Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2616687 A1 2007/02/15

(21) 2 616 687

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2006/07/14
(87) Date publication PCT/PCT Publication Date: 2007/02/15
(85) Entrée phase nationale/National Entry: 2008/01/24
(86) N° demande PCT/PCT Application No.: US 2006/027142
(87) N° publication PCT/PCT Publication No.: 2007/018942
(30) Priorité/Priority: 2005/07/28 (US11/191,815)

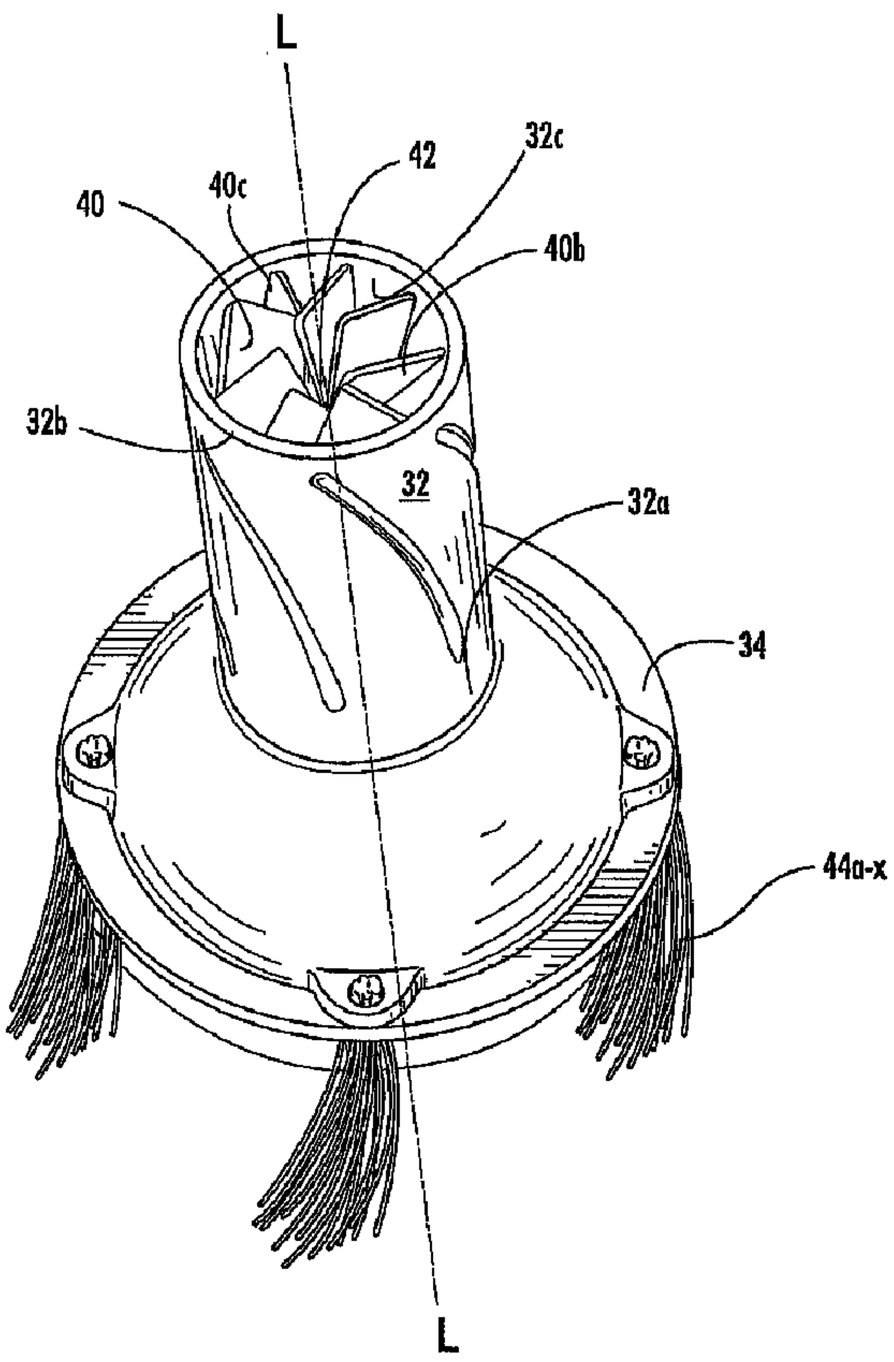
(51) Cl.Int./Int.Cl. *A47L 9/04* (2006.01),
A47L 5/26 (2006.01)

(71) Demandeur/Applicant:
KIBBEY, STEVEN M., US

(72) Inventeur/Inventor:
KIBBEY, STEVEN M., US

(74) Agent: GOWLING LAFLEUR HENDERSON LLP

(54) Titre : DISPOSITIF D'AGITATEUR POUR SYSTEME DE NETTOYAGE
(54) Title: AGITATOR DEVICE FOR CLEANING SYSTEM



(57) Abrégé/Abstract:
A cleaning apparatus includes an agitator device, which has an agitation head and a blade enclosure. The blade enclosure defines an interior wall from which a plurality of blades extend inwardly. A positively or negatively pressurized fluid is caused to flow through the blade enclosure to act on the blades to rotate the blade enclosure and the agitation head to agitate foreign matter on a workpiece. As the agitation head agitates the foreign matter, the pressurized fluid removes the foreign matter to clean the workpiece.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 February 2007 (15.02.2007)

PCT

(10) International Publication Number
WO 2007/018942 A1

(51) International Patent Classification:
A47L 9/04 (2006.01) *A47L 5/26* (2006.01)

(21) International Application Number:
PCT/US2006/027142

(22) International Filing Date: 14 July 2006 (14.07.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/191,815 28 July 2005 (28.07.2005) US

(71) Applicant and
(72) Inventor: **KIBBEY, Steven, M.** [US/US]; 1201 Chersonese Round, Mount Pleasant, SC 29464 (US).

(74) Agent: **KILLOUGH, Craig, B.**; Barnwell Whaley Patterson & Helms, LLC, 885 Island Park Drive, PO Drawer H, Charleston, SC 29402-0197 (US).

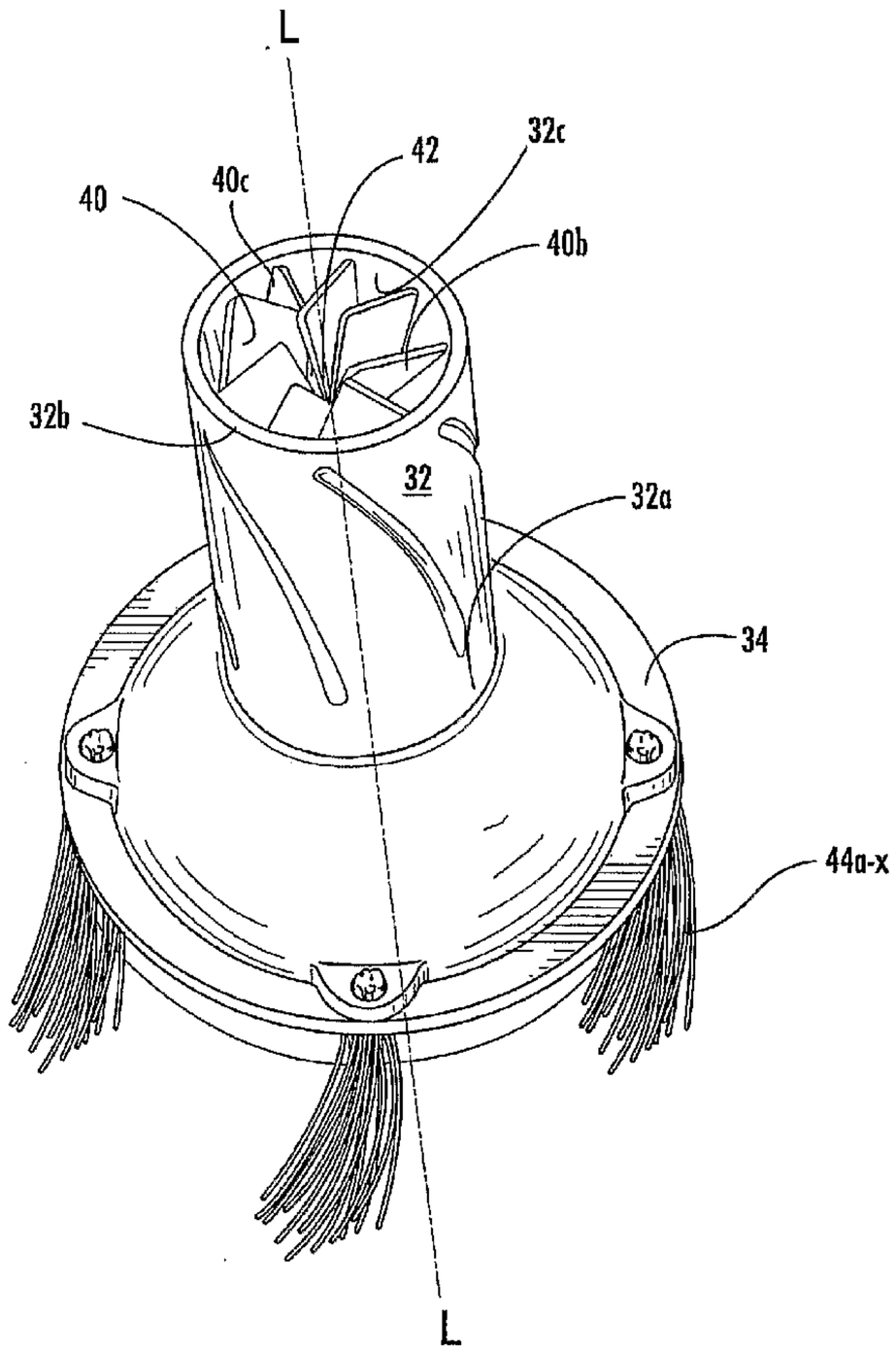
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

[Continued on next page]

(54) Title: AGITATOR DEVICE FOR CLEANING SYSTEM



(57) Abstract: A cleaning apparatus includes an agitator device, which has an agitation head and a blade enclosure. The blade enclosure defines an interior wall from which a plurality of blades extend inwardly. A positively or negatively pressurized fluid is caused to flow through the blade enclosure to act on the blades to rotate the blade enclosure and the agitation head to agitate foreign matter on a workpiece. As the agitation head agitates the foreign matter, the pressurized fluid removes the foreign matter to clean the workpiece.

