

[54] **LIGHTWEIGHT VACUUM CLEANER**

[72] Inventors: **Bruno M. Valbona**, Avon; **Robert J. Emons**, Manchester; **Maurice P. Samuelian**, West Hartford, all of Conn.

[73] Assignee: **Dynamics Corporation of America**, New York, N.Y.

[22] Filed: **Oct. 23, 1970**

[21] Appl. No.: **83,300**

[52] U.S. Cl. **15/323, 15/329, 15/339, 15/350, 15/368, 15/410, 15/412, 15/414**

[51] Int. Cl. **A47I 9/00**

[58] Field of Search **15/339, 350, 323**

[56]

References Cited

UNITED STATES PATENTS

2,346,339	4/1944	Vose.....	15/344
3,226,758	1/1966	Brown et al.....	15/327

Primary Examiner—Walter A. Scheel

Assistant Examiner—C. K. Moore

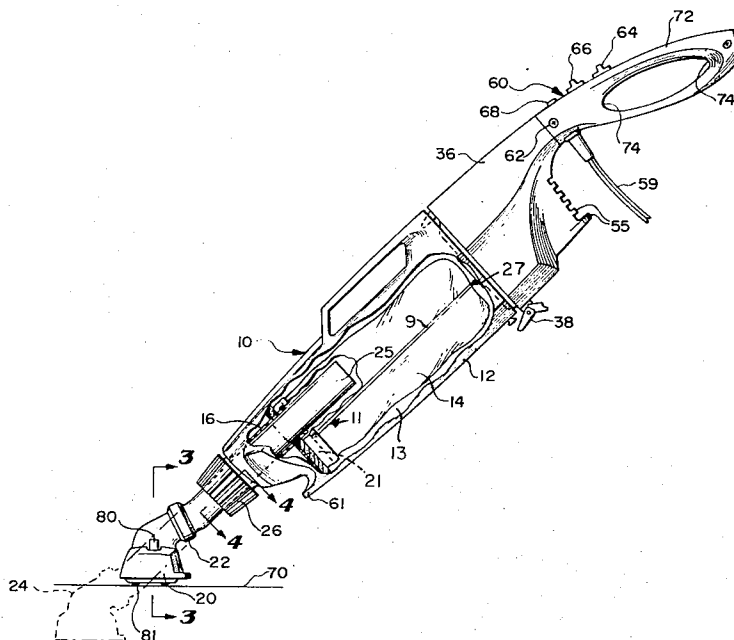
Attorney—Harbaugh and Thomas

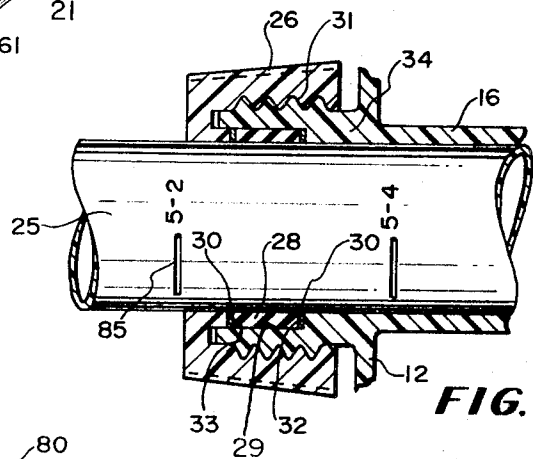
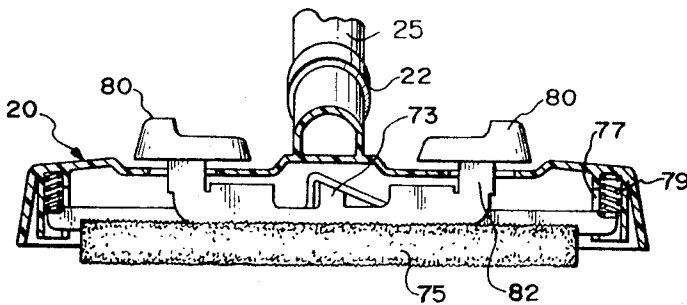
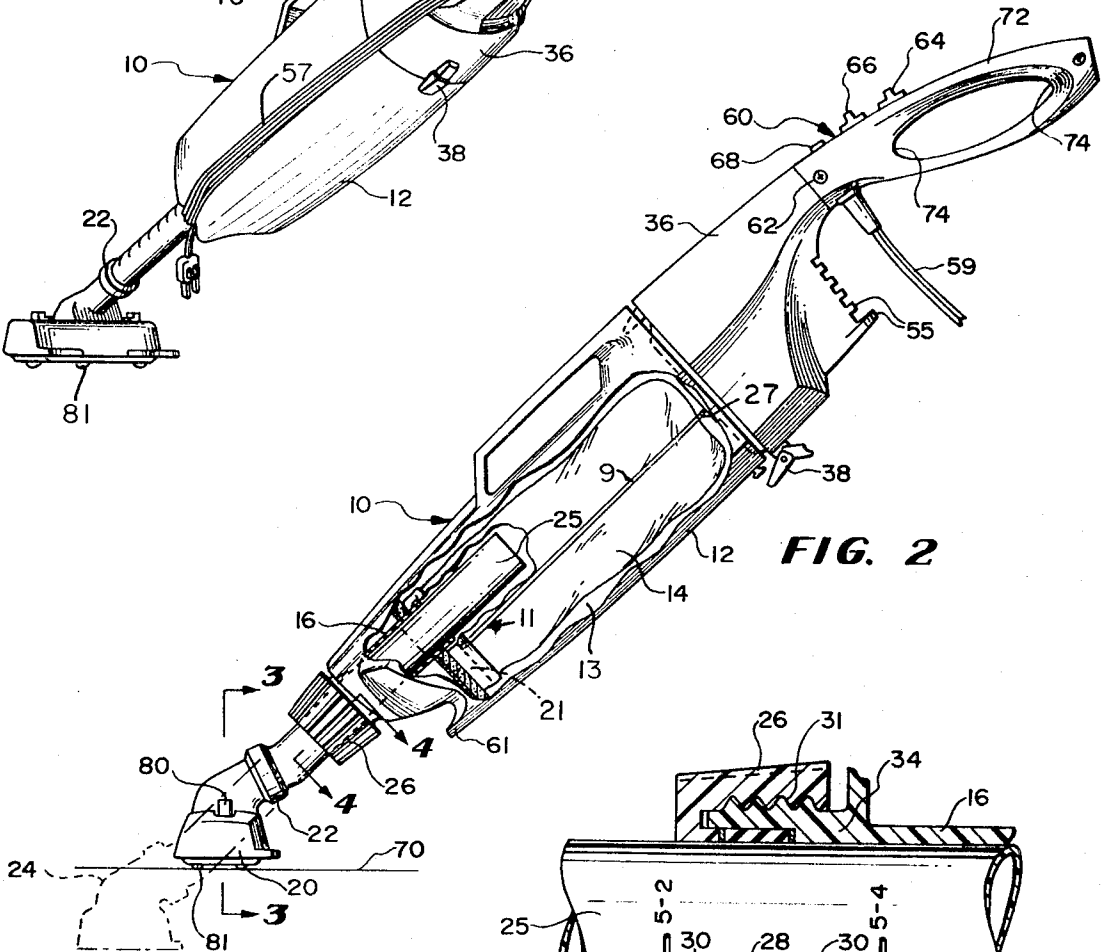
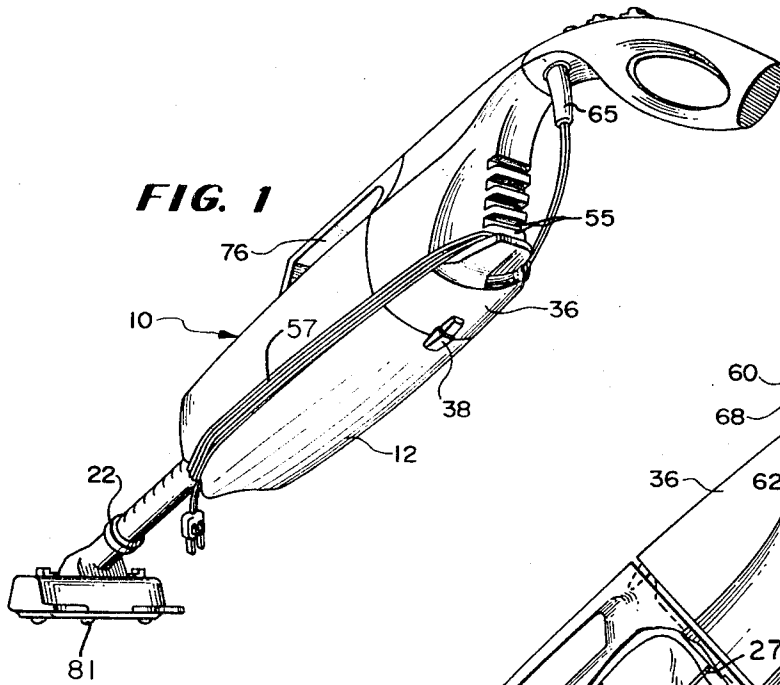
[57]

