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SURFACE CLEANING APPARATUS

Abstract

A surface cleaning apparatus such as a vacuum cleaner includes a suction source, a recovery container, and a base assembly with at least one agitator within an agitator chamber. The recovery container can be coupled to a separator assembly configured to remove dirt and debris from working fluid through the surface cleaning apparatus. In addition, a user interface can be provided for selective operation of components of the surface cleaning apparatus.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation application of U.S. patent application Ser. No. 17/253,419, filed Dec. 17, 2020, which application is a National Phase application of International Application No. PCT/US2019/039424 filed Jun. 27, 2019, which application claims the benefit of U.S. Provisional Patent Application No. 62/690,371, filed Jun. 27, 2018, all of which are incorporated herein by reference in their entirety.

BACKGROUND
[0002] Surface cleaning apparatuses such as vacuum cleaners are well-known devices for removing dirt and debris from a variety of surfaces such as carpets, hard floors, or other fabric surfaces such as upholstery. Such surface cleaning apparatuses typically include a recovery system including a recovery container, a nozzle adjacent the surface to be cleaned and in fluid communication with the recovery container through a conduit, and a source of suction in fluid communication with the conduit to draw debris-laden air from the surface to be cleaned and through the nozzle and the conduit to the recovery container.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0003] In the drawings:
[0004] FIG. **1** is a schematic view of a surface cleaning apparatus according to various aspects described herein.
[0005] FIG. **2** is a perspective view of the surface cleaning apparatus of FIG. **1** in the form of a hand-held vacuum cleaner including a base assembly and an upright assembly according to various aspects described herein.
[0006] FIG. **3** is a partially-exploded view of the vacuum cleaner of FIG. **2**.
[0007] FIG. **4** is a side sectional view of the vacuum cleaner of FIG. **2** along line IV-IV.
[0008] FIG. **5** is a perspective view of a hand grip of FIG. **2** including a user interface according to various aspects described herein.
[0009] FIG. **6** is a partially-exploded view of the hand grip of FIG. **5** with a user interface in a first configuration.
[0010] FIG. **7** is a sectional view of the hand grip and user interface of FIG. **6**.
[0011] FIG. **8** is a sectional view of a hand-held vacuum cleaner portion of the upright assembly of FIG. **2** along line IV-IV.
[0012] FIG. **9** is a sectional view of a dirt separation and collection module in the hand-held vacuum cleaner portion of FIG. **8** according to various aspects described herein.
[0013] FIGS. **10**A-**10**B illustrates an emptying process for the dirt separation and collection module of FIG. **9**.
[0014] FIG. **11** is a partially-exploded view of a wand of the vacuum cleaner of FIG. **2** according to various aspects described herein.
[0015] FIG. **12** is a sectional view of the wand of FIG. **11** along line XII-XII.
[0016] FIG. **13** is a partially-exploded view of another wand that can be utilized in the vacuum cleaner of FIG. **2** according to various aspects described herein.
[0017] FIG. **14** is a sectional view of the wand of FIG. **13** along line XIV-XIV.
[0018] FIG. **15** is a partially-exploded view of the base assembly of FIG. **2** according to various aspects described herein.
[0019] FIG. **16** is a perspective view of a brushroll that can be utilized in the base assembly of FIG. **2** according to various aspects described herein.

