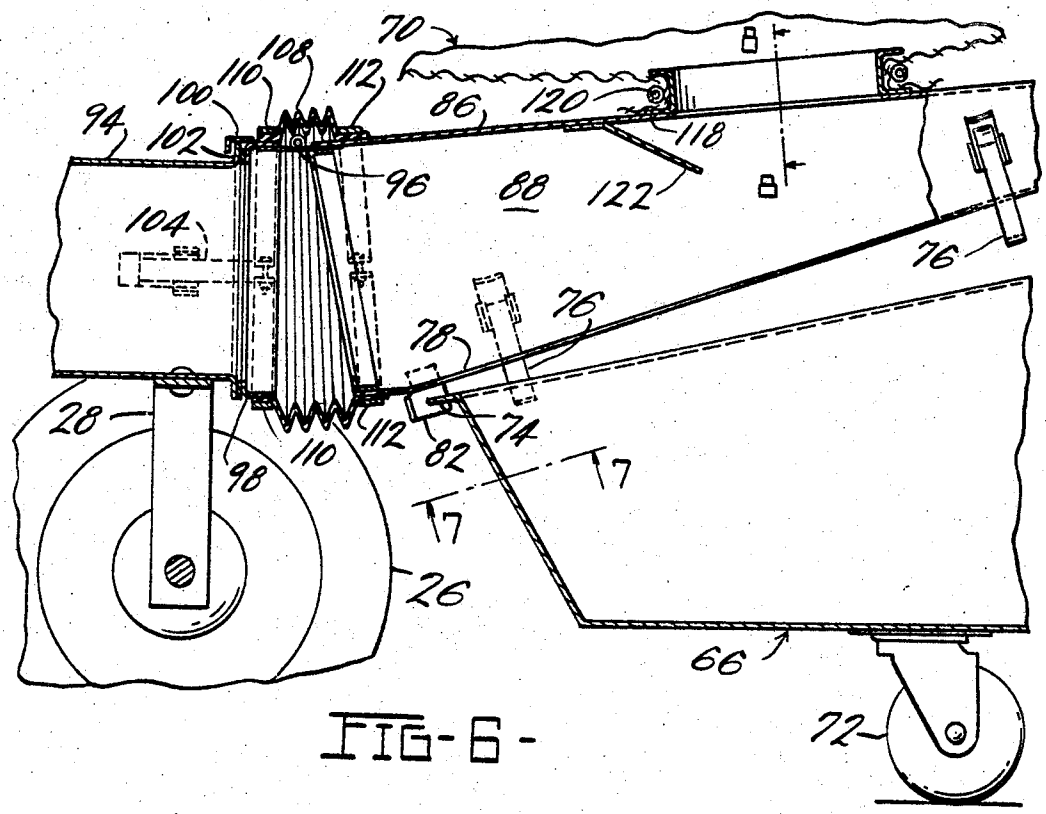


FIG-6-

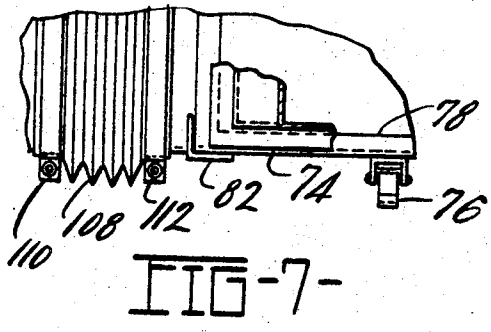


FIG-7-

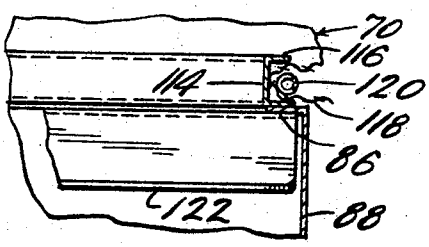


FIG-8-

INVENTORS:
FRANCIS D. DOLAN.
JACK L. BURGOON.
BY
Owen + Owen
ATT'YS.