ABSTRACT

A portable lightweight vacuum cleaner having an extendable nozzle intake conduit rigidly supported by an easily adjustable resilient seal losing the lower end of a filter bag compartment into which the intake conduit projects to vary the distance between a fixed operating handle and the nozzle without changing the manageability and nozzle-floor orientation with users of different statures.

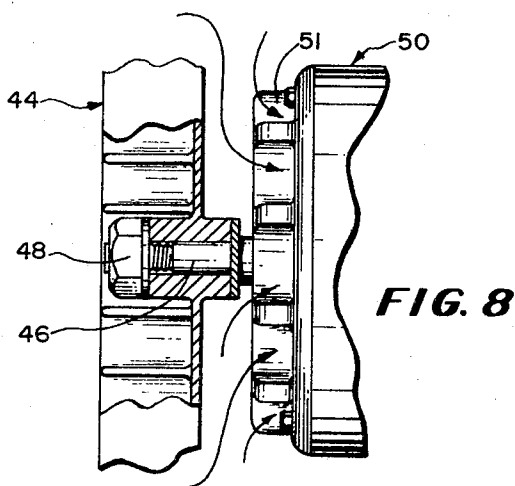
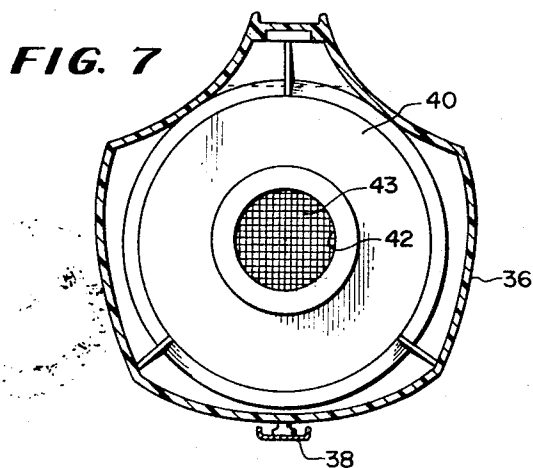
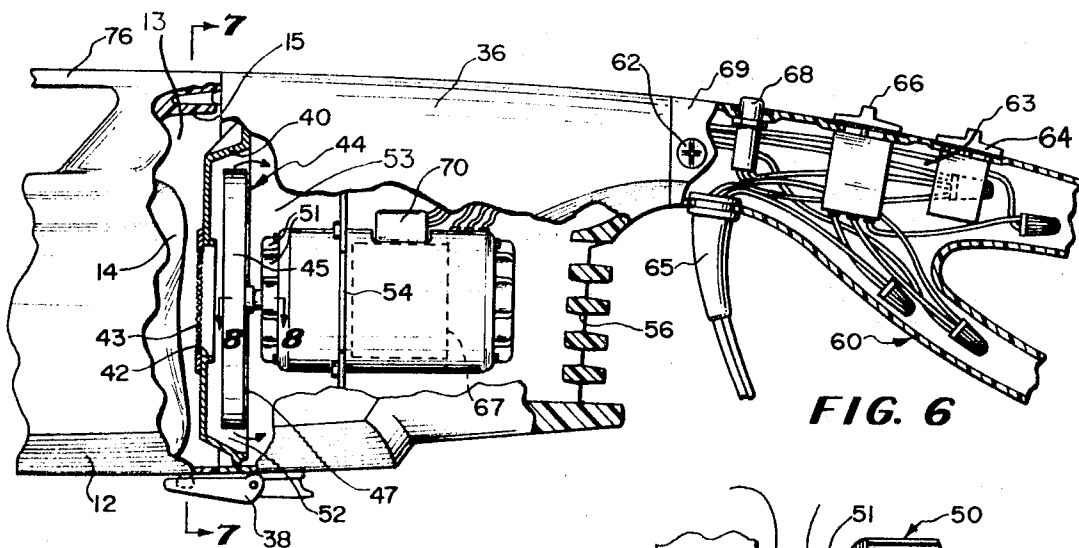
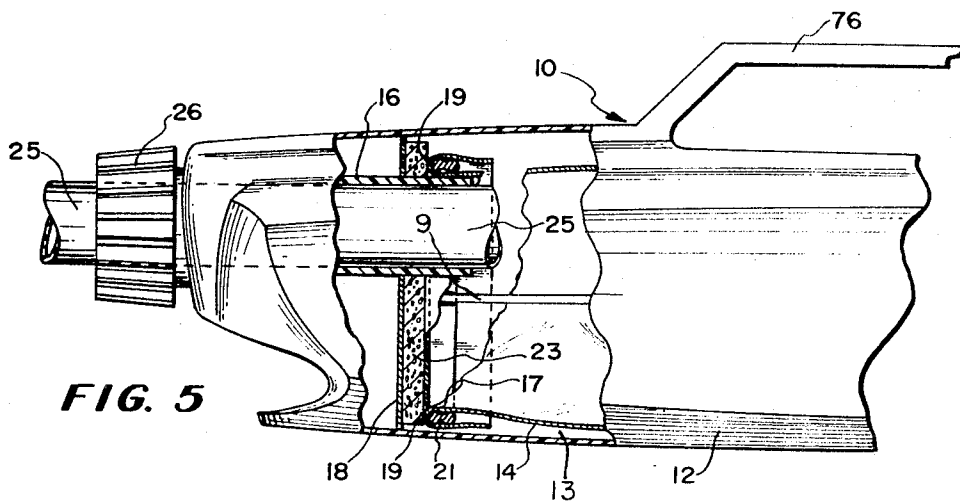
13 Claims, 8 Drawing Figures





INVENTORS:
BRUNO M. VALBONA
ROBERT J. EMMONS
MAURICE P. SAMUELIAN

By *Harbaugh & Thomas*
Attorneys



INVENTORS:
 BRUNO M. VALBONA
 ROBERT J. EMMONS
 MAURICE P. SAMUELIAN
 By *Harbaugh & Thomas*
 Attorneys

LIGHTWEIGHT VACUUM CLEANER

CROSS-REFERENCES TO RELATED CASES

Assigned to the assignee of the present application, Valbona et al., filed of even date Oct. 23, 1970, Ser. No. 83,504 for Vacuum Cleaner.

CONSIDERATION OF INVENTION

The usefulness and effectiveness of a hand propelled lightweight vacuum cleaner is reflected in its ability to reach remote areas as under furniture, and its short silhouette for packaging and storability in small spaces. Furthermore, its all around adaptability to the comfort and stature of a user and long periods of use without tiring are of importance, it being desirable that throughout its major use the nozzle is maintained at a predetermined angle to the floor and that this result be accomplished somewhat automatically and comfortably by the distance of the nozzle to the handle being adjusted so that the handle is close to the natural level of the hand of the user to maintain said predetermined nozzle angle as a natural concomitant of the use of the cleaner. This angle is preferably approximately 45° to compromise vectors of forces involved in pushing and pulling the nozzle across a carpet in conjunction with manually supporting the upper end of the sweeper so that the body weight of the cleaner maintains an adequate but light and constant pressure of the nozzle against the carpet. This is related also to the natural action of the user pushing with the handle lowered slightly and pulling with the handle raised slightly to rock the nozzle with respect to a natural intermediate supported position.