[0020] FIG. **17** is a sectional view of the base assembly of FIG. **2**.
[0021] FIG. **18** is a partially-exploded view of the base assembly of FIG. **2** illustrating an alternate brushroll that can be utilized in the base assembly.
[0022] FIG. **19** is a sectional view of the base assembly of FIG. **2**.
DETAILED DESCRIPTION
[0023] The disclosure relates to a surface cleaning apparatus such as a hand-held surface cleaner that cleans debris from the surface. Such hand-held cleaners can be in the form of a stick vacuum or wand vacuum. The surface cleaning apparatus also includes a hand grip with a user interface for selective operation of components of the surface cleaning apparatus. A base assembly can include an agitator chamber and an aperture. At least one agitator can be slidably received in the agitator chamber through the aperture.
[0024] FIG. **1** is a schematic view of various functional systems of a surface cleaning apparatus in the form of an exemplary vacuum cleaner **10**. The functional systems of the exemplary vacuum cleaner **10** can be arranged into any desired configuration including as a portable cleaner adapted to be hand carried by a user for cleaning relatively small areas. The vacuum cleaner **10** can be adapted to include a hose or other conduit, which can form a portion of the working air conduit between a nozzle and the suction source.
[0025] The vacuum cleaner **10** can include a recovery system **14** for removing debris from the surface to be cleaned and storing the debris. The recovery system **14** can include a suction inlet or suction nozzle **16**, a suction source **18** in fluid communication with the suction nozzle **16** for generating a working air stream, and a recovery container **20** for separating and collecting debris from the working airstream for later disposal.
[0026] The suction nozzle **16** can be provided on a base or cleaning head adapted to move over the surface to be cleaned. An agitator **26** can be provided adjacent to the suction nozzle **16** for agitating the surface to be cleaned so that the debris is more easily ingested into the suction nozzle **16**. Some examples of agitators **26** include, but are not limited to, a horizontally-rotating brushroll, dual horizontally-rotating brushrolls, one or more vertically-rotating brushrolls, or a stationary brush.
[0027] The suction source **18** can be any suitable suction source and is provided in fluid communication with the recovery container **20**. The suction source **18** can be electrically coupled to a power source **22**, such as a battery or by a power cord plugged into a household electrical outlet. A suction power switch **24** between the suction source **18** and the power source **22** can be selectively closed by the user, thereby activating the suction source **18**.
[0028] A separator **21** can be formed in a portion of the recovery container **20** for separating entrained debris from the working airstream.
[0029] The vacuum cleaner **10** shown in FIG. **1** can be used to effectively remove debris from the surface to be cleaned in accordance with the following method. The sequence of steps discussed is for illustrative purposes only and is not meant to limit the method in any way as it is understood that the steps may proceed in a different logical order, additional or intervening steps may be included, or described steps may be divided into multiple steps.
[0030] In operation, the vacuum cleaner **10** is prepared for use by coupling the vacuum cleaner **10** to the power source **22**. During operation of the recovery system **14**, the vacuum cleaner **10** draws in debris-laden working air through the suction nozzle **16** and into the downstream recovery container **20** where the fluid debris is substantially separated from the working air. The airstream then passes through the suction source **18** prior to being exhausted from the vacuum cleaner **10**. The recovery container **20** can be periodically emptied of collected fluid and debris.
[0031] FIG. **2** is a perspective view illustrating a vacuum cleaner **10** according to various aspects described herein. For purposes of description related to the figures, the terms “upper,” “lower,” “right,” “left,” “rear,” “front,” “vertical,” “horizontal,” “inner,” “outer,” and derivatives thereof shall be described from the perspective of a user behind the vacuum cleaner **10**, which defines the rear of the vacuum cleaner **10**. However, it is to be understood that the disclosure may assume

