US009700187B2

(12) **United States Patent**
Schultz et al.

(10) **Patent No.: US 9,700,187 B2**
(45) **Date of Patent: Jul. 11, 2017**

(54) **VACUUM NOZZLE WITH INTEGRATED LIGHT**

(71) Applicants: **Douglas C. Schultz**, Glen Carbon, IL (US); **Mark Tomasiak**, St. Peters, MO (US); **Jason Hill**, St. Louis, MO (US)

(72) Inventors: **Douglas C. Schultz**, Glen Carbon, IL (US); **Mark Tomasiak**, St. Peters, MO (US); **Jason Hill**, St. Louis, MO (US)

(73) Assignee: **EMERSON ELECTRIC CO.**, St. Louis, MO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 441 days.

(21) Appl. No.: **14/452,683**

(22) Filed: **Aug. 6, 2014**

(65) **Prior Publication Data**

US 2016/0037985 A1 Feb. 11, 2016

(51) **Int. Cl.**
A47L 9/30 (2006.01)
A47L 9/02 (2006.01)

(52) **U.S. Cl.**
CPC .. ***A47L 9/02*** (2013.01); ***A47L 9/30*** (2013.01)

(58) **Field of Classification Search**
CPC A47L 9/02; A47L 9/30
USPC 15/415.1
IPC A47L 9/30
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,521,928	A	1/1925	Campbell
1,942,358	A	1/1934	Grathwol
3,380,103	A	4/1968	Ritzau
D215,875	S	11/1969	Hoadley
4,553,284	A	11/1985	Strumbos
4,821,364	A	4/1989	McAllister et al.
4,951,340	A	8/1990	Rietsch
5,046,218	A	9/1991	Cerri
5,123,266	A	6/1992	Tabraham
5,184,372	A	2/1993	Mache
5,189,753	A	3/1993	Sousa
5,454,139	A	10/1995	Beck
5,462,311	A	10/1995	Cipolla
5,485,652	A	1/1996	Holland
5,539,953	A	7/1996	Kurz
5,600,866	A	2/1997	Berfield
5,718,016	A	2/1998	Sung
6,026,541	A	2/2000	Bailey
D538,986	S	3/2007	Ingram
D540,498	S	4/2007	Tobias
7,293,322	B2	11/2007	Matousek
7,300,172	B1	11/2007	Lefler
D621,110	S	8/2010	Eden et al.
D621,112	S	8/2010	Benacquisto

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1814430	9/2010
WO	2010/019869	2/2010

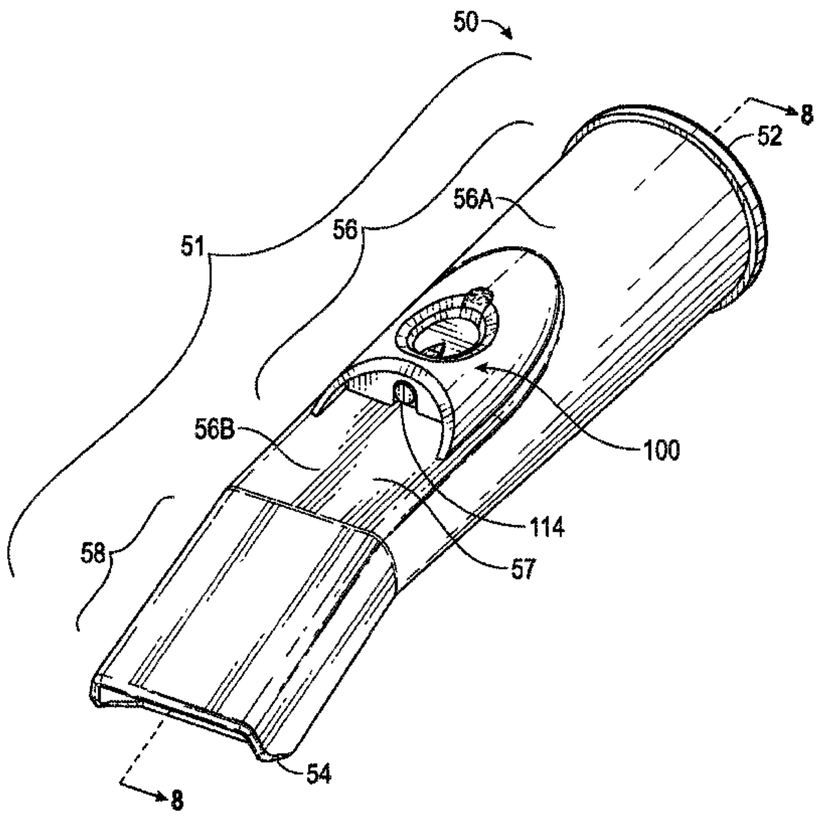
(Continued)

Primary Examiner — David Redding
(74) *Attorney, Agent, or Firm* — Sutton McAughan Deaver PLLC

(57) **ABSTRACT**

A vacuum accessory tool that includes a nozzle body having a first end and a second, spaced apart end and at least one light emitting element that emits light that will illuminate a surface to be cleaned by the accessory tool is described. The light emitting element is protected by a protective housing that protects the element when the tool is inserted into areas during cleaning, yet still allows the light to illuminate surfaces during operation.

19 Claims, 6 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

D621,565	S	8/2010	Pierce	
8,230,550	B2	7/2012	Krebs	
8,402,604	B2	3/2013	Dant	
8,533,907	B2	9/2013	Eccardt	
2006/0179606	A1	8/2006	Worwag	
2007/0240275	A1*	10/2007	Willenbring	A47L 9/2805 15/324
2012/0110770	A1	5/2012	Hirashima	
2012/0272473	A1	11/2012	Griffith	
2013/0326843	A1	12/2013	Schwartz	
2014/0215750	A1*	8/2014	Schultz	A47L 9/0018 15/323