Moreover, by way of easing the manual effort of holding and manipulating the sweeper and the nozzle, particularly by relaxing the conventional tightness of manually gripping the handle, the handle is curved substantially 25° toward the horizontal and comprises a substantially wide width helve over an oval opening through which the fingers of the user can be crooked to propel the sweeper in either direction without need for gripping the helve portion of the handle. The crooked fingers merely engage the shoulders defined by closed ends of the opening.

The housing is provided with a carrying handle located forwardly of the helved handle for several purposes including bimanual manipulation of the sweeper and for the manipulation of two separable housing parts, namely the lower housing and latch assembly, and for holding the lower housing while replacing or cleaning the filter bag therein.

Other and further structural characteristics and objects will appear from the ensuing description of a preferred construction that is lightweight, well balanced and adaptable for easy handling. It is economical to make, use and service, as well as readily packaged or stored in minimal space.

IN THE DRAWINGS

FIG. 1 is a perspective view, partially from the rear showing a preferred embodiment of the invention;

FIG. 2 is a side elevational view, partly cut away, of the embodiment in FIG. 1 showing its normal working orientation angle with respect to a floor and its length that is adjustable for persons of different heights;

FIGS. 3 and 4 are sectional views taken on lines 3—3 and 4—4, respectively, in FIG. 2;

FIG. 5 is an elevational view of the lower end of the lower housing partially cut away indicating the structural relationship of the intake tube and the filter bag mounting;

FIG. 6 is an elevational view of the upper housing secured to the upper end of the lower housing and partially cut away to show the blower and its relationship to the upper end of the filter bag and its cooling arrangement and electrical controls;

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

FIG. 8 is a partially sectional view showing the mounting of the blower and the circulation of the motor cooling air.

THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, the lightweight cleaner 10 embodying the invention comprises a lower housing 12 compartmentalized at 13 as a tank to receive loosely therein a rather stiff walled porous filter bag 14. The filter bag is mounted on a holder 11 and inserted to its working position through a full size opening 15 at the upper end of the housing with its open end 17 disposed downwardly, and the upper end of an intake tube 25 is received through a guide conduit 16 provided in the lower end of the housing 12 to extend upwardly into the open lower end 17 of the filter bag. Both the lower end of bag and the upper end of the tube are supported in place by the guide conduit 16 and a metal cross plate 18 (FIG. 5).

The bag holder 11 comprises a ring 21 and a U-shaped bail 9 secured thereto for handling. The filter bag is inserted through the ring 21 until it touches the bight at 27 of the bail. Then the edges of the bag are folded as at 19 externally back and around the ring 21. Thereupon, the assembled bag and holder are slid into the housing open end first. Drop out of the bag is accomplished by turning the housing with the nozzle end up. A urethane foam pad 23 interengages the conduit 16 and the open folded end of the filter bag in sealing relationship.

The guide conduit 16 preferably extends as at 34 beyond the lower end of the housing 12 where it is threaded with a heavy thread 31 and has an internal square shoulder 32 at the inner end of a terminal enlargement 29 receiving a gland seal 28.

The intake conduit 16 slidably receives the tube 25 which terminally carries a nozzle 20 by a connection 22 that permits a lateral swivelling of the nozzle, and, as indicated by broken lines 24 (FIG. 2), the tube is adjustable as to its exposed length by means of a gland nut 26 axially compressing the resilient gland seal 28 (FIG. 4) to expand it radially against the tube. The seal 28 is disposed between two anti-friction metal washers 30 resting against oppositely facing shoulders. Shoulder 33 is on the gland nut 26 and the shoulder 32 is at the inner end of the enlargement 29 within the threaded housing extension tube guide 34.