various alternative orientations, except where expressly specified to the contrary.
[0032] In the illustrated example, the vacuum cleaner **10** can include a housing **30** with an upright assembly **32** and a base assembly **34**. The upright assembly **32** can be pivotally connected to the base assembly **34** for directing the base assembly **34** across the surface to be cleaned. It is contemplated that the vacuum cleaner **10** can include any or all of the various systems and components described in FIG. **1**, including a recovery system **14** for separating and storing dirt or debris from the surface to be cleaned. The various systems and components schematically described for FIG. **1** can be supported by either or both the base assembly **34** and the upright assembly **32** of the vacuum cleaner **10**.
[0033] FIG. **3** illustrates a partially-exploded view of the vacuum cleaner **10** of FIG. **2**. The upright assembly **32** includes a hand-held portion **36** supporting components of the recovery system **14**, including, but not limited to, the suction source **18** and the recovery container **20**. By way of non-limiting example, the suction source **18** can includes a motor/fan assembly **124** (FIG. **8**).
[0034] The hand-held portion **36** can be coupled to a wand **40** having at least one wand connector **42**. In the illustrated example, both a first end **44** of the wand **40** and a second end **46** of the wand **40** include a wand connector **42**. The wand connector **42** at the second end **46** of the wand **40** can be coupled to the base assembly **34** via a wand receiver **48**. The wand connector **42** at the first end **44** of the wand **40** can couple to a second wand receiver **50** within the hand-held portion **36**. It is contemplated that the wand connectors **42** can be the same type of connector or can vary. Any suitable type of connector mechanism can be utilized, such as a quick connect mechanism or a tubing coupler in non-limiting examples.
[0035] A pivotal connection between the upright assembly **32** and the base assembly **34** can be provided by at least one pivoting mechanism. In the illustrated example, the pivoting mechanism can include a multi-axis swivel joint assembly **52** configured to pivot the upright assembly **32** from front-to-back and side-to-side with respect to the base assembly **34**. A lower portion **54** of the swivel joint assembly **52** is located between the wand **40** and the base assembly **34**. The lower portion **54** of the swivel joint assembly **52** provides for pivotal forward and backward rotation between the wand **40** and the base assembly **34**. An upper portion **56** of the swivel joint assembly **52** is also located between the wand **40** and the base assembly **34** and provides for lateral or side-to-side rotation between the wand **40** and base assembly **34**. More specifically, the lower portion **54** of the swivel joint assembly **52** is coupled between the base assembly **34** and the upper portion **56** of the swivel joint assembly **52**. The upper portion **56** of the swivel joint assembly **52** is coupled to the wand receiver **48** at the second end **46** of the wand **40**. Wheels **58** can be coupled to the lower portion **54** of the swivel joint assembly **52** or directly to the base assembly **34**, and are adapted to move the base assembly **34** across the surface to be cleaned.
[0036] The hand-held portion **36** can also include the recovery container **20**, illustrated herein as a dirt separation and collection module **60** fluidly coupled to the suction source **18** via an air outlet port **62**. The dirt separation and collection module **60** can be removable from the hand-held portion **36** by a release latch **64** as shown so that it can be emptied of debris.
[0037] An upper end of the hand-held portion **36** can further include a hand grip **66** for maneuvering the vacuum cleaner **10** over a surface to be cleaned and for using the vacuum cleaner **10** in hand-held mode. At least one control mechanism **68** is provided on the hand grip **66** and coupled to the power source **22** (FIG. **1**) for selective operation of components of the vacuum cleaner **10**. In the contemplated example, the at least one control mechanism **68** is an electronic control that can form the suction power switch **24**.
[0038] The agitator **26** of the illustrated embodiment includes a brushroll **70** (FIG. **4**) configured to rotate about a horizontal axis and operatively coupled to a drive shaft of a drive motor via a transmission, which can include one or more belts, gears, shafts, pulleys, or combinations thereof. An example of which will be explained in more detail below. An agitator housing **72** is provided around the suction nozzle **16** and defines an agitator chamber **74** (FIG. **4**) for the brushroll **70** (FIG.