FOREIGN PATENT DOCUMENTS

WO	2011092484	8/2011
WO	2013/060880	5/2013

* cited by examiner

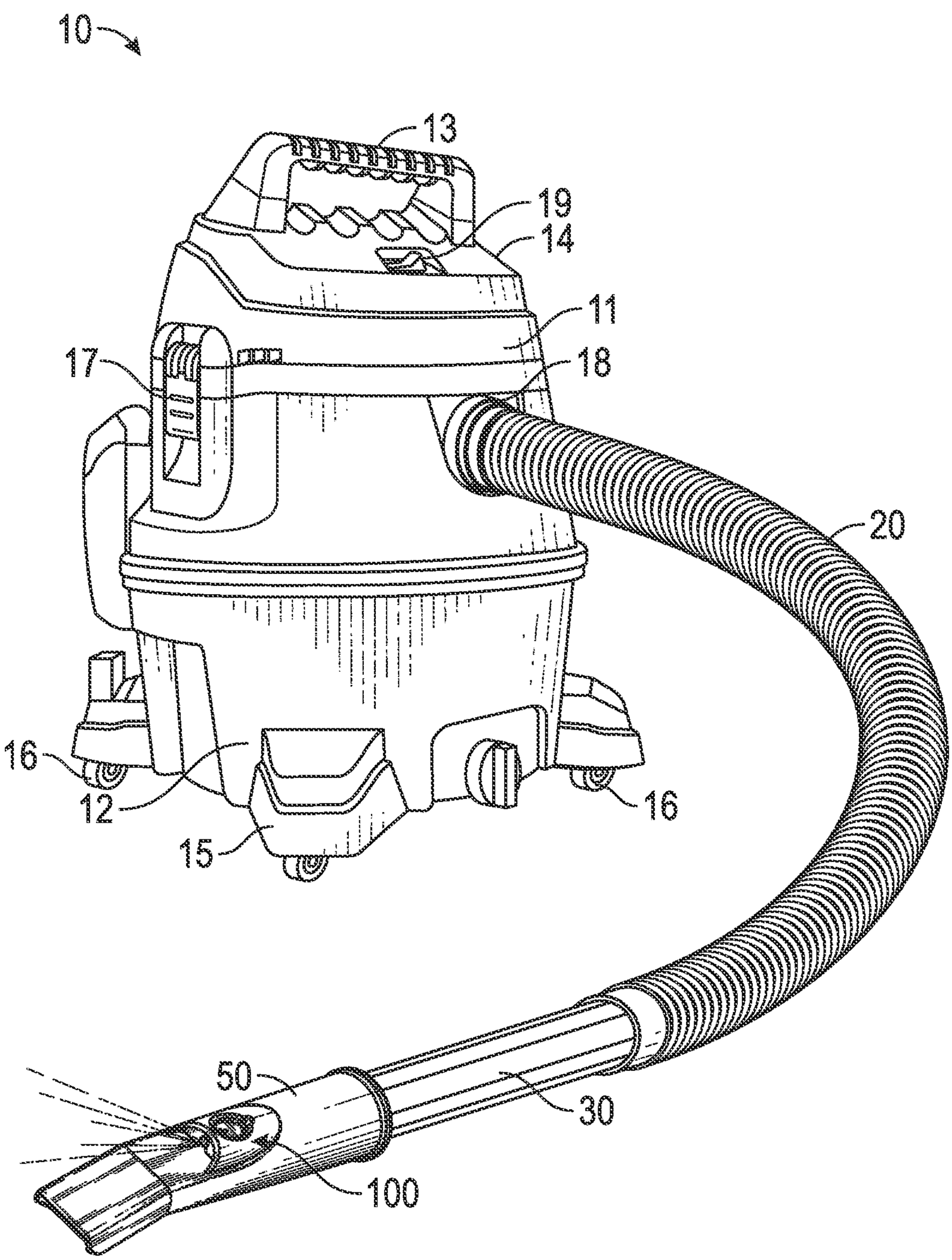


FIG. 1

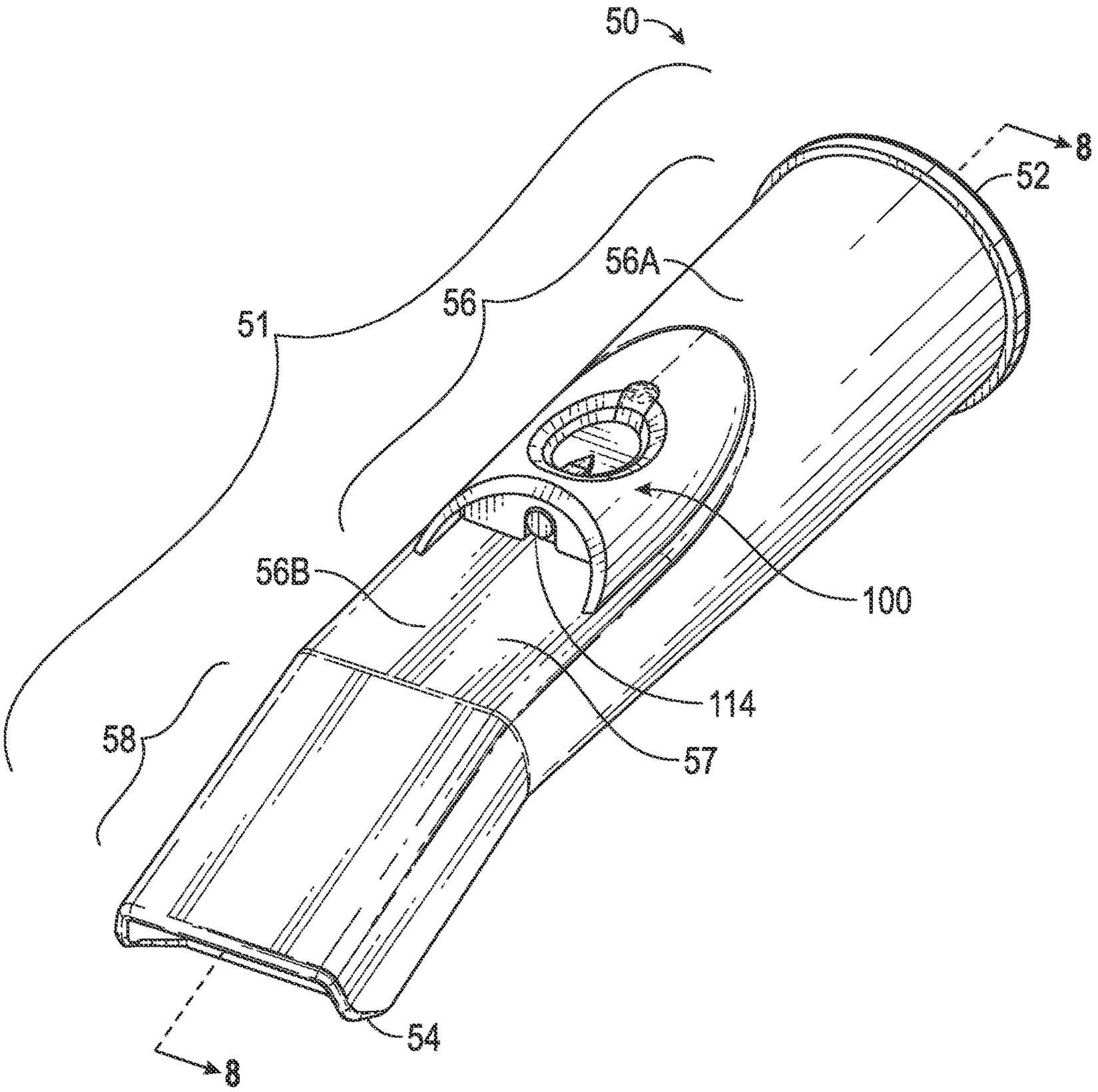


FIG. 2

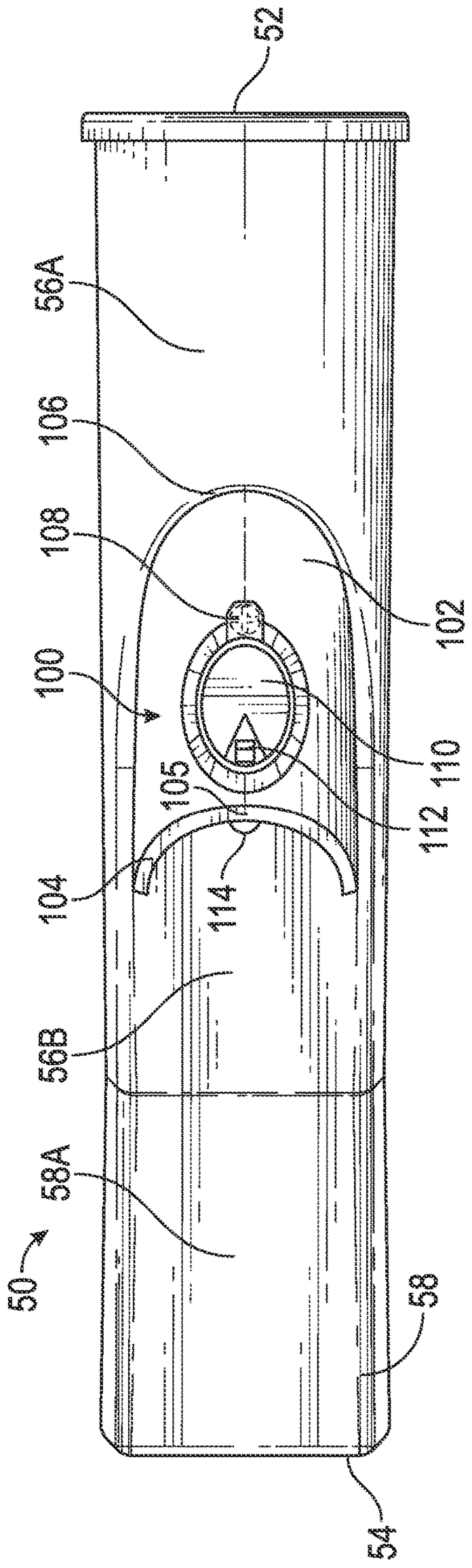

52
56A
106
108
100
102
105
110
112
104
114
56B
58A
50
58
54

FIG. 3

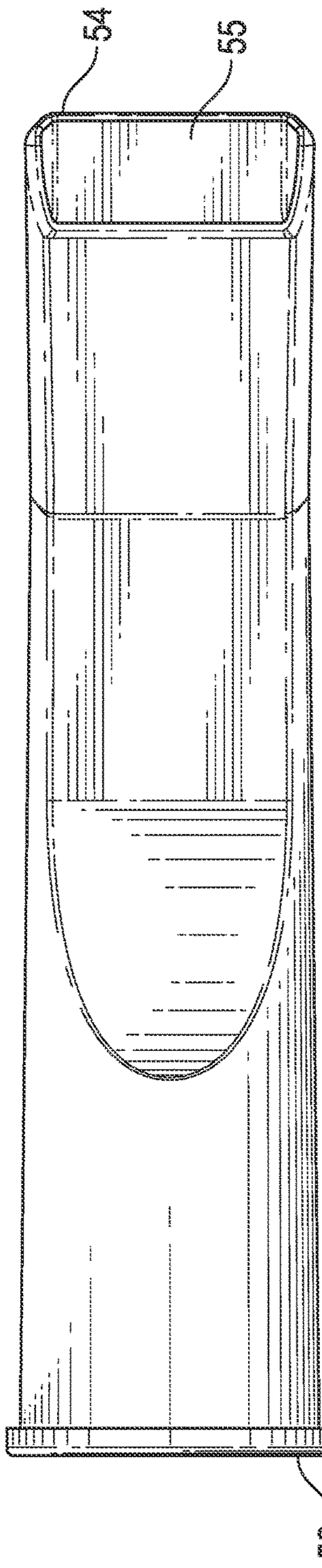

54
55
50
52

FIG. 4

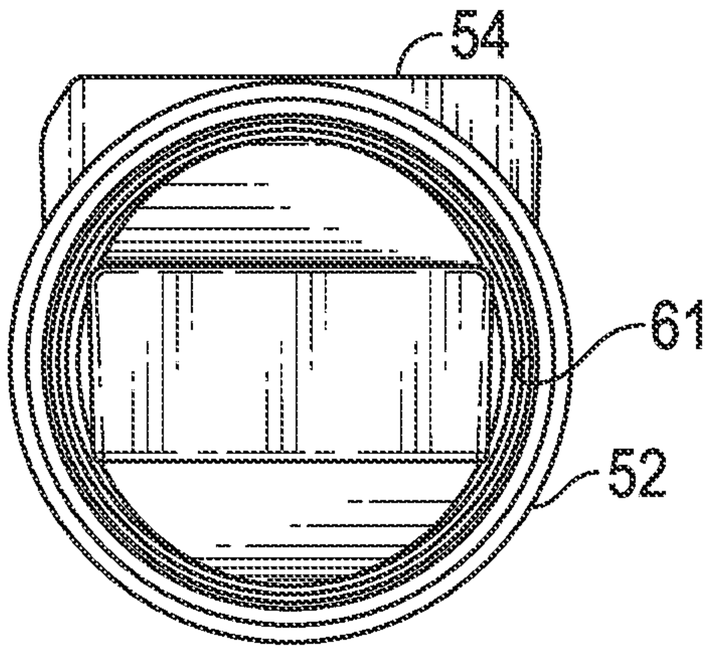


FIG. 5

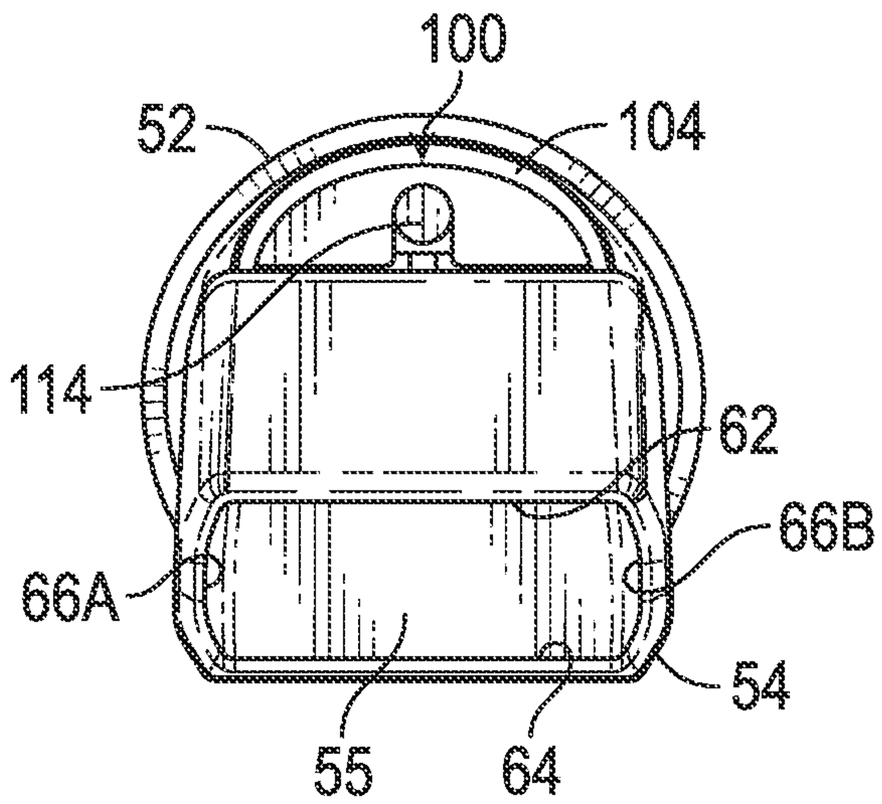


FIG. 6

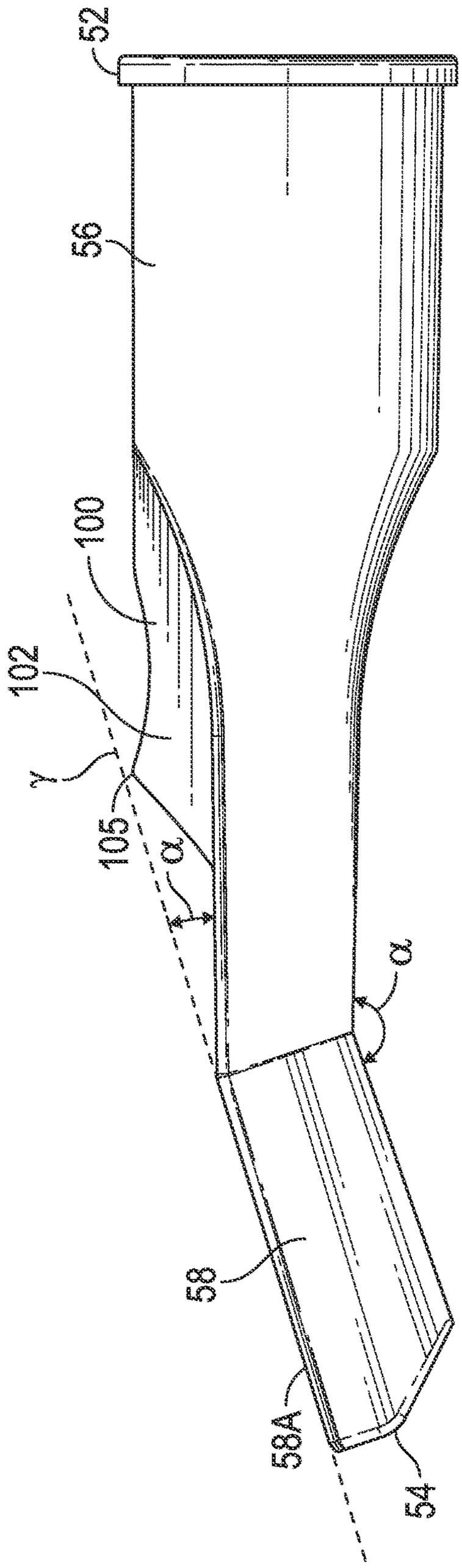


FIG. 7

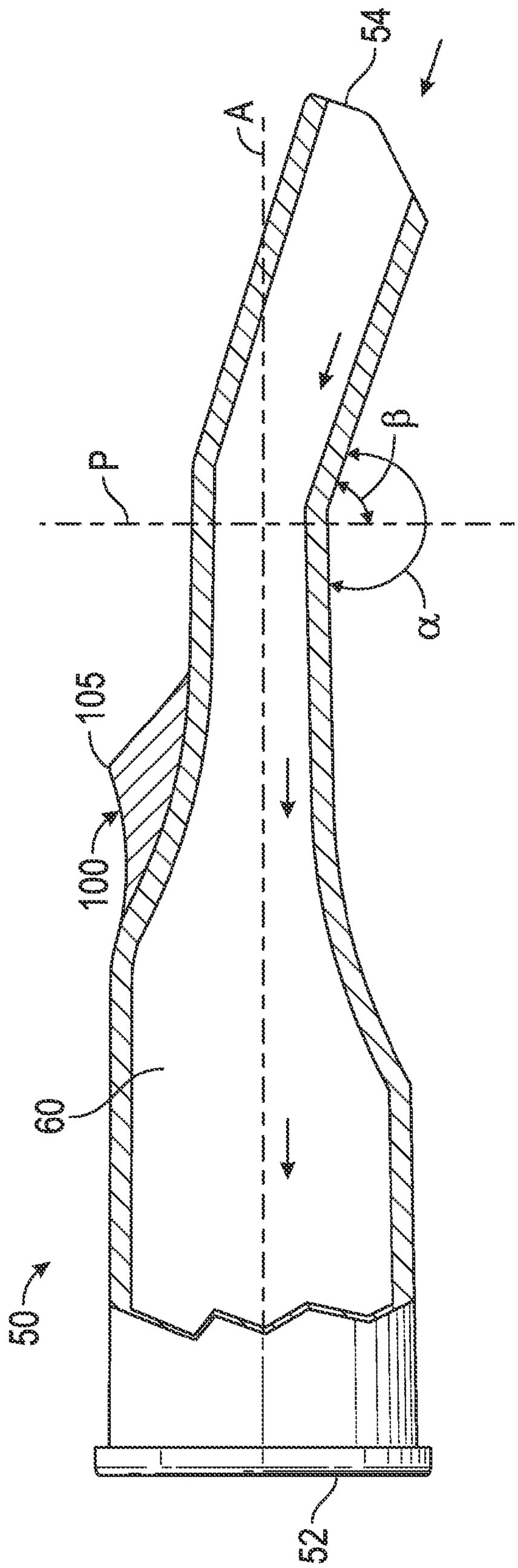


FIG. 8

VACUUM NOZZLE WITH INTEGRATED LIGHT

CROSS REFERENCE TO RELATED APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

REFERENCE TO APPENDIX

Not applicable.

BACKGROUND OF THE INVENTION

Field of the Invention

The inventions disclosed and taught herein relate generally to attachments for vacuum appliances. More specifically, the inventions disclosed and taught herein are related to cleaning tool attachments which are adaptable for use in conjunction with a variety of vacuum cleaners and which include an illuminated portion for use in dark areas during cleaning, such as under seats in an automobile.

Description of the Related Art

Vacuum cleaners of the type having a nozzle end and a handle end, as well as canister-type vacuum appliances like wet/dry vacuum cleaners, are generally well known in the art. When gripped by their handle ends and moved in a generally back and forth oscillatory motion, the nozzle ends of these devices trace a back-and-forth cleaning path. During such typical operation, the wrist of the hand by which the handle ends are gripped controls the trajectory of their nozzle ends. When in normal use with the hand extended straight out, the cleaning path is generally in front of the user, but when the wrists are rolled to either the right or to the left, the cleaning path traced by the nozzle ends follows the roll to the right and left of the wrist. In the case of vacuum appliances such as wet/dry vacuums, the user typically uses a vacuum hose that attaches directly to the vacuum head, allowing for collection of dirt, solid debris, and liquids in the vacuum collection drum. In this operation, the user typically moves the open end of the vacuum hose, versus the entire vacuum appliance, over the debris to be collected.