WO 2007/018942 A1

WO 2007/018942 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Title of the Invention

AGITATOR DEVICE FOR CLEANING SYSTEM

Field of the Invention

This invention relates to an agitator device that facilitates removal of dust or debris by a flow of positively or negatively pressurized fluid. More particularly, the flow of pressurized fluid is directed through a blade enclosure to act upon one or more blades attached to an inner wall of the enclosure for effecting rotation of the blade enclosure and an agitator head connectable thereto.

Background of the Invention

Conventional vacuum cleaners often feature implements that facilitate the removal of an unwanted substance such as dust or debris from a surface by utilizing brushes to agitate the unwanted substance to reduce its adherence to the surface. These brushes are positioned or affixed within or around an intake orifice of the implement and may be powered or static. Powered brushes are driven either directly by a separate electric motor, or by a mechanical linkage to some other power source.

The typical vacuum cleaner implements, whether utilizing powered or static brushes, suffer from multiple drawbacks. Implements with powered brushes work well on carpets, but they are expensive to manufacture and maintain, are often unwieldy due to their size and mass, and are poorly suited for cleaning delicate or fragile surfaces such as clothing, curtains, silk lampshades, household knick-knacks, fine furniture, electronics, etcetera. Implements with static brushes often drive dust and debris into the surface to be cleaned as a user applies pressure to compensate for the absence of powered agitation; such pressure may also damage fragile or delicate surfaces. If an implement with static brushes utilizes vacuum pressure that is sufficient to dislodge dust and debris without powered agitation, the increased suction distorts and damages fragile or delicate surfaces, causes the implement to consume small objects instead of

cleaning them, and over time causes bristles of the brushes to collapse into and restrict the intake orifice.

A device is needed that will make it easier to remove dust and debris from intricate and fragile surfaces without causing damage.

Brief Summary of the Invention

The present invention provides an agitator device for attachment to a wet or dry vacuum device or a blower. An operation of the agitator device is effected by the negative or positive pressure of the vacuum cleaner or blower to which it is attached. The component parts of the agitator device are simple, compact, lightweight and economical to manufacture, assemble, use and maintain. Other advantages of the invention will be apparent from the following description and the attached drawings, or can be learned through practice of the invention.

As used herein, the term "plurality" can mean "a", "an" or "one" or more than one unless otherwise indicated.

According to one aspect of the invention, a cleaning apparatus includes an agitator device. The cleaning apparatus can be in communication with a source of negatively or positively pressurized fluid such as, respectively, a vacuum power source or a blowing power source. More particularly, the agitator device includes a housing, a blade enclosure and an agitation head connected to the blade enclosure. A portion of the blade enclosure is positioned in the housing. The housing directs a flow of the pressurized fluid through the blade enclosure. The blade enclosure has an inner wall with a plurality of blades affixed to the wall. The blades extend inwardly from the wall and cause the blade enclosure to rotate in response to the flow of pressurized fluid through the blade enclosure. The rotating blade enclosure rotates the agitation head to agitate a foreign substance, such as dust or dirt, found on a workpiece such as a lampshade or clothing. The flow of pressurized fluid removes the agitated foreign substance from the workpiece.

The blade enclosure in this aspect of the invention is an interchangeable blade enclosure. More specifically, the housing permits removal of the

interchangeable blade enclosure for cleaning, maintenance or replacement of the interchangeable blade enclosure and its individual components.

Also in this aspect of the invention, the agitation head includes a plurality of brushes for agitating the foreign substance on the workpiece such that the flow of pressurized fluid removes the foreign substance from the workpiece.

At least one blade in this aspect of the invention defines a leading edge disposed in a plane divergent from a longitudinal axis of the blade enclosure. The blade further defines an inner edge mounted to the wall of the blade enclosure. If two or more blades are used, they can be helically intertwined to allow the flow of pressurized fluid F to pass substantially unimpeded through the intertwined blades.

Also in this aspect of the invention, the cleaning apparatus includes a bearing assembly located in, on or near a surface of the housing. The bearing assembly can include a plurality of bushings and bearings located within the housing, located on an exterior portion of the housing or positioned both within the housing and on the exterior portion to permit a rotation of the blade enclosure relative to the housing to drive the agitation head.

A handpiece is also provided in this aspect of the invention. The handpiece is connectable to both the agitator device and to a plurality of cleaning systems. Further, the handpiece can have an adjustable port for adjusting the flow of pressurized fluid through the blade enclosure. Moreover, this aspect of the invention can further include an adapter for connecting the agitator device to a foreign handpiece or to a hose of a different system.

According to another aspect of the invention, a cleaning apparatus includes an agitator device and a handpiece. The cleaning apparatus can be in communication with a source of negatively or positively pressurized fluid such as, respectively, a vacuum power source or a blowing power source. More particularly, the agitator device includes a housing, a blade enclosure and an agitation head connected to the blade enclosure. A portion of the blade enclosure is positioned in the housing. The housing directs a flow of the pressurized fluid through the blade enclosure. The blade enclosure has an inner wall with a

plurality of blades affixed to the wall. The blades extend inwardly from the wall and cause the blade enclosure to rotate in response to the flow of pressurized fluid through the blade enclosure. The rotating blade enclosure rotates the agitation head to agitate a foreign substance, such as dust or dirt, found on a workpiece such as a lampshade or clothing. The flow of pressurized fluid removes the agitated foreign substance from the workpiece. The handpiece is connectable to the agitator device to adapt the agitator device to a plurality of cleaning systems and to adjust the flow of pressurized fluid through the blade enclosure.

The present aspect of the invention can include features of the foregoing aspect, and further include a switch in electrical communication with a power source. The switch is used to control the power source to adjust the flow of pressurized fluid. The switch can also be used to adjust the flow of pressurized fluid between a negative and positive pressurized fluid; e.g., vacuum or suction and blowing air.

Also in this aspect of the invention, each blade can be a helical blade. Furthermore, the blades can be arranged to rotate the blade enclosure and the agitation head in either a clockwise or a counterclockwise direction.

This aspect of the invention can also include a steamer, which is connected to the agitation head for steaming the workpiece. More specifically, the steamer can include a nozzle and orifice in communication with a supply of water, cleaning solution or the like, as well as a heater to convert the water, for instance, to steam.

In yet another aspect of the invention, a cleaning apparatus includes a transportable container with means for providing a flow of pressurized fluid; an agitator device; and a handpiece. The transportable container may be a portable vacuum pack, and the means for providing a flow of pressurized fluid can be a motor or other power source. The motor, for instance, can be located in the transportable container.

The cleaning apparatus can be in communication with a source of negatively or positively pressurized fluid such as, respectively, a vacuum power source or a blowing power source. More particularly, the agitator device includes

a housing, a blade enclosure and an agitation head connected to the blade enclosure. A portion of the blade enclosure is positioned in the housing. The housing directs a flow of the pressurized fluid through the blade enclosure. The blade enclosure has an inner wall with a plurality of blades affixed to the wall. The blades extend inwardly from the wall and cause the blade enclosure to rotate in response to the flow of pressurized fluid through the blade enclosure. The rotating blade enclosure rotates the agitation head to agitate a foreign substance, such as dust or dirt, found on a workpiece such as a lampshade or clothing. The flow of pressurized fluid removes the agitated foreign substance from the workpiece. The handpiece is connectable to the agitator device to adapt the agitator device to a plurality of cleaning systems and to adjust the flow of pressurized fluid through the blade enclosure.

The present aspect can include features of the foregoing aspects of the invention as well as a plurality of wheels, a carrying strap, a handle and combinations of these locomotive devices for maneuvering, carrying or otherwise moving the cleaning apparatus about a building, house or other structures, and individual components such as furniture arranged in those structures.

Further, in this aspect of the invention an electrical switch can be provided to control the motor to adjust the flow of pressurized fluid; e.g., to increase or decrease power output of the motor and thus relative strength of the flow of pressurized fluid. Moreover, the switch can be used to adjust the flow of pressurized fluid between a negative and positive pressurized fluid; e.g., a vacuum or suction and a blowing fluid.

Other aspects and advantages of the invention will apparent from the following description and the attached drawings, or can be learned through practice of the invention.