4).
[0039] Referring now to FIG. **4**, a recovery airflow conduit **75** can be formed between the agitator housing **72** and the dirt separation and collection module **60**. For example, a hose conduit **76** in the base assembly **34** can be fluidly coupled to a wand central conduit **78** within the wand **40**. The hose conduit **76** can be flexible to facilitate pivoting movement of the swivel joint assembly **52** about multiple axes. The wand central conduit **78** is fluidly connected to a dirt inlet **80** on the dirt separation and collection module **60** via the air outlet port **62**.
[0040] In the illustrated example, the power source **22** is in the form of a battery pack **82** containing one or more batteries, such as lithium-ion (Li-Ion) batteries. Optionally, the vacuum cleaner **10** can include a power cord (not shown) to connect to a wall outlet. In still another example, the battery pack **82** can include a rechargeable battery pack, such as by connecting to an external source of power to recharge batteries contained therein.
[0041] During operation of the vacuum cleaner **10**, the power source **22** can supply power for the suction source **18**, such as by way of non-limiting example a motor/fan assembly **124** (FIG. **8**) to provide suction through the recovery airflow conduit **75**. Debris-laden working air within the agitator housing **72** can be directed through the flexible hose conduit **76** and wand central conduit **78** before flowing into the dirt separation and collection module **60** by way of the dirt inlet **80** as shown. In addition, the swivel joint assembly **52** can provide for forward/backward and side-to-side pivoting motion of the upright assembly **32** with respect to the base assembly **34** when moving the base assembly **34** across the surface to be cleaned. Additional details of the motor/fan assembly **124** (FIG. **8**) are described in U.S. Pat. No. 10,064,530, issued Sep. 4, 2018, which is incorporated herein by reference in its entirety.
[0042] FIG. **5** illustrates an exemplary hand grip **66** that can be utilized in the vacuum cleaner **10**. The hand grip **66** can include a user interface **84** with at least one status indicator for a component of the vacuum cleaner **10**. The status indicator is illustrated in the form of a suction level indicator **86** and a battery level indicator **88**. While not shown, other status indicators can be provided on the user interface **84**. In non-limiting examples, an LED or text display (not shown) can also indicate that a filter is clogged, that the recovery container **20** needs emptying, or that a brushroll **70** needs cleaning or inspecting.
[0043] The suction level indicator **86** is illustrated as being positioned at lateral edges of the user interface **84** and can illuminate to show a current level of suction power. More specifically, three progressively-illuminated LEDs **90** can be positioned at each lateral edge to indicate a level of suction between “high,” “medium,” and “low” suction powers for the suction level indicator **86**. For example, repeated pressing of a suction mode selector button **92** can cycle through the “high,” “medium,” and “low” suction power levels, and each LED **90** of the suction level indicator **86** can illuminate in sequence accordingly. In the illustrated example, the “medium” suction power level is shown wherein two of the three LEDs **90** are illuminated on the suction level indicator **86** of the user interface **84**. It will be understood that, in the illustrated example, the suction mode selector button **92** is configured to operate the suction source **18** (FIG. **2**) with low, medium, and high suction power, which in turn operates the suction source **18** including the motor/fan assembly **124** (FIG. **8**) at predetermined low, medium and high rotational speeds. Further still, a power button **94** can be positioned adjacent the suction mode selector button **92** or elsewhere on the user interface **84** to selectively power the suction source **18**.
[0044] The battery level indicator **88** is in the form of a series of lights, such as light-emitting diodes (LEDs) **96** that progressively illuminate to show a level of charge of the battery pack **82**. In an alternate example, the battery level indicator **88** can be in the form of a pre-drawn icon displayed on a screen to indicate a level of charge of the battery pack **82**.
[0045] FIG. **6** illustrates an exploded view of the hand grip **66** of FIG. **5**, which more clearly illustrates that the LEDs **90** and **96** can be provided within a substructure of the hand grip **66**. An upper grip **100** with an aperture **102** configured to receive and surround the power button **94** and

suction mode selector button **92**. A lower grip **104** coupled to the upper grip **100** can include a reflective concave portion **106**, such as a white-colored or reflective or mirrored surface. The lower grip **104** can also include a plurality of divider walls **108** to isolate light emitted by the LEDs **90** and **96**. The LEDs **90** (FIG. **7**) and **96** (FIG. **5** for the suction level indicator **86** and the battery level indicator **88**, respectively, can be positioned on a printed circuit board (PCB) **110**. In addition, an isolator **112** can be coupled to the PCB **110** and include a first seat **116***a* for the power button **94** and a second seat **116***b* for the suction mode selector button **92**. The isolator **112** can include openings **118***a*, **118***b* along each lateral edge to permit light for the suction level indicator **86** to be emitted. The isolator **112** can further include additional openings **120** through which the LEDs **96** can shine for the battery level indicator **88**.

[0046] FIG. **7** illustrates the assembled hand grip **66**. As assembled within the hand grip **66**, the PCB **110** defines a lower surface **114***a* and an upper surface **114***b*. The LEDs **90** for the suction level indicator **86** are positioned on the lower surface **114***a* of the PCB **110** and emit light downward, toward the lower grip **104** as illustrated by first arrows **123**. The reflective concave portion **106** of the lower grip **104** reflects the emitted light upward, toward the upper grip **100**. Overmolded portions **122** of the lower grip **104** can block or redirect emitted light from the LEDs **90** to shine upwardly toward the isolator **112**. The openings **118***a*, **118***b* along each lateral edge of the isolator **112** permit the emitted light to shine through at the edges of the upper grip **100**, as indicated via arrow **125**, thereby forming the suction level indicator **86** at each lateral edge of the hand grip **66**. It is further contemplated that the upper grip **100** can include molded or shaped portions to further direct or diffuse the emitted light, such as a translucent portion forming a viewing window for each LCD in the suction level indicator **86**.

[0047] Turning to FIG. **8**, the assembled hand-held portion **36** of the upright assembly **32** is shown including a portion of the wand **40**, the battery pack **82**, the hand grip **66**, the motor/fan assembly **124**, and the dirt separation and collection module **60**.