Jan. 27, 1970 F. D. DOLAN ET AL 3,491,399

VACUUM CLEANER

Filed June 27, 1966 5 Sheets-Sheet 4

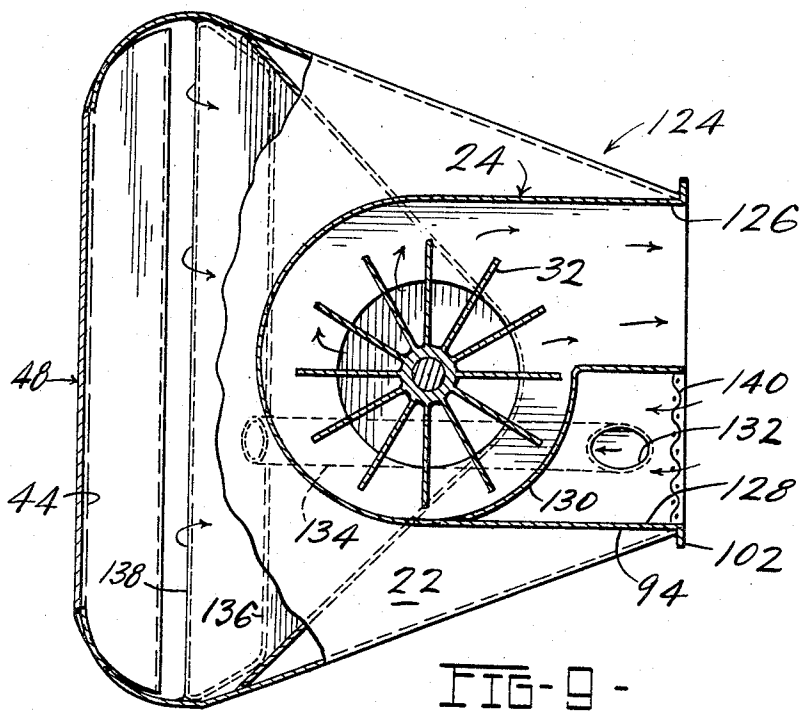


FIG-9-

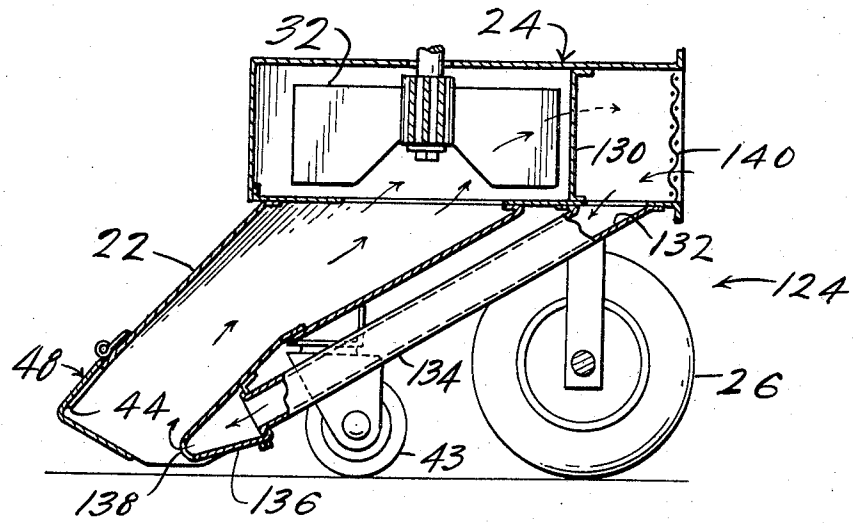


FIG-10-

INVENTORS:
FRANCIS D. DOLAN.
BY JACK L. BURGOON.
Owen & Owen
ATT'YS.