Brief Description of the Drawings

The above and other aspects and advantages of the present invention will be apparent from the detailed description below and in combination with the drawings in which:

FIGURE 1 is a perspective view of a cleaning apparatus with an agitator device being employed in an environment according to one embodiment of the invention;

FIGURE 2 is an exploded perspective view of the agitator device as in FIGURE 1;

FIGURE 3 is a perspective end view of a blade enclosure and an agitation head of the agitator device as in FIGURE 1;

FIGURE 4 is a plan view of the agitation head viewed in a direction of the blade enclosure as in FIGURE 3;

FIGURE 5 is a plan view of the blade enclosure viewed in a direction of the agitation head as in FIGURE 3;

FIGURE 6 is a perspective view of a blade enclosure and an agitation head in partial cross-section according to another embodiment of the invention; and

FIGURE 7 is an elevational view of an agitator device according to another aspect of the invention being employed in another environment.

Detailed Description of the Invention

Detailed reference will now be made to the drawings in which examples embodying the present invention are shown. The detailed description uses numerical and letter designations to refer to features of the drawings. Like or similar designations in the drawings and description have been used to refer to like or similar parts of the invention.

The drawings and detailed description provide a full and detailed written description of the invention, and of the manner and process of making and using it, so as to enable one skilled in the pertinent art to make and use it, as well as the best mode of carrying out the invention. However, the examples set forth in the drawings and detailed description are provided by way of explanation of the invention and are not meant as limitations of the invention. The present invention thus includes any modifications and variations of the following examples as come within the scope of the appended claims and their equivalents.

As broadly embodied in the figures, an agitator device or apparatus is provided for use with a wet or dry vacuum system or blower. The agitator device generally includes a blade carrying cylinder or enclosure having an inner wall in which a plurality of blades are attached and upon which a fluid acts to drive the carrying cylinder. The skilled artisan will instantly recognize that the components of the agitator device, described in detail below, and their materials and dimensions are modifiable to accommodate various manufacturing and cleaning requirements and are not limited to only those examples shown in the figures. As used herein, the term fluid means a liquid or a gas, which can be positively or negatively pressurized; i.e., the fluid can be blown or suctioned.

A first embodiment of a cleaning apparatus, designated in general by the number 10, is shown in FIGURES 1-5. The cleaning apparatus broadly includes a container 12, a tube (alternatively, pipe, conduit, hose or other source of pressurized fluid) 14 and an agitator device 16. The agitator device 16 includes a housing 28, a blade enclosure (alternatively, carrying cylinder, container or drive cartridge) 32, and an agitation head 34. The housing 28 houses the blade enclosure 32, and a plurality of blades 40 is attached within the blade enclosure 32.

By way of brief introduction, to assemble the exemplary cleaning apparatus 10, a container end 14a of the hose 14 is connected to the container 12, and the agitator device 16 is attached to an agitator end 14b of the hose 14 or an intervening handpiece 15 by a helical screw arrangement, a press-fit arrangement, a snap-fitting arrangement or the like as known in the art. When attached, the agitator device 16 is positioned substantially in line with a positively or negatively pressurized fluid flow F (respectively, a blowing force and a suction or vacuum force). The fluid flow F operates on the blades 40 to cause the blade enclosure 32 and the agitation head 34 to rotate in either a clockwise or a counterclockwise direction. Further details of the blades 40 and other components of the cleaning apparatus 10, their interconnections, materials and examples of their operation are provided in detail below.

With particular reference to FIGURE 1, the cleaning apparatus 10 is a portable wet/dry vacuum or blower in this aspect of the invention. The container 12 of the cleaning apparatus 10 includes a plurality of wheels 20 for maneuvering the cleaning apparatus 10 about a building, a house or a similar structure H and around workpieces W such as furniture situated within the structure H. Alternatively, or in addition to the wheels 20, a strap 22 can be provided for a user U to carry the cleaning apparatus 10 about the structure H. Likewise, a handle 24 can be used to maneuver and/or carry the cleaning apparatus 10 in and about the structure H.

As further shown in FIGURE 1, the container 12 includes an inlet/outlet 12a in or about which the container end 14a of the hose 14 is inserted. In this example, the hose 14 is also connected at its agitator end 14b to the handpiece 15, and the handpiece 15 is connected to the housing 28 of the agitator device 16. As shown, a power source or motor 26 is installed in the container 12 to produce the positively or negatively pressurized fluid flow F. A variable or adjustable port P and/or an electrical switch 46 can be provided to control a force of the positively or negatively pressurized fluid flow F. For instance, the port P can be opened to reduce the force of the fluid flow F, or the port P can be closed to ensure a relatively stronger force of the pressurized fluid flow F. This activity is governed of course by Bernoulli's principle.

More specifically, the skilled artisan will recognize that the volume of air, for instance, passing through the cleaning apparatus 10 per unit of time must be constant, assuming the speed of the motor 26 is also constant. By opening the port P, some amount of that volume of air can bypass the intake orifice 34a, thereby reducing the speed and force of the pressurized fluid flow F that passes through the intake orifice 34a in accordance with Bernoulli's principle. Such a reduced vacuum force, and thus, rotation of the agitation head 34 can be desirable for use on delicate workpieces W such as lampshades, silk curtains and the like. The skilled artisan will further appreciate that the port P can be closed to increase the force in accordance with Bernoulli's principle. Alternatively, or addition to

the port P, an electrical switch 46 can be provided to increase or decrease a power output of the motor 26 and thus, affect the force of the fluid flow F.

With further reference to FIGURE 1, the workpiece W is shown with foreign matter D such as dust, dirt, lint, pet hair and the like accumulated on the workpiece W. As shown, the agitation head 34 includes a plurality of brushes or bristles 44a-x (where x represents a theoretically endless number of brushes) spaced about the agitation head 34 around the orifice 34a. The brushes 44a-x are described in detail with respect to FIGURES 3 and 4 below. As noted above, the motor 26 is activated to produce the fluid flow F, which is a negatively pressurized or vacuum flow in this instance. As will be described below in greater detail with respect to FIGURE 2, as the fluid flow F passes through the blade enclosure 32 contained in the housing 28, the fluid flow F acts on a plurality of blades 40 attached to the blade enclosure 32. The blades 40 are fixed to the blade enclosure 32, and the fluid flow F acts upon the blades 40 to rotate the blade enclosure 32. As the blade enclosure 32 rotates, the agitation head 34 and thus the brushes 44a-x rotate in either a clockwise or a counterclockwise direction (indicated by the rotating arrow) to agitate the foreign matter D. As shown, the agitated foreign matter D is removed via the fluid flow F.

Turning now to FIGURE 2, the agitator device 16 includes a top 29 in this example for attaching to a first interface end 28a of the housing 28. The top 29 can be a screw-on arrangement as shown for threading onto the housing 28. Alternatively, or in addition to the top 29, the housing 28 can have a hinged cover or hatch 28e that can be opened easily to facilitate removal of the blade enclosure 32 for cleaning, servicing or replacement of a bearing 30 described below and/or the blade enclosure 32. For instance, the blade enclosure 32 can be replaced with another blade enclosure having an alternative blade arrangement to affect the fluid flow F.

FIGURE 2 further shows a second interface end 28b of the housing 28, and an interface orifice 28c defined between the first interface end 28a and the second interface end 28b. As shown, the second interface end 28b is for insertion in or about a handpiece orifice 15a of a handpiece 15, or directly to the tube

orifice 14c of the tube 14. An adapter 48 can be used to adapt any two of the tube 14, the handpiece 15, and the agitator device 16 together. As shown in this aspect of the invention, the handheld device 15 incorporates a variable port P such as the port P of the tube 14 described above to enable airflow to be redirected around the agitator device 16 as may be necessitated by certain applications that require less suction and torque. Those skilled in the art will appreciate that alternatively, or in addition to the tube 14 and/or the handheld device 15, the housing 28 of the agitator device 16 can incorporate such a port.

Also shown in FIGURE 2, the housing 28 further defines an inner wall 28d in which a thrust bearing 30 is situated. In this example, the thrust bearing 30 defines approximately a 1.02 inch inside diameter, approximately a 1.352 inch outside diameter, and approximately a 44 degree bevel on a leading edge 30a to aid in self-centering of the blade enclosure 32 during rotation of the blade enclosure 32. Specifically, the blade enclosure "floats" on the leading edge 30a of the thrust bearing 30 to minimize frictional load during rotation. The bearing 30 as well as other components of the invention may be made of polyvinyl chloride (PVC), high-density polyethylene (HDPE), nylon, polyoxymethylene (POM); i.e., acetyl plastic, polyetheretherketone (PEEK), polytetrafluoroethylene (PTFE), metal or any material suitable for lightweight construction and high-speed, friction-reducing rotation of component parts.

FIGURE 2 further shows a plurality of bushings or bearings 36, 37, 38 used to longitudinally center and retain the blade enclosure 32 within the housing 28. As shown, the bearings 36, 37, 38 slip over the blade enclosure 32 when assembled and act as guides or spacers between the inner wall 28d of the housing 28 and the blade enclosure 32 during rotation of the blade enclosure 32. The skilled artisan will instantly recognize that the bearings 36, 37, 38 also maintain the blade enclosure 32 within the housing 28 notwithstanding various orientations the agitator device 16 may assume. The skilled artisan will further appreciate that the invention is not limited to the foregoing examples of bearings and bushings and may further include complementary races defined in inner wall 28d of the housing 28 for receiving one or more of the bearings 36, 37, 38.