An upper housing 36, as also shown in FIG. 6, mates at its lower end with the contour of the upper end of the lower housing where it is held in alignment therewith by toggle latches 38 to close the upper end of the compartment 13 and hold the bag 14 in place by means of a removable partition 40 having an outlet opening 42 therein covered by a fine wire screen 43. The air is withdrawn from the filter bag compartment 13 through the wire screen 43 by a centrifugal blower (FIG. 8). The blower comprises an air impeller 44 having radial blades 45 disposed on a supporting plate 47 on the side of the opening 43 so that the partition 40 serves as a shroud for the blades and redirects the exhaust axially as indicated by the arrows in FIG. 6. The impeller is mounted on the motor shaft 46 by a nut and lock nut assembly 48 as driven by a motor 50 having a rotor and stator. These motor parts are disposed in a housing 52 having bearing support spiders 51 at opposite ends which establish a path for the flow of air through these parts.

The blower and motor are mounted in operative position on an impervious baffle partition 54 (FIG. 6) which compels air exhausted by the blower from the filter bag compartment to flow peripherally through the exhaust area 53 and then through the support spiders 51 and through the cooperating armature and stator elements to cool them before being expelled through the grating 56 at the upper end of the upper housing.

The grating 56 is shaped to provide parallel grill elements 55 spaced a distance adequate to receive loops 57 of an electrical extension cord 59 therebetween with a slight squeezing action to hold the loops in place either with or without the cooperation of the projection 61 at the other end of the housing providing a cleating action. The cord 59 can be wound circularly as shown in FIG. 1 or wound in a figure 8 (not shown) to avoid any twist tangling of the cord.

Extending beyond the upper housing is a handle section 60 secured thereto by assembly screws 62. The handle can be made in matching halves, but preferably, as shown, one portion is made as a base portion 63 that is deeply recessed and open to receive the wiring and wire nuts that connect a main switch 64, a surge switch 66 and a warning light 68 in circuit with the motor as more particularly described in said Valbona et al. application, reference to which is hereby made. It is sufficient to mention at this time that the main switch 64 provides two regular speeds HI and LO while the surge switch 66 must be hand held to override the main switch to provide a higher or surge speed for momentary operation.

A thermostat 70, in heat exchange contact with the stator core 67 of the motor, is responsive to the temperature of the motor and closes to warn of a high temperature by energizing the red warning light 68 to indicate that the bag should be emptied because not enough air is getting through the filter bag to adequately cool the motor. Thus, the warning light 68 indicates when the motor becomes too warm and also that the filter bag requires emptying for efficient vacuuming operation.

The switch 64 is preferably a three position switch for OFF, LO, and HI operation while the switch 66 preferably is a spring returned push button or slide switch which requires sustained manual operation to remain ON. The switch 66 is located at the top of the handle section 60 where it is remote enough to require some hand effort to hold it ON with little likelihood that it will be held on throughout continuous manual operation of the cleaner, but rather only when a particular vacuuming pick-up difficulty is presented.

Once the electrical switch and light components are conventionally mounted and the wiring is located in place, a cover plate 69 is secured in place to the base member 63 with the extension cord strain relief element 65 disposed as shown in FIG. 1.

As already mentioned in the objects, the handle is shaped for particular usefulness in coaction with the adjustable distance between the nozzle and the handle with respect to the floor 71 (FIG. 2), as held by users of different statures at an angle to the floor of substantially 45°. The handle is formed and inclined away from this angle of 45° approximately 25° thereto. This relationship is maintained throughout all adjustments as to height so that any one of a great majority of users, when standing, need only manipulate the sweeper at a level which is the natural position of the hand at the user's side.