Jan. 27, 1970 F. D. DOLAN ET AL 3,491,399

VACUUM CLEANER

Filed June 27, 1966 5 Sheets-Sheet 5

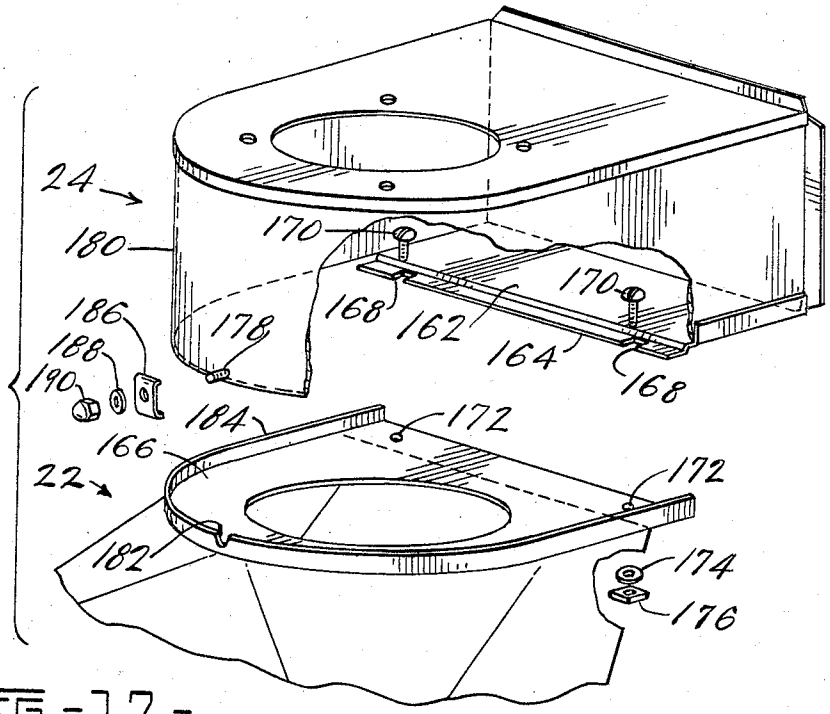


FIG-12-

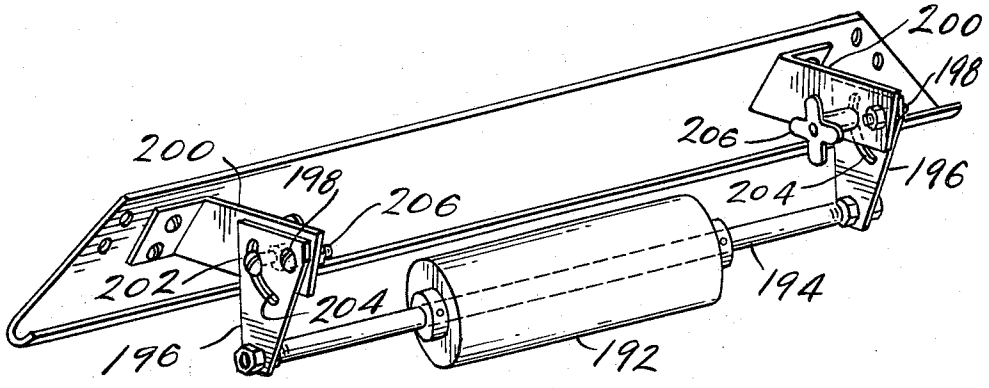


FIG-13-

INVENTORS:
FRANCIS D. DOLAN.
JACK L. BURGOON.
BY
Owen & Owen
ATT'YS.

United States Patent Office 3,491,399
Patented Jan. 27, 1970

3,491,399

VACUUM CLEANER

Francis D. Dolan and Jack L. Burgoon, Toledo, Ohio, assignors, by mesne assignments, to The Scott & Fetzer Company, Lakewood, Ohio, a corporation of Ohio

Filed June 27, 1966, Ser. No. 560,671
Int. Cl. A47l 9/10, 7/00
U.S. Cl. 15—351 5 Claims

ABSTRACT OF THE DISCLOSURE

An improved industrial-type vacuum cleaner has a rearwardly directed discharge with a metal hopper arrangement which can be quickly connected to and disconnected from the vacuum cleaner adjacent the discharge. The weight of the hopper is supported directly on the floor and can be easily detached for emptying. A large filtering bag communicates with an opening above the hopper and is located thereabove for receiving and filtering discharge air with heavier air-borne particles being collected directly by the hopper. The vacuum cleaner also includes a pivotal nozzle flap of a particular configuration, a pivotal blower spout, and a retractable supporting roller, all of which provide additional advantages for the vacuum cleaner.

This invention relates to a vacuum cleaner and more particularly to a large, walking-type vacuum cleaner capable of cleaning litter from large areas.

Large vacuum cleaners of the type under consideration are known in the art and are continually finding wider commercial acceptance. These vacuum cleaners usually are of the walking type in which the cleaner is mounted on wheels and is pushed and manipulated by an operator walking therebehind. Such cleaners can be used for industrial and commercial applications, as for cleaning factory aisles, sidewalks, and the like, or by home owners for removing leaves from lawns. In general, such cleaners are effective for use in areas which are too large to be cleaned with hand tools and which are too small or otherwise not adaptable for large riding type sweepers which usually employ rotating brushes.

The present invention relates to a vacuum cleaner of the above described type having a number of advantages over those heretofore known. The cleaner includes an elongate nozzle located adjacent the ground for picking up litter, which nozzle includes an auxiliary or additional opening for receiving larger litter, e.g. milk cartons, and also includes a manually-operable flap for exposing or covering the additional opening, as desired. The additional opening and the flap are designed to provide an effective flow of air through the nozzle which enables the litter to be carried through the nozzle more effectively than heretofore.

The vacuum cleaner according to the invention also is capable of operating for a longer period of time before the filtering bag becomes plugged excessively. One of the major problems in vacuum cleaners of the type under consideration is the plugging of the filtering bag by fine air-borne particles when the cleaner is operated. In practice, it has been found that if a cleaner of the instant type is operated over a dusty area or one covered by powder or silt, the filtering bag can be plugged sufficiently to reduce air flow through the nozzle as much as fifty percent in a period as short as fifteen minutes. Heretofore, attempts to increase the efficiency of the vacuum cleaner and reduce the deleterious effect of fine air-borne particles have been mainly directed to increasing the filtering area of the bag, as by various types of corrugations or undulations therein, or simply by increasing the overall size of the bag. These attempts have met with only limited success, however.