FIGURE 3 most clearly shows the blade enclosure 32 attached to the agitation head 34. Those skilled in the art will instantly recognize that the blade enclosure 32 and the agitation head 34 can be separate components that are press fit, snap fit, or screwed together. Alternatively, the blade enclosure 32 and agitation head 34 can be molded or glued together to form a unitary device as shown in this example. More particularly, the blade enclosure 32 includes a first or leading end 32a, which is attached to the agitation head 34 as indicated above. A second or trailing end 32b is inserted in the housing 28 via the interface orifice 28c or through the hatch 28e as described above with respect to FIGURE 2. In this example, the blade enclosure 32 is about 2.78 inches in length and has an outside diameter of approximately 1.25 inches and an inside diameter of approximately 1.12 inches. The trailing end 32b is radiused or chamfered to minimize contact with a surface of the thrust bearing 30.

FIGURE 3 further shows that the blade enclosure 32 defines the longitudinal axis L briefly mentioned above about which the blades 40 are arranged. In this example, there are eight (8) curved blades 40. However, those skilled in the art will appreciate that additional or fewer blades can be used in different orientations. For example, as will be described in an alternate embodiment below with respect to FIGURE 6, only one helical blade is employed.

With reference to FIGURES 3, 4 and 5, the blades 40 each define a leading edge 40a and a trailing edge 40b. As shown, the inner edges 40c of the blades 40 are connected to an inner wall 32c of the blade enclosure 32. The blades 40 may be molded within the blade enclosure 32 as shown or they may be slid into complementary receptacles (not shown) defined in the inner wall 32c. Further, the blades 40 can be attached to a hollow support (not shown) similar in shape to the blade enclosure 32. Such a hollow support with the blades 40 attached therein can be snap-fitted or otherwise attached within the blade enclosure 32.

FIGURE 3 particularly shows that the blades 40 terminate about the longitudinal axis L to form an opening 42 through the blade enclosure 32 such

that no impinging axle or shaft is necessary. In this example, each blade 40 is about 1.87 inches in length as measured from their leading edge 40a to their trailing edge 40b in the blade enclosure 32. Due to curvature, the blades 40 are longer than 1.87 inches if laid flat. The opening 42 measured at the leading edges 40a is approximately 0.36 inches, while the opening 42 at the trailing edges 40b is approximately 0.15 inches. Each blade 40 has a width at its leading edge 40a of approximately 0.42 inches. Each blade 40 has a width at its trailing edge 40b of approximately 0.41 inches with each trailing edge 40b being 0.125 inches from the second end 32b of the blade enclosure 32. Again, a person of ordinary skill in the art will instantly recognize that the foregoing parameters are merely examples provided to enable others to make and use this aspect of the invention. These examples are not meant as limitations, and the foregoing lengths and curvatures and angles of the blades 40 relative to the wall 32c are merely intended on this exemplary scale to provide sufficiently overlapping leading and trailing edges 40a,b to minimize airflow around the blades 40 under load.

FIGURES 3 and 4 most clearly show the brushes 44a-x attached to the agitation head 34. Again, additional or fewer brushes can be provided other than the examples shown. Likewise, the brushes 44a-x can be permanently affixed to the agitation head 34 or can be provided as removable/replaceable brushes. In this example, the agitation head 34 exhibits approximately a 2.75-inch outside diameter and is about 1.1 inches in height, and four (4) brushes 44a-d are spaced equally apart about the agitation head 34.

FIGURE 4 particularly shows the leading edges 40a of each blade 40. As shown, the leading edges 40a are disposed apart from each other to define a first or larger diameter D_1 about the opening 42, which is approximately 0.36 inches in this example as noted above.

FIGURE 5 shows an opposing view of FIGURE 4 in which the trailing edges 40b of each blade 40 funnel together to form a second or smaller diameter D_2 about the opening 42, which is approximately 0.15 inches in this example as noted above. Due to this arrangement, as the fluid flow F passes through and about the blades 40 the Venturi effect is increased. In this instance, the blade

enclosure 32 and the opening 42 act as a tube with a constricted throat that drive fluid pressures and velocities; i.e., the velocity of the fluid flow F increases as it passes through the opening 42 as it constricts in a direction of the trailing edges 40b in this example according to the continuity equation, RQ = VAQ = VA where Q is the volumetric flow rate, A is the area of flow and V is the fluid velocity. Because Q does not change, as A gets smaller then V must increase.

In another embodiment of the invention shown in FIGURE 6, a carrying cylinder 132 is connected either unitarily or by mechanical connection to an agitation head 134. The carrying cylinder 132 and the agitation head 134 are in some ways similar to the embodiment described above. Therefore, only some differences are described below to avoid unnecessary redundancy and reference is made to the foregoing embodiments for like or similar components to enable one skilled in the pertinent art to practice this aspect of the invention.

With more particular reference to FIGURE 6, the carrying cylinder 132 includes one helically shaped blade 140 aligned parallel to a longitudinal axis L of the carrying cylinder 132. In this arrangement, similar to metal or wood shavings passing along a drill bit, the fluid flow F in this example will flow about the helical blade 140 and through the blade enclosure 32 without an impinging axle, shaft or throughopening. As above, the helical blades 140 can be slid into complementary receptacles in the carrying cylinder 132, formed such as by press molding in the end and inner wall 132c of the carrying cylinder 132, or the blades 140 can be slid into a support device (not shown), which in turn can be snapped, slipped or screwed into the carrying cylinder 132.

FIGURE 7 shows yet another embodiment of the invention in which a cleaning apparatus 210 is based on a central or remote power source 226. An agitator device 216 is attached to a hose 214, which are both portable about a house, building or like structure H. The house H includes a plurality of junctions/apertures 212a in communication with the power source 226 via tubes or other conduits C. Therefore, a user can move the hose 214 and the agitator device 216 about the house H for insertion in the various junctions/apertures 212a to clean various articles W and areas of the house H.

The invention may be better understood with reference to an exemplary operation of one embodiment of the invention. With reference to FIGURES 1-5, the agitator device 16 includes the blade enclosure 32, which is slipped into the adapter 28 and to rest on the bearing 30. As the fluid flow F is induced into the hose 14 by the motor 26 in a vacuum arrangement, the fluid flow F acts on the blades 40 to rotate the blade enclosure 32, which turns the agitation head 34 to which the brushes 44a-d are attached. Therefore, as the blade enclosure 32 rotates, the brushes 44a-d agitate the foreign particles D on the workpiece W and the fluid flow F is able to remove the foreign particles D in this aspect of the invention.

The skilled artisan will appreciate that because the brushes 44a-d in this example rotate about the longitudinal axis L of the agitator device 16, the brushes 44a-d do not "fold inward" to clog or block the intake orifice 34a of the agitation head 34. By way of example, when the user U uses the agitator device 16 in a sweeping motion, a trailing edge of the brushes 44a-d will contact the workpiece W at an attitude to cause the foreign matter D to be swept toward a suction center of the intake orifice 34a, which facilitates collection and removal of the foreign matter D by the fluid flow F.

It will be further appreciated that the fluid flow F as well as the foreign particles D are not affected by an impinging component such as a shaft or axle within the agitator device 16 since the blades 40 are attached to the inner wall 32c substantially in line with the fluid flow F. Alternatively stated, the arrangement of the blades 40 based on the Venturi effect described above use the power of the power source 26 in this example to drive the blade enclosure 32, which freely "floats" on the bearing 30. Additionally, because the agitator device 16 leverages existing power of the cleaning apparatus 10, no additional motors or the like are required to power the agitator device 16 separately; thus, the agitator device 16 is lightweight, compact, easily maneuverable and will not "overpower" and harm delicate items such as silk curtains, lampshades and the like.

While preferred embodiments of the invention have been shown and described, those skilled in the art will recognize that other changes and

modifications may be made to the foregoing embodiments without departing from the scope and spirit of the invention. For example, specific pressures and dimensions are set forth for current applications and industry regulations and specific shapes of various elements of the illustrated embodiments may be altered to suit particular applications. It is intended to claim all such changes and modifications as fall within the scope of the appended claims and their equivalents. Moreover, references herein to first and second ends, negative and positive pressures and trailing and leading edges are intended solely for purposes of providing an enabling disclosure and in no way suggest limitations regarding the operative orientation of the exemplary embodiments or any components thereof.

That which is claimed is:

1. A cleaning apparatus in communication with a source of negatively or positively pressurized fluid, the cleaning apparatus comprising:

an agitator device including a housing, a blade enclosure and an agitation head connectable to the blade enclosure, a portion of the blade enclosure being disposed in the housing, the housing being configured to direct a flow of pressurized fluid through the blade enclosure, the blade enclosure defining a wall therein, a plurality of blades affixed to the wall and depending inwardly therefrom, the blades being configured to cause the blade enclosure to rotate in response to the flow of pressurized fluid through the blade enclosure, the rotating blade enclosure rotating the agitation head to agitate a foreign substance disposed on a workpiece such that the flow of pressurized fluid removes the agitated foreign substance from the workpiece.

2. The cleaning apparatus as defined in Claim 1, wherein the blade enclosure is an interchangeable blade enclosure, the housing being configured to remove the interchangeable blade enclosure.

3. The cleaning apparatus as defined in Claim 1, wherein the agitation head includes a plurality of brushes being configured to agitate the foreign substance on the workpiece for removal by the flow of pressurized fluid.

4. The cleaning apparatus as defined in Claim 1, wherein at least two of the blades each define a leading edge disposed in a plane divergent from a longitudinal axis of the blade enclosure, each blade defining an inner edge mounted to the wall, the at least two blades being helically intertwined and configured to allow the flow of pressurized fluid to pass substantially unimpeded through the intertwined blades.

5. The cleaning apparatus as defined in Claim 1, further comprising a bearing assembly disposed proximate a surface of the housing, the

bearing assembly being configured to permit a rotation of the blade enclosure relative to the housing to drive the agitation head.