To assure optimum comfort of hand position and sweeper operation, the helve portion 72 is provided with rounded ends or shoulders 74 for the crooking of the user's fingers therebetween. Then the fingers engage one or the other shoulder for push and pull movements without need for gripping the helve anymore than to retain it in the crooked fingers. Thus the wrist of the user is not strained as when a tight grip of a conventional sweeper handle is required of the user. Even with the present invention such a habitual tight grip is relieved of strain so much that the user gradually relaxes in comfort with the ease of operation. It is preferred to connect the lower ends of the shoulders 74 to prevent them catching on articles. Moreover, the ultimate appearance is also improved as well as the avoidance of sharp corners and edges.

As shown in FIGS. 1 and 2 a second or carrying handle 76 for the cleaner is located on the lower housing 12. It is of a length and so located that a person can pick up the cleaner 10 above its center of gravity for carrying, or both handles 60 and 76 can be used by both hands of the user to sweep other than horizontally disposed objects.

The construction of the nozzle 20 also adds to the ease and user comfort of operation when rocking the nozzle by lowering the handle while pushing it and raising the handle while pulling it under certain sweeping conditions. The level of the brush is controlled by a foot operated cam that centrally raises and lowers it in vertical tracks 77 at the ends of the nozzle as urged downward by compression springs 79 for resilient engagement of the brush with a work surface under the weight of the cleaner. This brush can be raised by the cam 73 being moved longitudinally to raise the brush so that its lower edge is

at or above the level of the edges of the mouth of the nozzle. The cam can be foot or finger operated by buttons 80 on carrier arms 82 secured to the cam. Furthermore, three spaced oval shaped rollers 81 (FIG. 1) are journaled within the mouth of the nozzle to extend a short distance therebelow to carry the weight of the sweeper on hard flooring.

It will be further appreciated that various cleaning attachments can be provided for the sweeper and used interchangeably with the nozzle carrying tube 25 including a flexible hose merely by loosening the gland nut 26, removing the tube 25, inserting a like tube carrying another cleaning attachment, and retightening the gland nut. If there is any substantial length provided for the tube, the tube can be adjusted as to its exposed length the same way as already described since the tube is of uniform size throughout and the tube can have measuring indicia on it if the adjusted exposed length of the tube is critical beyond the desires of the user. In fact, to assist users in readily adjusting the nozzle carrying tube 25 to their statures, personalizing height marks 85 are provided on the tube 25 every 1.50 inches approximately, and can be related to every 2 inches of stature height within a general range of user statures which will provide approximately the proper handle height for the level of the user's hand which is one-half the stature height. The range accommodated thereby is quite wide because the marked tube 25 has clearance in the filter bag to telescope more than one foot and this provides a stature range that is over 16 inches. These marks and the gland nut position are so arranged that when one of the marks is at the front edge of the gland nut, as shown in FIG. 4, the adjacent higher mark is not located at the seal 28. Accordingly, the marks can be recessed into the external surface of the tube without any possibility of air leaking past the seal. Otherwise, the tube 25, preferably being made of plastic, can have the recesses filled with a plastic filler of a contrasting color. The number and arrangement of the marks are then design free of possible physical requirements.

The nozzle, 20, the housings 12 and 36, the gland nut 26, and the tube 25 are preferably for lightness, strength and durability made of a plastic taken from the following group of plastics:

- polyester resins;
- rigid vinyls;
- styrene polymers;
- acrylics;
- polyvinyl chlorides;
- acrylic-PVC alloys; and

A B S resins such as:
styrene-acrylonitrile-butadiene tetrapolymers.

Having thus described the preferred embodiments with explanation of the concepts involved, it will be understood how various and further embodiments can be made without departing from the spirit of the invention.

What is claimed is:

1. In a lightweight vacuum cleaner the combination of a portable housing having a filter bag compartment subjected to subatmospheric pressures,
 - a guide conduit means extending into said compartment at its lower end,
 - a member defining an end wall for the compartment around said conduit,
 - sealing member carried by said wall on the compartment side thereof,
 - a porous walled filter bag received in said compartment with its open end disposed in sealing engagement against the sealing member around said conduit,
 - an intake nozzle supporting tube slidably received in said conduit means to extend into said filter bag an adjustable distance,
 - means interconnecting said conduit and tube for sealing and holding said tube at any one of a number of different distances of extension from said conduit.