To meet this problem, in one form of the invention, the vacuum cleaner can be equipped with an imperforate, metal hopper with a filtering bag mounted above the hopper and in communication therewith in a manner such that the hopper receives a large amount of the airborne particles so that the amount of air-borne particles available to plug the filtering bag is minimized. The cleaner according to the invention also is effective in minimizing the plugging problem in another unique manner. Accordingly, part of the air sucked through the nozzle and expelled into the receiver or bag is recirculated back to the nozzle opening instead of all air being expelled through and filtered by the bag. With this arrangement, a large portion of the finer air-borne particles are recirculated to the nozzle with a correspondingly lesser amount being retained in and plugging the bag.

Further in accordance with the invention, the vacuum cleaner can be equipped with a blower used in place of the air-borne particle-receiving bag, which blower can be used to blow litter, particularly leaves, into a pile or off of a given area. The blower attachment is quickly attached to or removed from the vacuum cleaner and is equipped with a pivotable nozzle for directing air in any desired direction from the vacuum cleaner.

The new vacuum cleaner also is designed so that the nozzle can be quickly separated from the blower housing in order to remove clogged debris or to service the impeller. The vacuum cleaner also has an adjustable roller which can be mounted near the nozzle to facilitate supporting the front portion of the vacuum cleaner on soft surfaces, such as lawns.

It is, therefore, a principal object of the invention to provide a vacuum cleaner with an improved nozzle arrangement capable of effectively picking up larger pieces of litter.

Another object of the invention is to provide a vacuum cleaner having an improved air-borne particle-receiving receptacle including an impervious hopper and a filtering bag located thereabove.

A further object of the invention is to provide a vacuum cleaner having means for recirculating part of the air from the filtering bag to the vacuum nozzle.

Yet another object of the invention is to provide a vacuum cleaner with a blower located at the rear of the chamber for directing air from the cleaner in a predetermined direction.

Still a further object of the invention is to provide a vacuum cleaner with a nozzle which can be quickly removed from the blower housing.

Still another object of the invention is to provide a vacuum cleaner with an adjustable roller for supporting a portion of the vacuum cleaner on soft surfaces.

Many other objects and advantages of the invention will be apparent from the following detailed description of preferred embodiments thereof, reference being made to the accompanying drawings, in which:

FIG. 1 is a view in perspective of a vacuum cleaner embodying the invention;

FIG. 2 is a side view in elevation of the cleaner of FIG. 1, showing a nozzle and flap arrangement for enabling the cleaner to receive larger litter and a detachable blower mounted in place of the filtering bag;

FIG. 3 is a view of the nozzle portion of the cleaner of FIG. 2, showing a flap in a raised position to enable the nozzle to receive larger litter;

FIG. 4 is a view in elevation of the vacuum cleaner employing an impervious hopper and filtering bag thereabove in place of the single filtering bag;

FIG. 5 is an enlarged view in elevation of the hopper,

an upper connecting housing, and the filtering bag shown in FIG. 4, with the hopper shown in a detached position in dotted lines;

FIG. 6 is a further enlarged view of the hopper and an attachment for connecting the upper housing to the vacuum cleaner;

FIG. 7 is a detailed view taken along the line 7—7 of FIG. 6, showing means for positioning the hopper relative to the upper connecting housing;

FIG. 8 is a detailed view taken along line 8—8 of FIG. 6 and showing the manner in which the filtering bag is attached to the upper housing;

FIG. 9 is a top view of a modified vacuum cleaner, with parts broken away and with parts in section, which cleaner is capable of recirculating part of the air received in an air-borne particle receptacle;

FIG. 10 is a side view, with parts broken away and with parts in section, of the cleaner of FIG. 9;

FIG. 11 is a plan view, with parts broken away and with parts in section of the detachable blower shown in FIG. 2;

FIG. 12 is a fragmentary exploded view in perspective with parts broken away, of the nozzle and impeller housing of the vacuum cleaner; and

FIG. 13 is a view in perspective of a roller which can be used with the vacuum cleaner, particularly on soft surfaces.

Referring particularly to FIG. 1, a vacuum cleaner according to the invention is indicated at **20**. The cleaner includes a nozzle **22** and a blower or impeller housing **24** communicating with the nozzle **22** and supported by large rubber-tired wheels **26** through frame members **28**. An internal combustion engine **30** of suitable design is mounted on the housing **24** and drives an impeller **32** (FIG. 2) located within the housing **24**.