6. The cleaning apparatus as defined in Claim 1, further comprising a power source being configured to provide the flow of pressurized fluid.

7. The cleaning apparatus as defined in Claim 1, further comprising a handpiece being connectable to the agitator device, the handpiece being configured to adapt the agitator device to a plurality of cleaning systems.

8. The cleaning apparatus as defined in Claim 7, further comprising an adapter being configured to connect a foreign handpiece to the agitator device.

9. The cleaning apparatus as defined in Claim 1, further comprising a handpiece being connectable to the agitator device, the handpiece defining an adjustable port therethrough for adjusting the flow of pressurized fluid through the blade enclosure.

10. The cleaning apparatus as defined in Claim 1, further comprising an interchangeable adapter being configured to connect the agitator device to a pressurized fluid conduit.

11. A cleaning apparatus in communication with a source of negatively or positively pressurized fluid, the cleaning apparatus comprising:

an agitator device including a housing, a blade enclosure and an agitation head connectable to the blade enclosure, a portion of the blade enclosure being disposed in the housing, the housing being configured to direct a flow of pressurized fluid through the blade enclosure, the blade enclosure defining a wall therein, a plurality of blades affixed to the wall and depending inwardly therefrom, the blades being configured to cause the blade enclosure to rotate in response to the flow of pressurized fluid through the blade enclosure, the rotating

blade enclosure rotating the agitation head to agitate a foreign substance disposed on a workpiece such that the flow of pressurized fluid removes the agitated foreign substance from the workpiece; and

a handpiece being connectable to the agitator device, the handpiece being configured to adapt the agitator device to a plurality of cleaning systems and to adjust the flow of pressurized fluid through the blade enclosure.

12. The cleaning apparatus as defined in Claim 11, wherein the blade enclosure is an interchangeable blade enclosure, the housing being configured to remove the interchangeable blade enclosure.

13. The cleaning apparatus as defined in Claim 11, wherein the agitation head includes a plurality of brushes being configured to agitate the foreign substance on the workpiece for removal by the flow of pressurized fluid.

14. The cleaning apparatus as defined in Claim 11, wherein at least two of the blades each define a leading edge disposed in a plane divergent from a longitudinal axis of the blade enclosure, each blade defining an inner edge mounted to the wall, the at least two blades being helically intertwined and configured to allow the flow of pressurized fluid to pass substantially unimpeded through the intertwined blades.

15. The cleaning apparatus as defined in Claim 11, further comprising a bearing assembly disposed proximate a surface of the housing, the bearing assembly being configured to permit a rotation of the blade enclosure relative to the housing to drive the agitation head.

16. The cleaning apparatus as defined in Claim 11, further comprising a power source being configured to provide the flow of pressurized fluid.

17. The cleaning apparatus as defined in Claim 16, further comprising a switch in electrical communication with the power source, the switch

being configured to control the power source to adjust the flow of pressurized fluid.

18. The cleaning apparatus as defined in Claim 16, further comprising a switch in electrical communication with the power source, the switch being configured to adjust the flow of pressurized fluid between a negative and positive pressurized fluid.

19. The cleaning apparatus as defined in Claim 11, further comprising an adapter being configured to connect a foreign handpiece to the agitator device.

20. The cleaning apparatus as defined in Claim 19, wherein the adapter is further configured to connect the handpiece to a pressurized fluid conduit.

21. The cleaning apparatus as defined in Claim 11, wherein the handpiece defines an adjustable port therethrough for adjusting the flow of pressurized fluid through the blade enclosure.

22. The cleaning apparatus as defined in Claim 11, wherein each blade is a helical blade.

23. The cleaning apparatus as defined in Claim 11, further comprising a bearing assembly disposed proximate a surface of the housing, the bearing assembly being configured to permit a rotation of the blade enclosure relative to the housing to drive the agitation head.

24. The cleaning apparatus as defined in Claim 11, further including a steamer connected to the agitation head and being configured to steam the workpiece.

25. A cleaning apparatus in communication with a source of negatively or positively pressurized fluid, the cleaning apparatus comprising:

a transportable container including means for providing a flow of pressurized fluid;

an agitator device including a housing, a blade enclosure and an agitation head connectable to the blade enclosure, a portion of the blade enclosure being disposed in the housing, the housing being configured to direct the flow of pressurized fluid through the blade enclosure, the blade enclosure defining a wall therein, a plurality of blades affixed to the wall and depending inwardly therefrom, the blades being configured to cause the blade enclosure to rotate in response to the flow of pressurized fluid through the blade enclosure, the rotating blade enclosure rotating the agitation head to agitate a foreign substance disposed on a workpiece such that the flow of pressurized fluid removes the agitated foreign substance from the workpiece; and

a handpiece being connectable to the agitator device, the handpiece being configured to adjust the flow of pressurized fluid through the blade enclosure.

26. The cleaning apparatus as defined in Claim 25, wherein the transportable container includes a plurality of wheels, a carrying strap, a handle or combinations thereof.

27. The cleaning apparatus as defined in Claim 25, wherein the means for providing a flow of pressurized fluid is a motor disposed in the transportable container.

28. The cleaning apparatus as defined in Claim 27, further comprising a switch in electrical communication with the motor, the switch being configured to control the motor to adjust the flow of pressurized fluid.

29. The cleaning apparatus as defined in Claim 27, further comprising a switch in electrical communication with the motor, the switch being configured to adjust the flow of pressurized fluid between a negative and positive pressurized fluid.

30. The cleaning apparatus as defined in Claim 25, wherein the blade enclosure is an interchangeable blade enclosure, the housing being configured to remove the interchangeable blade enclosure.

31. The cleaning apparatus as defined in Claim 25, wherein the agitation head includes a plurality of brushes being configured to agitate the foreign substance on the workpiece for removal by the flow of pressurized fluid.

32. The cleaning apparatus as defined in Claim 25, wherein at least two of the blades each define a leading edge disposed in a plane divergent from a longitudinal axis of the blade enclosure, each blade defining an inner edge mounted to the wall, the at least two of the blades helically intertwined and configured to allow the flow of pressurized fluid to pass substantially unimpeded through the intertwined blades.

33. The cleaning apparatus as defined in Claim 25, further comprising a bearing assembly disposed proximate a surface of the housing, the bearing assembly being configured to permit a rotation of the blade enclosure relative to the housing to drive the agitation head.

34. The cleaning apparatus as defined in Claim 25, wherein each blade is a helical blade.

35. The cleaning apparatus as defined in Claim 25, further comprising an adapter being configured to connect a foreign handpiece to the agitator device.

36. The cleaning apparatus as defined in Claim 35, wherein the adapter is further configured to connect the handpiece to a pressurized fluid conduit.

37. The cleaning apparatus as defined in Claim 25, wherein the handpiece defines an adjustable port therethrough for adjusting the flow of pressurized fluid through the blade enclosure.

38. The cleaning apparatus as defined in Claim 25, wherein the blades are configured to rotate the blade enclosure and the agitation head in a clockwise direction.

39. The cleaning apparatus as defined in Claim 25, wherein the blades are configured to rotate the blade enclosure and the agitation head in a counterclockwise direction.

40. The cleaning apparatus as defined in Claim 25, further comprising a bearing assembly disposed proximate a surface of the housing, the bearing assembly being configured to permit a rotation of the blade enclosure relative to the housing to drive the agitation head.

41. The cleaning apparatus as defined in Claim 25, further comprising a steamer connected to the agitation head and being configured to steam the workpiece.