2. The combination called for in claim 1 including an electric motor driven blower means in sealed communication with said compartment outside of said filter bag to withdraw air from said compartment, and

exhaust means for conducting withdrawn air through the electrical motor.

3. The combination called for in claim 2 including an extension cord, and

a grating covering an air exhaust opening in said housing and having parallel grille elements at least two of which are spaced a distance adequate to receive loops of said extension cord therebetween with a slight squeezing action in supporting relationship.

4. The combination called for in claim 3 in which said grating vents in one direction longitudinally of said housing, and a projection on said housing remote from said grating and extending in the opposite direction therefrom to provide a cleating action for the extension cord in combination with said grating.

5. In a vacuum cleaner housing having a filter bag compartment subjected to subatmospheric pressures, the combination of

a guide conduit means extending into said compartment at its lower end,

a member defining an end wall for the compartment around said conduit,

a sealing member carried by said wall,

a porous walled filter bag received in said compartment with its open end disposed in sealing engagement against the sealing member around said conduit,

an intake nozzle having an intake opening defining a working plane,

a tube disposed at an acute angle to said plane for supporting said nozzle and slidably received in said conduit to extend into said filter bag an adjustable distance,

means interconnecting said conduit and tube including a resilient member sealing and holding said tube at any one of a number of different distances of extension from said conduit.

6. The combination called for in claim 5 in which the nozzle is supported in its working position with the tube disposed at approximately 45° from the vertical, and

handle means elongated to provide a helve at the upper end of the housing disposed at an angle of approximately 20° to the horizontal and terminally bordered by shoulders engaged by a user's fingers crooked around the helve.

7. The combination called for in claim 6 including

a carrying handle located on said housing approximately above the center of gravity thereof for carrying the cleaner and for two handed manipulation of the cleaner to sweep other than horizontally disposed objects,

said tube being adjustable an extendable distance from the housing in combination with said handle means for

greater cleaning reach of said nozzle in two handed operation of the cleaner.

8. The combination defined in claim 5 in which said tube has indicia on it oriented to said interconnecting means indicating the adjusted position of the tube in relation to the geometric location of the upper end of the cleaner with respect to the height of the user.

9. The combination called for in claim 8 in which said indicia represents the heights of users and are spaced on the tube in increments proportioned to approximately one-half the heights of the users as based upon the square root of one-half the square of the distance from the nozzle to the handle.

10. The combination defined in claim 5 including a manually engaged handle means located at the upper end of the housing and cooperating indicia on said tube and interconnecting means oriented with respect to said interconnecting means to indicate the adjusted position of the tube with respect to the working height of the handle with respect to the stature of the user and the height of said handle.

11. The combination called for in claim 10 in which said tube is of plastic and has indicia in the outer wall thereof spaced a distance different from the distance between said indicia on said interconnecting means and said resilient member.

12. In a lightweight vacuum cleaner

a plastic housing having a filter bag compartment subjected to sub atmospheric pressures, the combination of

plastic guide conduit means externally threaded around a gland receiving enlargement at its outer end and extending into said compartment at its inner end,

a member defining an end wall for the compartment around said inward extension of the conduit,

a sponge sealing member supported by said wall,

a porous stiff walled filter bag means removably secured in said compartment with its open end disposed in sealing engagement against the sealing member around said conduit means,

a plastic intake nozzle,

a plastic tube slidably received in said conduit to extend into said filter bag an adjustable distance,

resilient gland means in said enlargement interengaging said conduit and tube manually actuated gland nut means engaging said external thread to compress said resilient gland means for sealing and holding said tube in any one of a number of different distances of extension from said conduit.

13. The combination called for in claim 12 in which said tube is appreciably curved at its lower end and said nozzle is swivelly mounted on said tube at its lower end for relative rotation in a plane disposed at an acute angle to the tube, said tube being rotatively and extendably adjustable for two handed operation of the cleaner.

* * * * *

55

60

65

70

75