A control handle **34** for the cleaner **20** includes a pair of legs **36** and **38** which are pivotally connected to the housing **24** and a cross bar **40**. A large filtering bag **42** is attached to an outlet portion of the blower housing **24** for receiving air-borne particles from the blower which are sucked through the nozzle **22**. The nozzle **22** has casters **43** pivotally attached thereto for holding the lower end of the nozzle **22** a predetermined distance above the ground. To this point, the vacuum cleaner is generally of the type known in the art and will not be discussed in detail.

Referring particularly to FIGS. 2 and 3, the nozzle has a main inlet opening **44** and an auxiliary opening **46** formed by notching a front wall portion of the nozzle. The auxiliary inlet opening **46** normally is closed and is opened temporarily only when it is desired to receive larger size litter through the nozzle **22**. For this purpose, an L-shaped flap **48** is pivotally mounted by hinges **50** to the front of the nozzle and can be raised and lowered by a control rod **52** pivotally attached to an ear **54** of the flap and extending to an upper portion of the handle leg **36** where it is connected to a lever **56**. The lever **56** is manipulated by the operator of the cleaner to temporarily raise and lower the flap **48** by moving the lever forwardly and rearwardly, respectively.

The flap **48** includes a main or lower leg portion **58** and an auxiliary, upper leg portion **60**. When the flap **48** is in the lower position, as shown in FIG. 2, the lower leg portion **58** partially covers the main opening **44** of the nozzle **22**, leaving a relatively narrow slot opening **62** through which air can flow at high velocity and which is exceptionally effective in picking up small litter particles and enabling them to be carried to the impeller **32** and to the bag **42**. At this time, of course, the auxiliary opening **46** is completely closed off, being overlapped by the upper leg **60** of the flap.

If relatively large litter is encountered by the cleaner **20**, the operator can raise the flap **48** just before reaching the piece, to the position of FIG. 3, to expose the entire main opening **44** as well as the auxiliary opening **46** to enable the piece to enter the nozzle **22**. When the flap **48** is swung downwardly to the normal position again, it can urge the piece up the nozzle somewhat if it has not already been pulled up by the suction. With this arrangement of the main and auxiliary openings as well as the flap, both small and large particles can be effectively picked up by the nozzle without dropping back, as has heretofore occurred with some other cleaners. This is made possible in part by the lower leg portion **58** of the flap which forms a narrowing, high velocity passage with the ground immediately in front of the opening **62**. A rear lip **63** of the nozzle is even closer to the ground than the leg portion **58** so as to draw air from the rear at even higher velocity. The latter air flow minimizes the chance for particles, especially heavier ones, from passing completely under the nozzle opening.

The nozzle **22** can be provided with an access door **64**, as is known in the art, which can be removed in order for various accessories to be attached.

With a vacuum cleaner of the type under consideration, a serious problem is the plugging of the filtering bag **42** during operation, with a consequential rapid decrease in the efficiency of the vacuum cleaner. Where a machine is used in relatively dust- or silt-free areas and only larger air-borne particles are picked up, the problem is relatively insignificant. However, in almost any application for a vacuum cleaner of the type under consideration, some areas will be encountered containing various types of powdery particles, such as silt or dust. Where such materials are relatively thick, it has been found that even in as short a period as fifteen minutes, the efficiency of the cleaner can decrease fifty percent because of the plugging of the filtering bag by the fine particles and a consequential rapid decrease of air flow through the bag. Most attempts to meet this problem previously have been in the form of increasing the surface area of the filtering bag by increasing the size thereof and by using various surface-extending configurations thereof. While such measures tend to increase the time somewhat that elapses before the efficiency of the vacuum cleaner drops a given amount, generally speaking, such measures are of limited values.

In accordance with the invention, the vacuum cleaner **20** can be provided with air-borne particle-receiving means in the form of an impervious metal hopper and a filtering bag, as shown in FIGS. 4–8. The hopper and bag are arranged so that more of the air-borne particles are collected in the hopper and less tend to be caught by the bag and plug it as the air passes therethrough. Referring particularly to FIGS. 5 and 6, the receptacle basically includes a metal hopper **66**, a connecting housing **68**, and a filtering bag **70**. The metal hopper **66** can be supported on a central ground wheel **72** to reduce the weight of the overall air-borne particle receptacle carried by the cleaner. The hopper is preferably quickly detachable from the connecting housing **68** and for this purpose, as shown, the hopper includes a slanted upper edge terminating in outwardly extending flanges **74** which are engaged by quick-acting, over-the-center clamps **76** which can quickly attach the flanges **74** to and detach them from inwardly-extending flanges **78** of the connecting housing. When the hopper **66** is detached, it can be pulled rearwardly by a rear handle **80** and rolled to a suitable dumping site, with the slanted arrangement of the flanges facilitating the removal of the hopper. When the hopper is to be reassembled with the connecting housing **68**, it is rolled back into position until the front corners of the hopper engage positioning flanges **82** (see also FIG. 7) with rear side flanges **84** aiding in aligning the hopper and the housing.