In general, these vacuum appliances perform quite well to pick up dirt, solid debris, and liquid spillage (in the case of wet/dry vacuums) immediately subjacent to their nozzle ends, whether stationery, or when moved in one of the manners described above. However, to clean areas that lie beyond the cleaning path obtained by manipulating such devices, e.g., within the crevices of wood floors, or under furniture, various attachment tools need to be employed. One type of known attachment tool is the crevice tool. Generally, such a tool includes an end for attachment to the nozzle end of a hand-held vacuum appliance or an associated vacuum hose, a nozzle end, often smaller than the nozzle end of the vacuum cleaner, and a rigid, narrow tube axially connecting the attachment and the nozzle ends in fluid-tight communication.

With the crevice tool attached, back and forth motion of the hand-held vacuum cleaner enables cleaning in small or spatially-confined areas, such as in crevices and cracks (such as the cracks between wood floor boards), as well under

furniture where dust, debris, or liquids can accumulate and which do not lie in an area that is easily traced by the standard cleaning path of a vacuum cleaner. For example, U.S. Pat. No. 4,951,340 describes a multi-component crevice tool for a hand-held vacuum cleaner, the nozzle end of which may be indexed to different rotation positions so as to clean spillage in small areas defined by angular cross-sections, such as the small space between a bookshelf and a closely adjacent wall, that otherwise may not permit of ready cleaning (except, for example, by moving the bookcase away from the wall). Other approaches have included crevice tools adapted for use with a water extraction cleaning machine, and tools which incorporate a long, rubber body for flexibility. However, while allowing for access to confined spaces for cleaning, there is no way for the user to see the area being cleaned in order to determine if all the debris has been removed by the vacuuming operation.

Another type of known attachment tool for use with vacuum cleaners for cleaning narrow or hard-to-reach areas is the so-called "extension wand." Generally, such a tool includes an end for attachment to the nozzle end of a hand-held vacuum cleaner, a nozzle end, and an elongated, rigid tube connecting the attachment and nozzle ends in fluid-tight communication. The reach of the vacuum cleaner is thus extended to the degree that the rigid interconnecting tube is elongated, thereby permitting cleaning of spillage and debris in areas that otherwise would lie beyond the reach of the hand-held vacuum cleaner. For example, U.S. Pat. No. 5,462,311 discloses a telescoping assembly especially suited for vacuum cleaner wands that includes a first tube having an outer diameter and a second tube having an inner diameter which is larger than the outer diameter of the first tube. In this way, the first tube fits within the second tube in an axially sliding manner. A collet is positioned within the second tube and encircles the first tube. The collet includes a locking element for selectively securing the first tube in relation to the second tube, the locking element cooperating with a portion of the second tube upon a rotation of the collet to prevent a telescoping movement of the first tube in relation to the second tube. This multi-component extension wand reportedly telescopes outward so as to clean spillage in areas that may lie at different distances.

The previously described and utilized attachment tools, however, have had their utility limited either by over-complexity, difficulty in manufacturing, shortened tool lifespan, or poor air flow design such that during operation, the amount of vacuum pressure available for cleaning is reduced. Additionally, none of these approaches allow for the illumination of dark regions to be cleaned with the attachment nozzle, such as within automobiles, most particularly under the seats and by the operating pedals.

The inventions disclosed and taught herein are directed to vacuum attachments for use with a vacuum appliance, wherein the attachments include a shaped body for enhanced air flow during operation, and a light to allow for the illumination of the regions to be cleaned with simple engagement from the operator.

BRIEF SUMMARY OF THE INVENTION

The objects described above and other advantages and features of the invention are incorporated in the application as set forth herein, and the associated drawings, related to systems for cleaning surfaces, the systems including vacuum accessory tools with at least one light emitting element.

In accordance with a first embodiment of the present disclosure, an attachment tool for a vacuum cleaner operable

as a crevice tool is described, the attachment tool comprising an attachment end adapted for mounting to a vacuum cleaner; a nozzle end spaced apart from the attachment end; a nozzle body intermediate between the attachment end and the nozzle end and defining an exterior of the tool, the nozzle body comprising a lower housing region proximate the nozzle and an upper housing region comprising a first, upper body region proximate the air conduit and a second, intermediate body region intermediate the upper housing region and the lower housing region; and a light assembly comprising a housing containing at least one light emitting element that emits light in a UV or visible spectrum and that will illuminate a surface to be cleaned, the light assembly being mounted on a leading, forward end of the nozzle body, wherein the nozzle end is tapered downward and away from the nozzle body. In further aspects of this embodiment, the lower housing region is tapered downward and away from the nozzle body.

In accordance with a further embodiment of the present disclosure, a tool for use with a vacuum accessory is described, the tool comprising a main body having a first end including a suction inlet, a second end including a discharge outlet, and an internal air path; a receiving region on a top face of the main body sized to receive an illumination assembly; and an illumination assembly, the illumination assembly including a cover and a light emitting element, wherein the suction inlet is in fluid communication with the discharge outlet and the tool includes a longitudinal centerline axis A.

In yet another embodiment of the present disclosure, a vacuum cleaner system is described, the vacuum system comprising a housing; a debris collection vessel; a vacuum suction generator; a cleaning hose connected to the suction generator; and a crevice tool including: a main body having a first end including a suction inlet, a second end including a discharge outlet, an internal air path, and a longitudinal centerline axis A; a nozzle body intermediate between the suction inlet and the discharge outlet, the nozzle body comprising a lower housing region proximate the suction inlet and an upper housing region comprising a first, upper body region proximate the discharge outlet and a second, intermediate body region intermediate the upper housing region and the lower housing region; and a light assembly comprising a light housing containing at least one light emitting element that will illuminate a surface to be cleaned, the light assembly being mounted on a leading, forward end of the intermediate body region, wherein the lower housing region is tapered downward and away from the nozzle body.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The following figures form part of the present specification and are included to further demonstrate certain aspects of the present invention. The invention may be better understood by reference to one or more of these figures in combination with the detailed description of specific embodiments presented herein.

FIG. **1** illustrates a perspective view of an exemplary vacuum appliance incorporating a vacuum nozzle attachment tool in accordance with the present disclosure.

FIG. **2** illustrates a perspective view of an exemplary attachment tool in accordance with the present disclosure.

FIG. **3** illustrates a top view of the attachment tool of FIG. **2**.

FIG. **4** illustrates a bottom view of the attachment tool of FIG. **2**.

FIG. **5** illustrates a rear view of the attachment tool of FIG. **2**.

FIG. **6** illustrates a front view of the attachment tool of FIG. **2**.

FIG. **7** illustrates a side view of the attachment tool of FIG. **2**.

FIG. **8** illustrates a partial cross-sectional view of the attachment tool of FIG. **2**, taken along line A-A.

While the inventions disclosed herein are susceptible to various modifications and alternative forms, only a few specific embodiments have been shown by way of example in the drawings and are described in detail below. The figures and detailed descriptions of these specific embodiments are not intended to limit the breadth or scope of the inventive concepts or the appended claims in any manner. Rather, the figures and detailed written descriptions are provided to illustrate the inventive concepts to a person of ordinary skill in the art and to enable such person to make and use the inventive concepts.