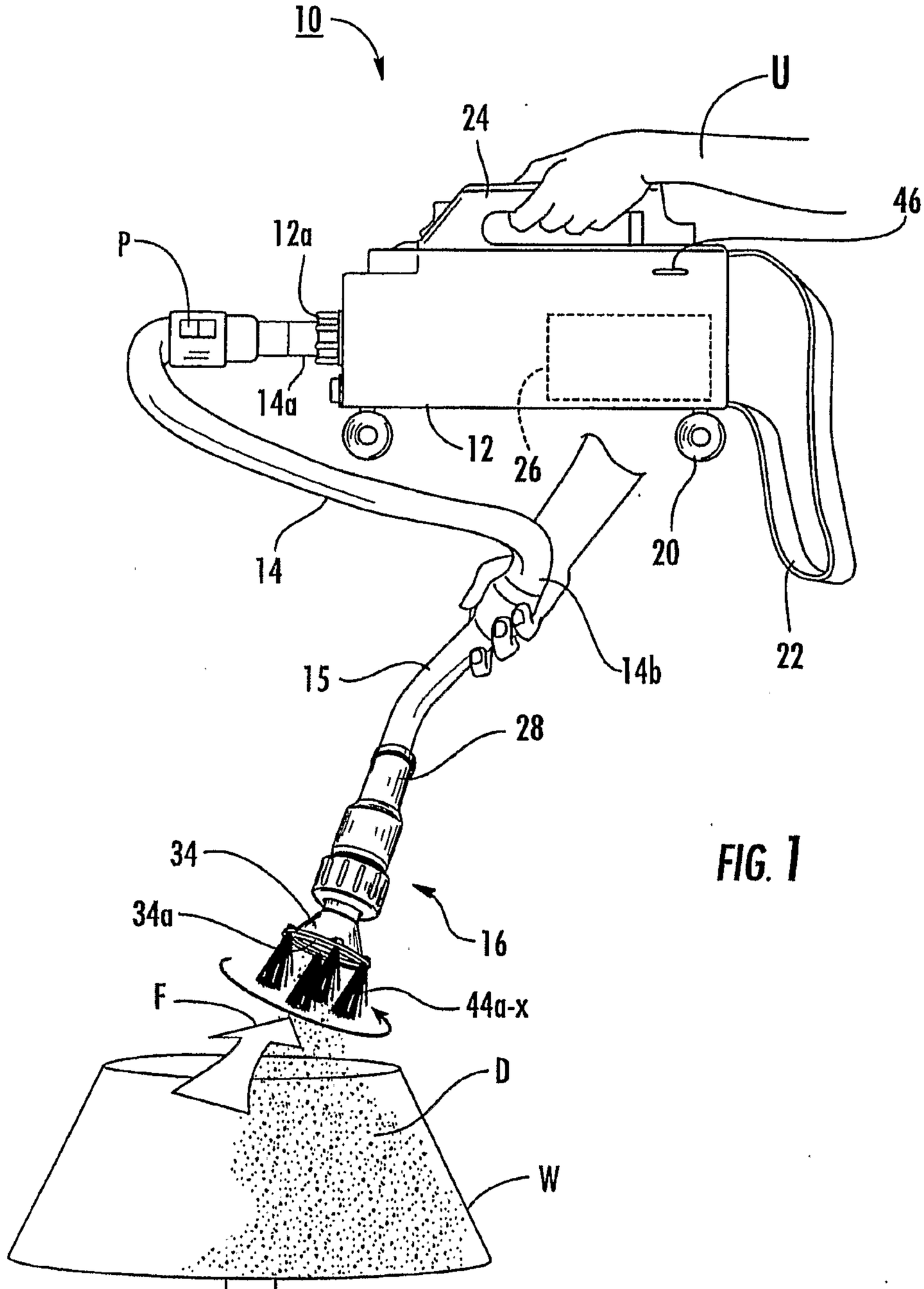


FIG. 1

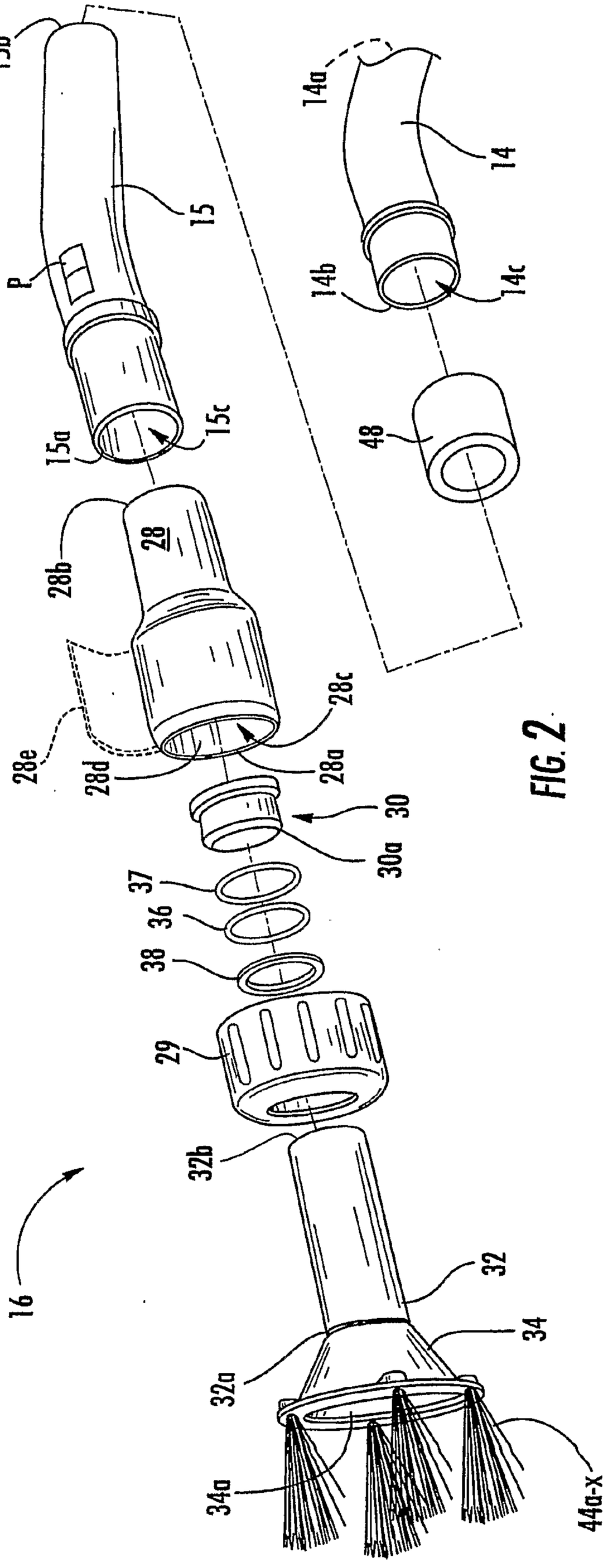

15b
14a
14
15
P
14b
14c
15a
15c
48
28b
28
28e
28d
28c
28a
30
30a
37
36
38
29
32b
32
16
34
32a
34a
44a-x