The connecting housing **68** has a rectangular top wall **86** and generally triangular sidewalls **88** to form an inverted U-shaped top for the hopper **66**. The housing **68** also has a rear handle **90** which enables the housing **68** to be lifted when the hopper **66** is to be retracted.

As shown particularly in FIG. 6, the front of the housing terminates in an inlet **92** having a forward edge sloping downwardly and rearwardly away from an outlet end **94** of the impeller housing **24**. The upper end of the inlet

92 is affixed to a hinge 96 which also is affixed to a connecting flange or ring 98. The connecting flange 98 has an upper hook portion 100 which fits over an outlet flange 102 of the outlet 94 and the connecting flange also has side ears which can be engaged by quick-acting clamps 104. A sponge rubber gasket 106 is located between the outlet flange 102 and the connecting flange 98. A bellows 108 is affixed to the connecting flange 98 and the inlet 92 by bands 110 and 112 to provide a seal which prevents air leakage yet still enables the connecting housing 68 and the hopper 66 to move relative to the main body of the cleaner and specifically the impeller housing 24. This enables the cleaner to accommodate unevenness in the surface over which it is moved and also enables it to be manipulated up or down curbs and the like, for example.

The upper wall or top 86 of the connecting housing 68 has an upwardly-extending rectangular neck 114 (FIGS. 4, 6, and 8), terminating in a horizontal flange 116. The filtering bag 70 has an inlet neck 118 which fits around the flange 116 and is connected to the neck 114 by a suitable band 120. A deflector plate 122 is located below and slightly in front of the filtering bag opening and serves to deflect downwardly air and air-borne particles entering the hopper 66. The air thereby moves toward the lower rear of the hopper and swirls to that area in eddy currents before eventually being forced upwardly through the filtering bag opening and through the wall of the filtering bag 70. Consequently, large air-borne particles and even many of the small air-borne particles capable of plugging the filtering bag drop out and remain in the impervious metal hopper 66 until it is eventually emptied. With a smaller amount of the finer air-borne particles contacting and plugging the bag 70, the efficiency of the cleaner can be maintained at higher levels for greatly extended periods of time.

The combination particle-receiving receptacle formed by the hopper 66 and the filtering bag 70 also has a much longer life than the filtering bag 42 when used alone. Particularly the lower portion of the filtering bag is subject to abuse when the cleaner is operated, whereas the combination receptacle, the lower portion being of metal, is capable of much more effectively withstanding such abuse. In addition, larger litter or airborne particles are frequently forcibly thrown through the impeller housing outlet. Even though a deflector wall of some nature is usually employed behind the outlet to stop such large particles when a filtering bag is used alone, nevertheless some particles will occasionally be thrown past the plate and, in such instances, thrown completely through the bag. With the metal hopper and bag arrangement of FIGS. 4–8, it is impossible for any large litter to enter the bag 70 with sufficient force to damage it. Hence, even though the combination hopper 66 and bag 70 is more expensive than the larger single bag 42, the life of the combination is several times that of the bag alone.

A modified vacuum cleaner 124 of FIGS. 9 and 10 also enables the efficiency of the cleaner to be maintained higher than that of conventional cleaners. This is accomplished by recirculating part of the air sucked in from the nozzle and exhausted into the particle-receiving receptacle. Accordingly, the impeller housing 24 has an outlet duct 126 formed in the discharge end 94 with a dead air chamber 128 formed adjacent the duct 126 by a sidewall of the discharge end 94 and an inner partition 130 which forms part of the impeller chamber and part of the outlet duct. An opening 132 is located in the chamber 128 and is in communication with a return or recirculating duct or passage 134. The duct 134 extends downwardly below the vacuum nozzle 22 and is in communication with a manifold 136 located at the rear of the main nozzle opening 44. The manifold 136 has a suitable slot 138 preferably extending over the length of the main opening 44 to supply air to the main opening. A coarse screen 140 is located at the inlet side of the air chamber 128 to remove coarser air-borne particles from the air which is received from the receptacle and flows back to the main opening 44 through the manifold and duct.