DETAILED DESCRIPTION

The Figures described above and the written description of specific structures and functions below are not presented to limit the scope of what Applicants have invented or the scope of the appended claims. Rather, the Figures and written description are provided to teach any person skilled in the art to make and use the inventions for which patent protection is sought. Those skilled in the art will appreciate that not all features of a commercial embodiment of the inventions are described or shown for the sake of clarity and understanding. Persons of skill in this art will also appreciate that the development of an actual commercial embodiment incorporating aspects of the present inventions will require numerous implementation-specific decisions to achieve the developer's ultimate goal for the commercial embodiment. Such implementation-specific decisions may include, and likely are not limited to, compliance with system-related, business-related, government-related and other constraints, which may vary by specific implementation, location and from time to time. While a developer's efforts might be complex and time-consuming in an absolute sense, such efforts would be, nevertheless, a routine undertaking for those of skill in this art having benefit of this disclosure. It must be understood that the inventions disclosed and taught herein are susceptible to numerous and various modifications and alternative forms. Lastly, the use of a singular term, such as, but not limited to, "a," is not intended as limiting of the number of items. Also, the use of relational terms, such as, but not limited to, "top," "bottom," "left," "right," "upper," "lower," "down," "up," "side," and the like are used in the written description for clarity in specific reference to the Figures and are not intended to limit the scope of the invention or the appended claims.

Applicants have created a vacuum accessory tool, specifically a vacuum nozzle, such as the type used for cleaning surfaces within automobiles, wherein the tool includes a nozzle body having a suction nozzle at one end formed by the body, and an attachment end for fluidic attachment to a remote vacuum source, such as a vacuum cleaner. The body of the tool also includes at least one light emitting element that emits light on a surface to be vacuumed.

Turning now to the figures, FIG. **1** illustrates a perspective view of an exemplary vacuum appliance **10** with a collection drum incorporating a vacuum nozzle accessory tool **50**, in accordance with the present disclosure. The vacuum nozzle tool **50** may be coupled directly to a suction means such as

flexible vacuum hose **20** attached to a vacuum inlet of a vacuum appliance, such as a wet/dry vacuum **10**, or to an optional hose extension wand **30** which can be inserted intermediate between a vacuum hose **20** and the tool **50**, via any appropriate coupling method, such as by frictional attachment, threaded attachment, or similar, locking attachment methods. While the figure illustrates a wet/dry vacuum appliance **10**, it will be realized that the vacuum nozzle **50** as described herein may be used in association with any of a number of types of vacuum appliances, including but not limited to upright vacuum cleaners, backpack vacuum cleaners, hand-held vacuum cleaners, wall-mounted vacuum cleaners, canister-type vacuum cleaners, and central-vacuum systems.

As shown in FIG. **1**, there is illustrated in perspective view an exemplary vacuum appliance **10** suitable for use with the accessory tool **50** described herein. In one preferred embodiment of the instant disclosure, vacuum **10** is of the wet/dry variety, i.e., capable of picking up both wet and dry material. Vacuum **10** comprises a collection canister, or drum, **12** having a bottom, sides, an open top opposite the bottom, a lid **11**, and a powerhead **14** attached to the top face of lid **11**, which is releasably secured over the open top of collection canister **12** via handles **17**. Affixed to the bottom of drum **12** are a plurality of casters **15** having wheels **16** which allow the vacuum **10** to be pushed or pulled, the casters **15** being optionally shaped to have stepped mounting means formed on their top face for accepting vacuum accessories such as vacuum wands and the like for storage when the accessories are not in use. Collection drum **12** may also include a drain outlet and drain plug member **13** at the bottom of the drum, so as to allow for enhanced removal of liquid debris from within the drum itself, such as with a pump accessory as shown in U.S. Design Pat. No. D551,681. Powerhead **14** houses a motor and impeller assembly (not shown) within an impeller chamber, for establishing vacuum pressure within the vacuum **10** during operation. A flexible vacuum hose **20** is configured so that one end can be inserted into an air inlet **18** formed in the front portion of the powerhead **14**. In one embodiment, hose **20** is simply friction-fitted into inlet port **18**. In other embodiments of the present disclosure, hose **20** may be lock-fit into inlet port **18**, or employ a quick-connect/disconnect mechanism in order to obtain a leak-free seal, in accordance with U.S. Pat. Nos. 6,370,730 and 6,115,881, both of which are incorporated herein by reference. The collection drum, the lid and the powerhead of vacuum **10** are preferably made of injection-molded plastic, such as polypropylene or the like, in accordance with conventional practice.

In accordance with conventional designs, the air inlet port **18** is defined in a side wall of the collection drum **12** as shown, or alternatively, may be defined in the lid or within a face of powerhead **14**. The powerhead assembly **14** houses a motor and an impeller assembly housed within an impeller chamber, and has defined therein an air exhaust or outlet port (not shown). The powerhead assembly **14** is operable to create a suction within the collection drum **12**, such that during operation debris and/or liquid is drawn into the collection drum **12** through the hose **20**, which is attached to the inlet port **18** via an appropriate connection member that may be locking or not.

From FIG. **1** it is apparent that an upper portion of the powerhead may be configured to serve as a carrying handle for vacuum **10**. Toward the front of handle **13**, an on/off switch **19** may be disposed, such that the switch may be conveniently reached with one's thumb while holding vacuum **10** by the handle. Power to the vacuum appliance **10** may be via a typical AC power source via power cord, or via a so battery system, as appropriate.

The details of an exemplary vacuum nozzle **50** in accordance with the present disclosure are illustrated in FIGS. **2-8**. FIG. **2** is a perspective view of an exemplary vacuum nozzle **50**. FIG. **3** is a top view of the exemplary nozzle **50**; FIG. **4** is a bottom view of nozzle **50**. FIG. **5** is a front end view of the exemplary vacuum nozzle **50**, and FIG. **6** is a rear, or back end view of the exemplary vacuum nozzle **50**. These Figures will be discussed in combination.

As best shown in the perspective view of FIG. **2**, vacuum nozzle accessory tool **50** according to a first embodiment of the invention comprises a nozzle body **51** formed by the an upper housing region **56** and a lower housing region **58**, forming an attachment end and a spaced apart nozzle end, respectively. The tool **10** further comprises an illumination, or light emitting element **114** and associated light assembly **100** attached to a top face **57** of the upper housing. The tool **50**, in whole or in parts thereof, such as at least the nozzle body **51**, is preferably formed of a plastic or other polymeric material by any appropriate method, such as by blow molding, rotomolding, or similar production methods.

In the illustrated embodiment, a suction nozzle **54** is formed at a forward, lower portion of the lower housing **58**. The upper housing **56** further includes a working air conduit **52** positioned on an end of the nozzle body **51** opposite the suction nozzle **54**, the upper housing further comprising a first, upper body region **56**A, proximate the air conduit **52**, and a second, intermediate body region **56**B intermediate the upper body region **56**A and the lower housing region **58**. As shown in the figures, intermediate body region **56**B may further and optionally be shaped, such as in a substantially planar manner to form a flat, planar region **57** on the top surface of region **56**B, so as to receive at least a part of a similarly-shaped illumination assembly **100**. The working air conduit **52** is configured to be connected to a vacuum hose **20** (or similar vacuum connection assembly, such as a vacuum wand **30**) to couple the tool **50** to a remote suction source **10**, such as a wet/dry vacuum appliance.