FIG. 2

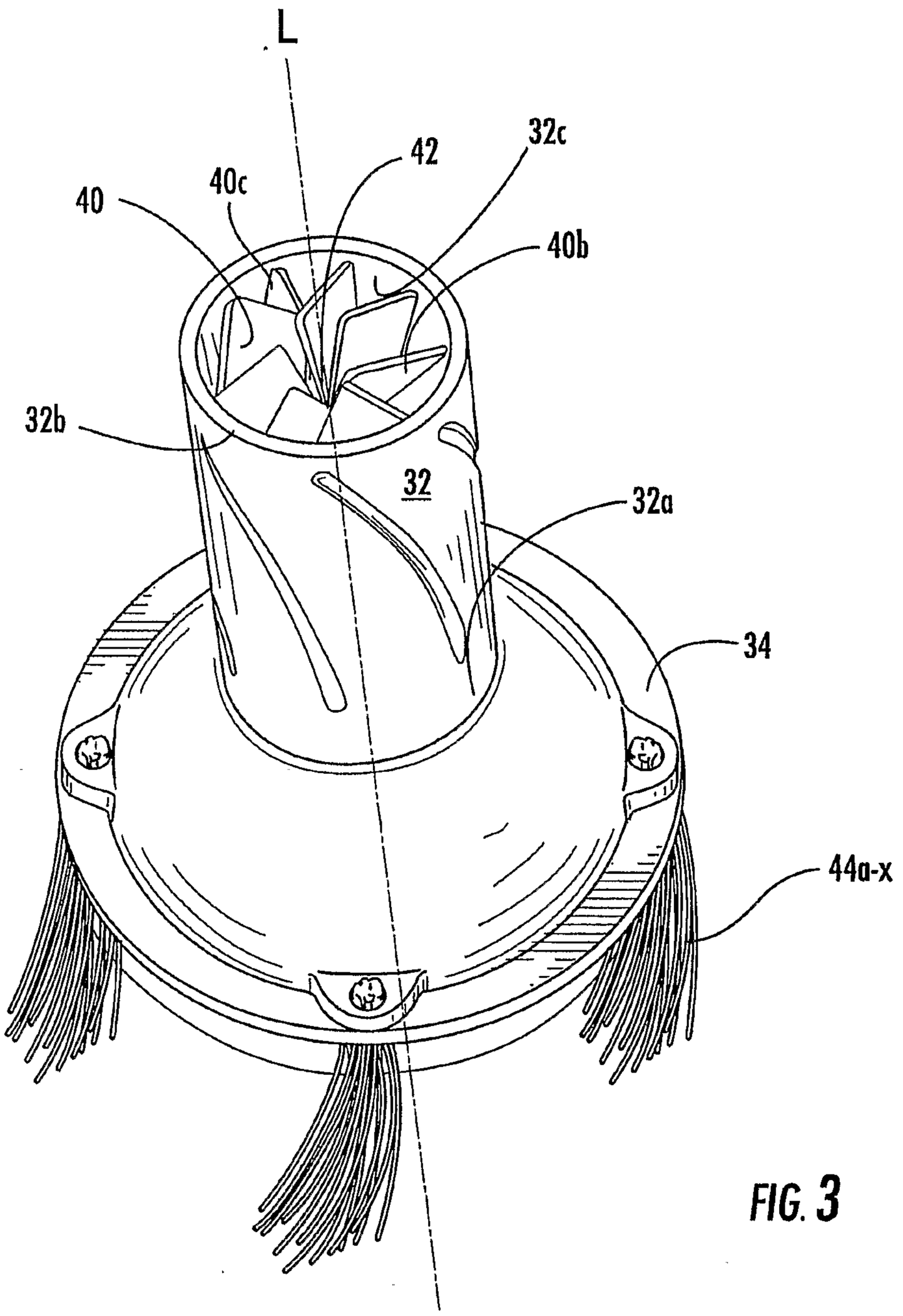


FIG. 3

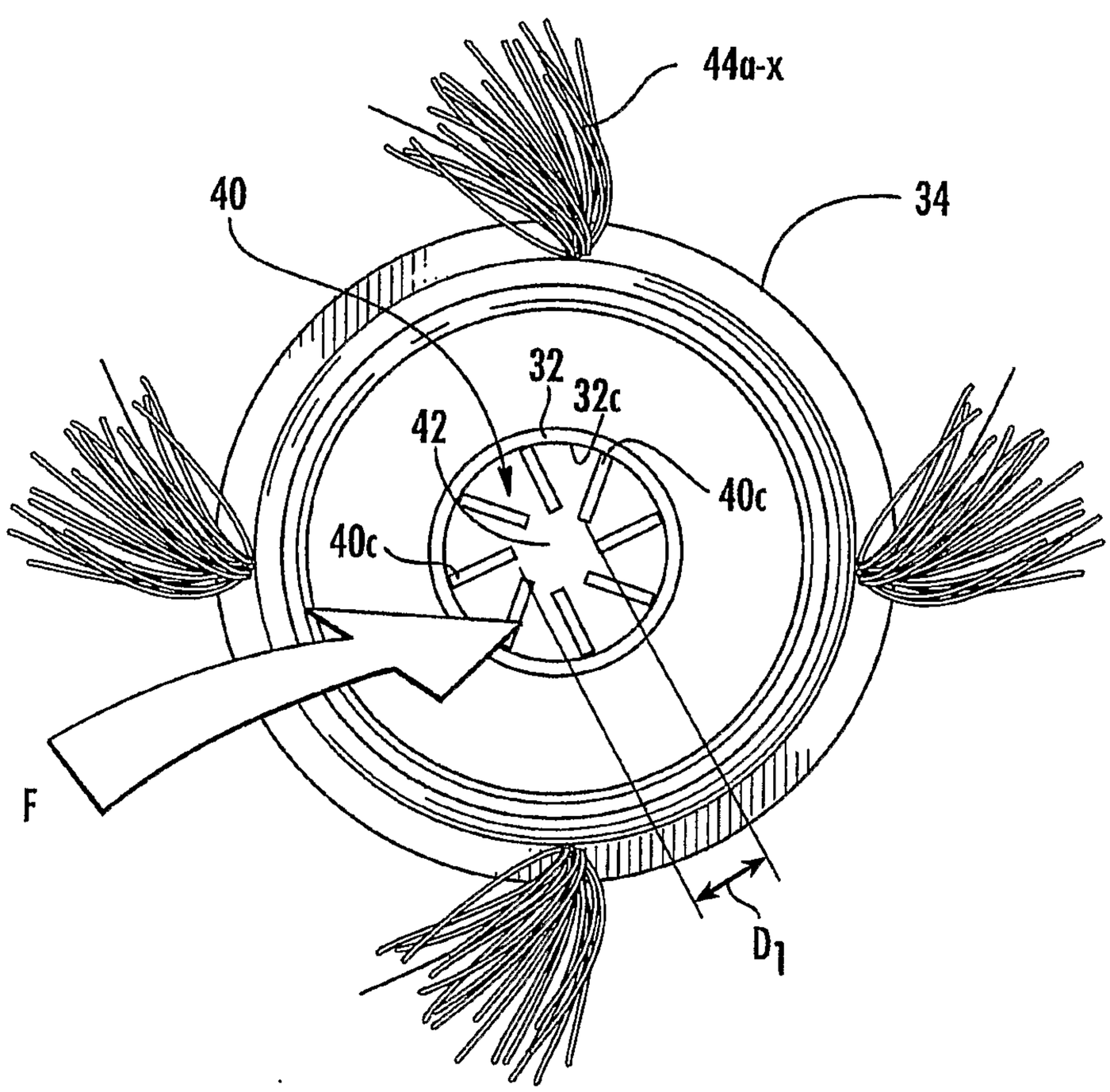


FIG. 4

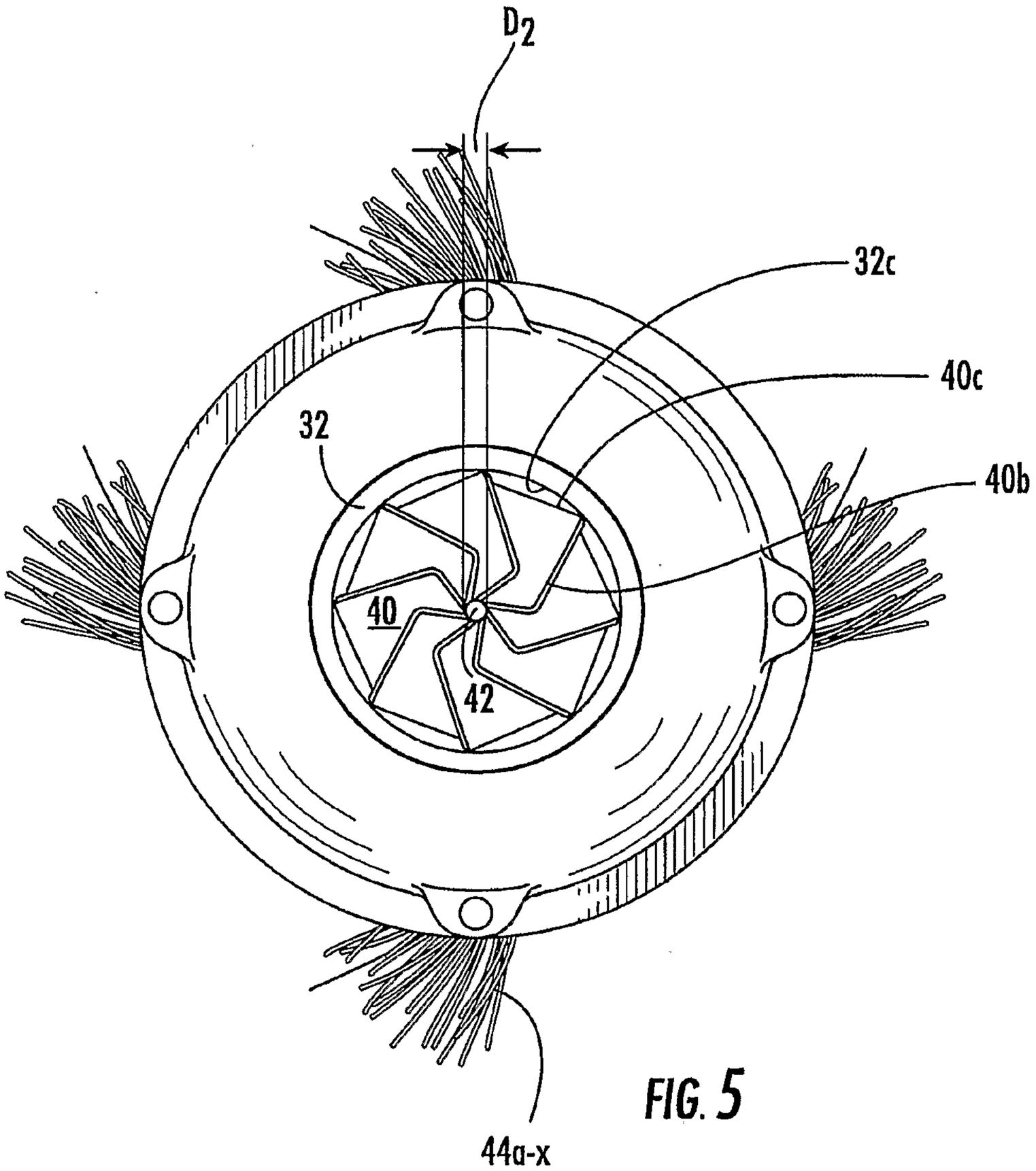


FIG. 5