The recirculating arrangement for the vacuum cleaner 124 is designed primarily to remove back pressure from the filtering bag or combination filtering bag and hopper, whichever may be attached to the impeller housing discharge end 94. Under average operating conditions, approximately thirty percent of the air discharged from the impeller housing 24 into the filtering bag or receptacle will be recirculated back through the coarse screen 140, and through the opening 132, the duct 134, and the manifold 136 to the main opening. When the filtering bag is clean and substantially unobstructed, a much smaller amount of air will be recirculated. On the other hand, as the bag becomes more completely clogged, the amount of air recirculated will rise and may well exceed fifty percent in some instances. However with the return air opening 132 positioned such that all recirculated air must pass through the filtering bag or receptacle, even if the bag becomes one hundred percent plugged, the vacuum cleaner will operate with some cleaning efficiency since most litter and coarser air-borne particles will be received in the bag or receptacle and only the finer particles will remain air-borne and pass through the bag and back to the duct 134. The air must extend through a U-shaped path when moving from the outlet duct 126 to the recirculating opening 132 to facilitate the separation therefrom of the heavier particles.

In some instances, particularly when removing leaves from a lawn, it is more advantageous to blow the leaves into windrows or piles directly rather than to collect them in the filtering bag and to carry them to a pile. For this purpose, a blower unit 142 is provided as shown in FIGS. 2 and 11. The unit 142 includes a manifold 144 of semicylindrical configuration having a lower central opening 146. An L-shaped pivotable spout 148 communicates with the opening 146 and has an upper flange 150 located in the manifold 144 and held for slidable movement relative thereto by ears 152. With this arrangement, the spout 148 can be pivoted to one side or the other while being supported between the lower wall of the manifold 144 and the ears 152 by the flange 150. The spout 148 terminates in a discharge nozzle 154 which enables the air to be discharged at high velocity and is effective to blow litter or leaves a substantial distance when the vacuum cleaner 20 is wheeled along behind the litter with the spout 148 positioned to direct the air from the nozzle 154 in that direction. An adjustable deflector 156 can be used to direct the air more effectively.

With the air from the impeller discharged through the discharge nozzle 154 to the rear of the nozzle 22 and the inlet opening 44, a unique operation of the vacuum cleaner when used for windrowing can be achieved. The vacuum cleaner is first moved over a given path to blow the leaves off a contiguous strip. When the vacuum cleaner is subsequently moved over the strip from which the leaves have been blown, the cleaner nozzle 22 will pick up any leaves, etc. which were missed by the blowing operation and direct these leaves through the impeller housing and out through the blower nozzle 154. Hence, the vacuum cleaner with the rear spout and nozzle subjects the litter or leaves to two cleaning operations, namely air from the discharge nozzle directly and, if this does not achieve the purpose, the litter is drawn through the inlet opening and impeller housing and discharged directly through the nozzle.

The manifold 144 has an upper hook 158 and side flanges 160 by means of which the blower unit can be assembled with the impeller housing 24 through the quick-acting clamps 104. With this mounting arrangement, the blower unit 142 also can be mounted in an inverted position with the spout 148 above the manifold 144 to discharge material from the nozzle 154 into a suitable receptacle. For this purpose, a hose can be at-

tached to the nozzle **154** to direct the litter, leaves, etc. from the blower unit to the recptacle.

On occasion, access to the impeller housing **24** is required to inspect, repair, or replace the impeller or to remove clogged debris. For this purpose, a rear bottom wall **162** of the impeller housing has an offset lip **164** which receives and supports a rear edge portion of a front bottom wall **166** of the housing. The lip **164** has slots **168** therein which receive bolts **170** extending through holes **172** in the bottom wall **166** and having washers **174** and nuts **176**. At the front of the housing **24**, a third bolt **178** extends through an arcuate vertical wall **180** of the housing and is received in a notch **182** in an upwardly extending lip **184** of the bottom wall **166**. A clip **186** is held on the bolt **178** by a washer **188** and an acorn nut **190**. The clip **186** has a lower flange extending downwardly below the lip **184** of the bottom wall to hold the bottom wall **166** securely in place along with the overall nozzle **22**.

The nozzle is easily assembled with the housing by inserting the rear edge portion of the bottom wall **166** above the lip **164** of the rear bottom wall **162**. The shanks of the bolts **170** are then received in the slots **168** and the nuts **176** tightened. The front portion of the bottom wall **166** is moved upwardly to position the notch **182** around the bolt **178**, at which time the nut **190** is tightened to move the clip **186** inwardly and cause it to engage the lip **184** of the bottom wall **166**. The nozzle can then be quickly removed by loosening the nuts **176** and the nut **190** to enable the front portion of the bottom wall **166** to drop down, at which time the nozzle can be moved forwardly slightly to disengage the bolts **170** from the slots **168**.