Light assembly **100** includes a light housing or cover **102** containing a power source (such as a battery, not shown) and the light emitting element(s) **114**, the cover **102** having a forward, frontal edge **104** and a rearward edge **106**, the rearward edge sized and shaped to mate with upper body region **56**A. As shown in the Figures, cover **102** may be of an inverted "U-shape", although it is not limited to this configuration, and any other appropriate shape may be used as desired. The top face, or surface of the light housing, or cover **102** further includes at least one attachment element **108**, such as a screw or similar threaded attachment element, or similar attachment means. Also located on the top face or surface of the cover **102** is at least one power switch, or actuator, **110**. In the embodiment shown in the figures, and as particularly shown in FIG. **3**, the accessory tool **50** can include a primary power switch **110**, and a secondary power switch **112**. During operation, the user depresses the primary power switch **110** to turn the light emitting element **114** "on" or "off", the switch being actuated by either depressing and releasing it, or depressing it and keeping it depressed during operation to keep the light element **114** illuminated. Alternatively, a user can depress the secondary power switch **112** so as to toggle the light between a "constant on" operation mode and a "intermittent" mode, or an "off" and "on" mode, the latter of these working, for example, when the switch **112** is toggled and held in one direction or another by the user, as the user deems appropriate for the particular task for

which the tool **50** is being used. Other power actuation modes and variations will be understood by those of skill in the art.

The air and debris suction chamber **60** within nozzle tool **50** is defined by the interior regions of the various body regions, which typically include top walls, bottom walls, and side walls, as appropriate, and depending upon the shape of the particular body region. For example, in upper body region **56**A, as illustrated, there is a single wall **61** rather than separate top, bottom, and side walls. However, as illustrated in the frontal view of FIG. **6**, the chamber **60** is defined by interior top wall **62**, opposite, interior bottom wall **64**, and opposite interior side walls **66**A, **66**B, the side walls being generally perpendicular to the top and bottom walls. The walls **62**, **64**, **66** at the terminal end of the lower housing region **58** of the suction chamber define an open mouth **55**.

FIG. **5** and FIG. **6** illustrate rear and front views of accessory nozzle tool **50**, respectively. As shown in the exemplary figures, the first end, suction nozzle **54**, has a substantially oval-shaped cross section, while the second end of the main body **51**, working air conduit **52**, has a generally circular cross section. The oval cross-section tapers upward toward a more circular cross section moving from the first end of the tool to the second end, as shown perhaps most clearly in FIG. **6**.

FIG. **7** and FIG. **8** illustrate in more detail the tapered and downward angle orientation of the lower housing **58** relative to the upper housing **56**. These figures also illustrate the relationship between the orientation, or downward deflection angle, of the lower housing **58** to the forward, front edge **104** of the of the light assembly **100**, which advantageously allows for a deep penetration of the nozzle assembly **50** into an orifice, such as between a seat in an automobile, while simultaneously allowing for illumination of the surface to be cleaned with the light assembly and light emitting element **114** without damaging or blocking the light assembly **100**. That is, the relationship between the angle of downward deflection of the lower housing **58** and the placement of the light assembly **100** on the upper housing **56** is such that illumination is not compromised, and the light emitting element **114** is protected from damage. FIG. **7** illustrates this relationship, in accordance with embodiments of this disclosure.

More particularly, as illustrated in the side view of FIG. **7**, a plane γ that is in alignment with and parallel to the top face **58**A of lower housing region **58**, when extended upward in the direction of the upper housing **56**, intersects the front, or forward edge **104** of the light cover **102**. In accordance with select aspects of this embodiment of the present disclosure, plane γ intersects the light cover **102** at the highest, most forward and central point **105**. As also illustrated generally in FIG. **7**, the plane γ forms an angle δ between the top face **57** of upper body region **56**B and the plane γ, the angle δ ranging from about 20° to about 40°, preferably about 30°.

FIG. **8** illustrates a cross-sectional view of the tool **50** of FIG. **2**, taken along line **8**-**8**. The tool of the present disclosure includes a central, longitudinal axis A. The arrows (→) indicate direction of air flow through the internal air path **60** of the nozzle in tool **50**, from a surface being cleaned (not shown), in through the suction inlet region **55** of the suction nozzle **54**, though the interior suction chamber **60**, and out the air conduit **52** and toward a vacuum appliance **10** that is in operation with the vacuum nozzle tool. An axis drawn perpendicular, or normal, to the longitudinal axis A, perpendicular axis P, allows for a relationship between the upper housing region **56** of the tool **50**, and the lower housing region **58** to be described. That is, the lower housing region **58** is disposed at a downward, deflective angle relative to the longitudinal axis A along which upper housing region **56** is aligned. The angle of downward deflection can be described as an obtuse angle α relative to the longitudinal axis A, or as an acute angle β relative to the perpendicular axis P. More particularly, lower housing region **58** can be oriented in a downward direction away from the upper housing region **56** at an obtuse angle α relative to the longitudinal axis A, the angle α ranging from about 100° to about 170°, more particularly from about 110° to about 165°, and more particularly from about 120° to about 160°, including an angle of about 130°, about 140°, and about 150°. This relationship is also shown schematically in the side view of FIG. **7**, similarly illustrating the angle of downward offset α. Alternatively, and equally acceptable, the lower housing region **58** can be oriented in a downward direction away from the upper housing region **56** at an acute angle β relative to the perpendicular axis P, the angle β ranging from about 30° to about 80°, more particularly from about 30° to about 75°, and more particularly from about 40° to about 70°, including an angle of about 45°, about 50°, about 55°, about 60°, and about 65°.

Details of the light assembly **100** attached to tool **50** are perhaps best seen with reference to FIG. **3**. The illumination, or light emitting element **114** is preferably positioned on or towards a leading edge of the tool **50**, so as to effectively illuminate the surfaces to be cleaned. The light assembly **100** comprises at least one light emitting element **114**, a housing or cover **102**, and a power source, such as a battery (not shown). The light emitting element **114** can be chosen from a range of optional light emitting elements based upon the desired effect and dictated by the range in the light spectrum. For example, illumination of the surface to be cleaned requires a light source in the visible light spectrum with a wavelength of at least 400 nanometers (nm). Other options include various ranges in the ultraviolet (UV) light spectrum. For example, light in the UVA range comprising a wavelength from about 400 nanometers to about 320 nanometers (also known as "black light") is effective for illuminating carbon-based stains, including pet stains such as urine stains. UVA light causes carbon-based stains to fluoresce, thus making the previously invisible stain visible to the eye. Furthermore, it is known that illuminating certain peroxygen cleaning compounds with UVA light can improve cleaning efficacy and decrease the cleaning time. In accordance with aspects of the present disclosure, the light emitting element **114** can also optionally be chosen to have a sanitization or disinfection action on the surface to be cleaned. Disinfecting the surface to be cleaned is best achieved with a UVC wavelength of about 260 nanometers; however wavelengths from about 280 nm to about 100 nm are also effective. Once the desired effect is known, the light emitting element **114** can be chosen from known constructions, including light emitting diodes (LED), incandescent, fluorescent, and combinations thereof. Furthermore, multiple dissimilar light emitting element types can be incorporated into the illumination light assembly **100**, without limitation. Use of a commonly known selector or toggle switch, such as toggle switch **112**, can allow selection of UVA, UVC, and/or visible light independently, or, in various combinations depending on the specific desired use.