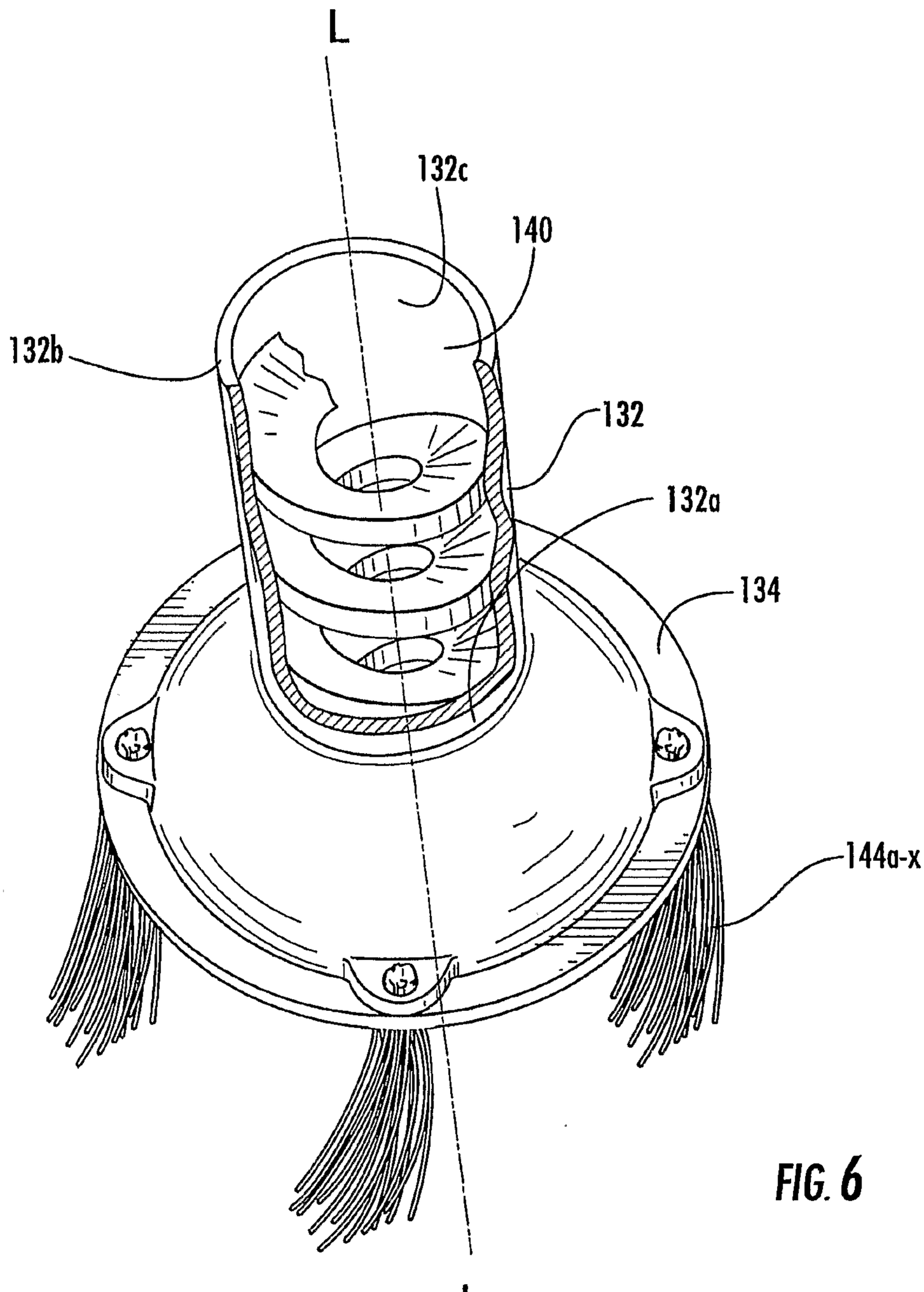


FIG. 6

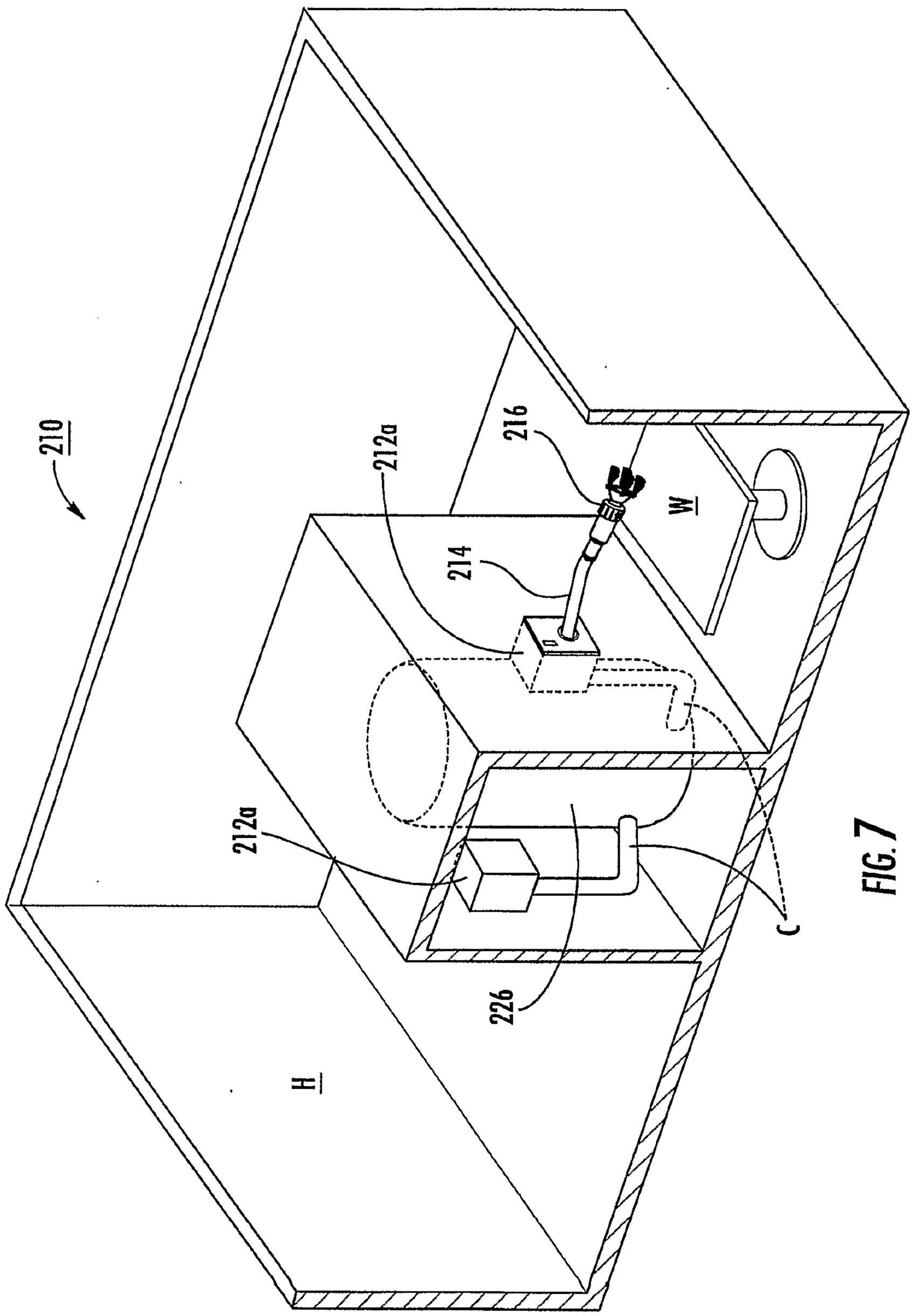
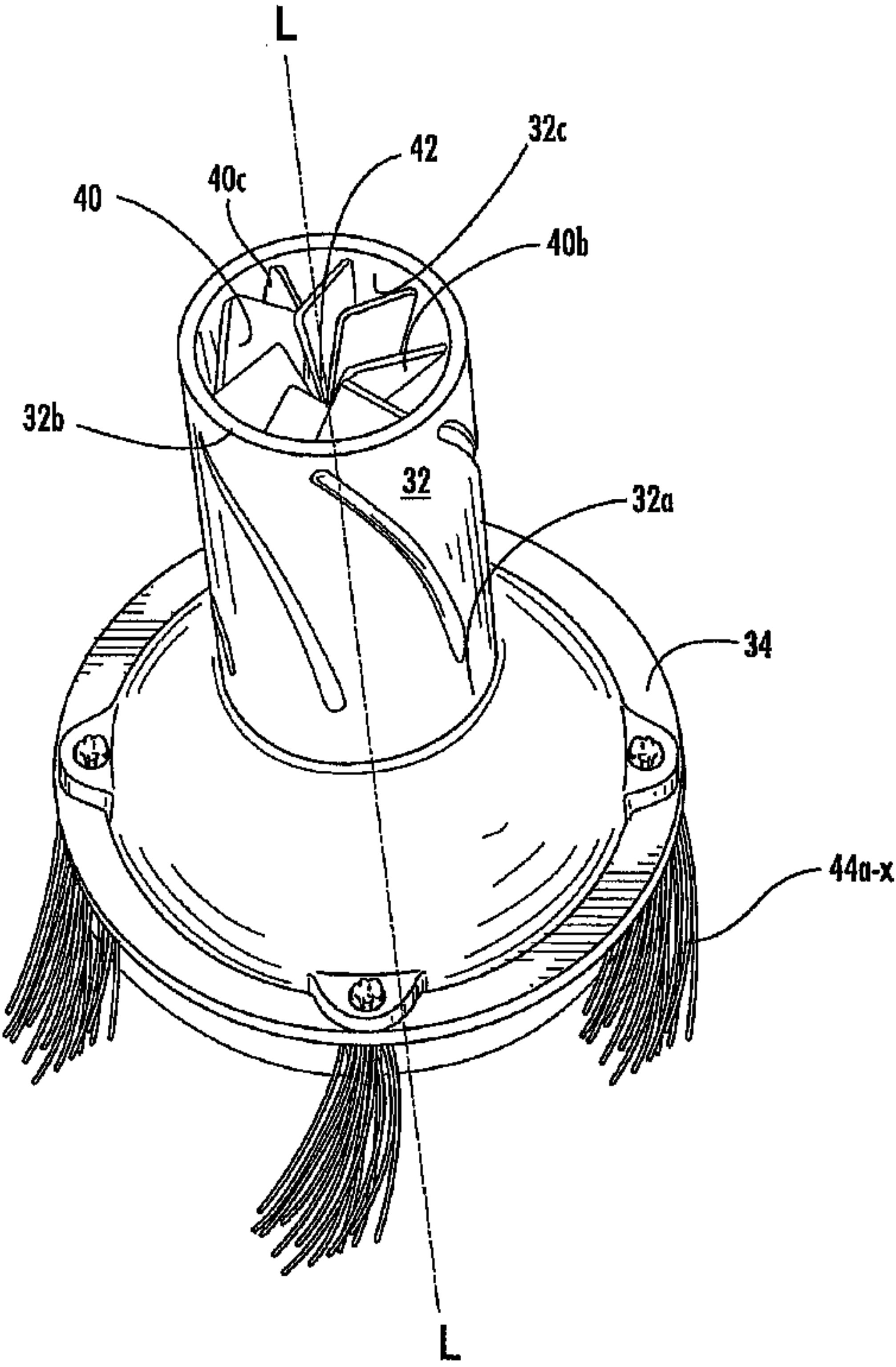


FIG. 7


L
42
32c
40c
40
40b
32b
32
32a
34
44a-x
L