When the vacuum cleaner is to be used on soft, and especially uneven, surfaces, such as lawns, a roller **192** can be used in place of the casters **43**. As shown particularly in FIG. 13, the roller **192** is mounted on an axle **194** which is carried by side arms **196**. The arms **196**, in turn, are pivotally supported by bolts **198** to brackets **200**. The brackets **200** can be suitably fastened to the rear wall of the nozzle **22**. Adjusting bolts **202** are carried by the brackets **200** and extend through arcuate slots **204** in the arms **196**. The bolts **202** can be loosened and tightened by hand nuts **206** to enable the roller **192** to be positioned anywhere in an arcuate path between the ends of the slots **204**. Under normal usage, on hard surfaces, the roller **192** can be swung to the upper position as shown in FIG. 2, in which case the casters **43** support the forward portion of the vacuum cleaner. When the machine is to be used on soft surfaces, the roller can be swung to the lower position, as shown in FIG. 3, in which the roller is lower than the casters **43** and supports the forward portion of the vacuum cleaner.

We claim:

1. A vacuum cleaner comprising a nozzle having an elongate main nozzle opening, means for supporting said nozzle with said opening near the ground, an impeller for establishing flow of air through said nozzle, a discharge duct for said impeller, said nozzle having an auxiliary elongate opening at a front edge thereof and extending over a substantial part of the length of the main nozzle opening, a flap of L-shaped configuration in transverse cross section pivoted to said nozzle and having a first position in which a first leg portion extends rearwardly under said nozzle and covers part of said nozzle opening and in which a second leg portion covers the entire auxiliary opening, said flap having a second position in which said first leg portion of said flap is spaced from said nozzle opening and said leg portion of said flap completely clears said auxiliary opening, means for moving said flap between said positions, means for receiving air and air-borne material from said discharge duct comprising a metal hopper, means for movably supporting said hopper on the ground, housing means having connecting means including hinge means connecting said housing means to said cleaner adjacent said discharge duct, a bellows around said connecting means and said hinge means, quick-disconnect means connecting said housing means and said hopper to enable detachment of said hopper, said housing means having an opening in an upper surface thereof, a filtering bag, and means for attaching said bag to said housing means around said housing opening.

2. In combination, a large portable vacuum cleaner comprising a nozzle, a motor, an impeller for establishing flow of air through said nozzle, and a discharge duct discharging air from said impeller in a rearward direction, means for receiving air and air-borne material from said dischage duct comprising a metal hopper located to the rear of said impeller, housing means having quick-disconnect means connecting said housing means to said cleaner adjacent said discharge duct, means including a hinge connecting said quick-disconnect means and said housing means to enable said hopper and said housing means to pivotally move in a vertical plane relative to said quick-disconnect means and said discharge duct, flexible sealing means located around said connection means and said hinge between said housing means and said quick-disconnect means to prevent escape of air therebetween, connecting means connecting said housing means and said hopper to enable detachment of said hopper, said housing means having an opening in an upper surface thereof, a filtering bag, and means for attaching said bag to said housing means around said opening.

3. A large, portable vacuum cleaner comprising a nozzle, a housing communicating with said nozzle, an impeller in said housing for establishing flow of air through said nozzle, a motor mounted above said housing for driving said impeller, a discharge duct discharging air rearwardly from said impeller housing, and wheel means for supporting said nozzle, said motor, said housing, said impeller, and said discharge duct, means for receiving air and air-borne material from said discharge duct comprising rigid housing means having connecting means pivotally connected with said housing adjacent said discharge duct, a flexible bellows located around said connecting means and connected with said discharge duct and said rigid housing means to prevent escape of air therebetween, a hopper located below said housing means, quick-disconnect means connecting said housing means and said hopper to enable said hopper to be disconnected quickly from said housing means, said housing means having an opening in an upper surface thereof, a flexible filtering bag mounted on said housing means around said opening, and means connected to said hopper to support said hopper on the surface being cleaned independently of said wheel means.

4. A vacuum cleaner according to claim **3**, characterized by said pivotally connecting means includes a hinge to enable said housing means to move independently of said discharge duct and said impeller housing.

5. A vacuum cleaner according to claim **2** characterized further by said quick-disconnect means including a connecting ring carried by said hinge and quick-disconnect clamps mounted on said discharge duct and engageable with said connecting ring.

References Cited

UNITED STATES PATENTS

2,678,462	5/1954	Lison et al.	15—353 X
2,985,905	5/1961	Caufield	15—353
3,089,178	5/1963	Sherman	15—354 X
3,112,511	12/1963	Lankenau	15—350

ROBERT W. MICHELL, Primary Examiner

U.S. Cl. X.R.

15—328, 346, 352, 353, 354, 373, 418