Referring to FIGS. **2** and **3**, at least one mounting recess can optionally be formed on a leading surface of the intermediate body region **56**B on which the light assembly **100**, which includes light emitting element **114**, may be posi-

tioned. A cover **102** is mounted on the intermediate body region **56**B to enclose the mounting recesses and can further optionally include at least one lens (not shown) at the forward region, proximate to forward edge **104**, to allow light from the light emitting element **114** to pass through the lens. The lens can be transparent or translucent and can advantageously be convex-shaped to disperse the light emitted by the light emitting element **114**. Alternately, the cover **102** can be made from a transparent or translucent material thereby transmitting light from the light emitting element **114** through at least a part of the cover in addition to, or without need for, an optional lens. The cover **102** can also include integral mounting features (not shown) to house and retain the light emitting element **114**.

In accordance with alternative embodiments of the present disclosure, the vacuum nozzle accessory tool **50** can further comprises an external power source for supplying power to the Illumination assembly **100**. In one exemplary, preferred embodiment, the external power source can be the vacuum appliance itself, supplying power though a cord or similar power conveying means or system to power the illumination assembly **100** while the vacuum appliance is in operation.

Other and further embodiments utilizing one or more aspects of the inventions described above can be devised without departing from the spirit of Applicant's invention. For example, the Illumination device can be arranged so as to circumscribe one or more portions of the vacuum nozzle or tool, e.g., the lights can circumscribe the body of the vacuum tool. Further, the various methods and embodiments of the methods of manufacture and assembly of the system, as well as location specifications, can be included in combination with each other to produce variations of the disclosed methods and embodiments. Discussion of singular elements can include plural elements and vice-versa.

The order of steps can occur in a variety of sequences unless otherwise specifically limited. The various steps described herein can be combined with other steps, interlineated with the stated steps, and/or split into multiple steps. Similarly, elements have been described functionally and can be embodied as separate components or can be combined into components having multiple functions.

The inventions have been described in the context of preferred and other embodiments and not every embodiment of the invention has been described. Obvious modifications and alterations to the described embodiments are available to those of ordinary skill in the art. The disclosed and undisclosed embodiments are not intended to limit or restrict the scope or applicability of the invention conceived of by the Applicants, but rather, in conformity with the patent laws, Applicants intend to fully protect all such modifications and improvements that come within the scope or range of equivalent of the following claims.

What is claimed is:

1. An attachment tool for a vacuum cleaner operable as a crevice tool, the attachment tool comprising:

an attachment end adapted for mounting to a vacuum cleaner;

a nozzle end spaced apart from the attachment end;

a nozzle body intermediate between the attachment end and the nozzle end and defining an exterior of the tool, the nozzle body comprising a lower housing region proximate the nozzle and an upper housing region comprising a first, upper body region proximate the air conduit and a second, intermediate body region intermediate the upper housing region and the lower housing region; and

a light assembly comprising a housing containing at least one light emitting element that emits light in a UV or visible spectrum and that will illuminate a surface to be cleaned, the light assembly being mounted on a leading, forward end of the nozzle body,

wherein the nozzle end is tapered downward and away from the nozzle body, and

wherein the housing of the light assembly has a forward edge, and wherein a plane extending parallel to the nozzle end intersects the forward edge.

2. The attachment tool of claim **1**, wherein the lower housing region is tapered downward and away from the nozzle body.

3. The attachment tool of claim **2**, wherein the lower housing region is tapered at an angle ranging from about 130° to about 170° relative to a horizontal axis of the attachment tool.

4. The attachment tool of claim **1**, wherein the at least one light emitting element is at least one light emitting diode (LED).

5. The attachment tool of claim **1**, wherein the at least one light emitting element further comprises a convex lens to disperse light illuminated from the at least one light emitting element.

6. The attachment tool of claim **1**, further comprising a power switch mounted within the light assembly for powering the at least one light emitting element.

7. The attachment tool of claim **1**, wherein the housing of the light assembly has a U-shape.

8. The attachment tool of claim **1**, wherein the first upper body region has a circular cross section.

9. The attachment tool of claim **1**, wherein the lower housing region has an oval cross section.

10. The attachment tool of claim **1**, wherein the nozzle body is formed of a plastic material by blow molding.

11. A tool, comprising:

a main body having a first end including a suction inlet, a second end including a discharge outlet, and an internal air path;

a receiving region on a top face of the main body sized to receive an illumination assembly; and

an illumination assembly, the illumination assembly including a cover and a light emitting element,

wherein the suction inlet is in fluid communication with the discharge outlet and the tool includes a longitudinal centerline axis A, and

wherein the cover of the illumination assembly has a forward edge, and wherein a plane extending parallel to the suction inlet intersects the forward edge.

12. The tool of claim **11**, wherein the first end of the main body is tapered toward the first suction inlet and the taper is offset from the longitudinal centerline axis A.

13. The tool of claim **12**, wherein the offset taper is offset at an angle ranging from about 110° to about 165° relative to the longitudinal centerline axis A.

14. The tool of claim **11**, wherein the second end of the main body has a circular cross section.

15. The tool of claim **11**, wherein the plane intersects the forward edge at an angle relative to a body portion intermediate between the first end and the second end at an angle between about 20° and about 40°.

16. A vacuum cleaner system comprising:

a housing;

a debris collection vessel;

a vacuum suction generator;

a cleaning hose connected to the suction generator; and

a crevice tool including:

a main body having a first end including a suction inlet, a second end including a discharge outlet, an internal air path, and a longitudinal centerline axis A;

a nozzle body intermediate between the suction inlet and the discharge outlet, the nozzle body comprising a lower housing region proximate the suction inlet and an upper housing region comprising a first, upper body region proximate the discharge outlet and a second, intermediate body region intermediate the upper housing region and the lower housing region; and

a light assembly comprising a light housing containing at least one light emitting element that will illuminate a surface to be cleaned, the light assembly being mounted on a leading, forward end of the intermediate body region,

wherein the lower housing region is tapered downward and away from the nozzle body, and

wherein the housing of the light assembly has a forward edge, and wherein a plane extending parallel to the suction inlet intersects the forward edge.

17. The system of claim **16**, wherein the lower housing region is tapered downward at an angle ranging from about 110° to about 165° relative to the longitudinal centerline axis A.

18. The system of claim **17**, wherein the angle ranges from about 130° to about 160° relative to the longitudinal centerline axis A.

19. The system of claim **16**, wherein the discharge outlet has a circular cross section.

* * * * *