[0048] As illustrated, a wand axis **126** can be defined through the center of the wand **40** (FIG. **4**) and wand connector **42**. In FIG. **8** the wand **40** is held upright, and thus the wand axis **126** is vertical. In this example, references to “a vertical axis” will be understood to also refer to the wand axis **126**. It will be understood, that during use the wand **40** may be oriented in any suitable manner including angled with respect to the vertical axis.

[0049] A collector axis **128** can be defined through the center of the dirt separation and collection module **60**, and a motor axis **130** can be defined through the center of the motor/fan assembly **124**. It is contemplated that the wand axis **126**, the collector axis **128**, and the motor axis **130** can all be parallel to one another as shown. Put another way, when the wand **40** is held upright such that the wand axis **126** is vertical, the collector axis **128** and the motor axis **130** are also vertical.

[0050] A grip axis **132** can be defined through the center of the hand grip **66** as shown. The grip axis **132** forms a grip angle **134** with respect to a vertical direction, such as 60 degrees in a non-limiting example. Further, a battery axis **136** can be defined through the center of the battery pack **82** and intersect the grip axis **132**. The battery axis **136** can also define a battery angle **138** with respect to a vertical direction, such as 30 degrees in a non-limiting example. Optionally, the grip axis **132** can be orthogonal to the battery axis **136**.

[0051] FIG. **9** illustrates additional details of the dirt separation and collection module **60**. The dirt separation and collection module **60** can include a dirt cup in the form of recovery container **20** with an inlet port in the form of the dirt inlet **80**, and a separator assembly **140** coupled to the recovery container **20**. Working air can enter through the dirt inlet **80** and swirls around a first stage separator assembly chamber **144** for centrifugally separating debris from the working air flow. The separator assembly **140** includes a first stage separator **142**, such as a grill, that, in combination with the swirling working air, removes relatively large debris out of the working air which collects at a lower portion of the recovery container **20** defining a first stage collection area **146**.

[0052] The working air moves through an inlet to a second stage separator **148** in the separator

assembly **140**, such as a grill or a mesh configured to filter smaller debris, and enters a second stage separation chamber **150**, which is shown as a cyclonic separator herein. Smaller debris removed from the working air collects in a second stage collector **152** near the bottom of the recovery container **20**. The first stage collector **146** can surround the second stage collector **152** as shown.
[0053] An exhaust outlet **154** and filter housing **158** are fluidly coupled to an upper portion of the second stage separation chamber **150**. With additional reference to FIG. **8**, working air exits the second stage separation chamber **150** through the exhaust outlet **154** and at least one filter in the filter housing **158** and which is shown herein as a pre-motor filter **156** of the motor/fan assembly **124**. The filtered working air flows into the motor/fan assembly **124** whereupon it can be exhausted into the surrounding atmosphere through an exhaust filter, i.e. a post-motor filter **155**, and an air outlet of the working air pathway through the vacuum cleaner **10**, which is shown herein as formed by an exhaust grill **153**.
[0054] The outer surface of the first stage separator **142** can accumulate debris, such as hair, lint, or the like that may become stuck thereon and may not fall into the first stage collection area **146**. FIG. **10**A shows the separator assembly **140** being removed and FIG. **10**B shows the separator assembly **140** fully removed from the recovery container **20** to empty collected dirt and debris from the first and second stage collection areas **146** and **152**.
[0055] The separator assembly **140** can further include a ring **161** slidably coupled to the recovery container **20**. The ring **161** can be coupled to a wiper **160**, such as an annular wiper, configured to contact the first stage separator **142**. The separator assembly **140** can be lifted upwards with respect to the ring **161** and recovery container **20**. During this lifting, the ring **161** temporarily remains coupled to the recovery container **20**, either by friction fit or a mechanical coupling such as bayonet hook, for example, and the wiper **160** slides or scrapes along the first stage separator **142** to remove accumulated debris from the outer surface of the first stage separator **142** or grill, which falls down to the first stage collection area **146**.
[0056] When the separator assembly **140** has been raised to a predetermined level, it can lift away from the recovery container **20** along with the ring **161** and wiper **160**. The recovery container **20** can then be inverted to remove dirt and debris from the first and second stage collection areas **146** and **152**. After emptying, the separator assembly **140** can be repositioned within the recovery container **20** and the ring **161** can once again be coupled to the recovery container **20** for additional use of the vacuum cleaner **10**.
[0057] FIG. **11** shows additional details of an exemplary wand assembly, which can include a wand body **162** enclosing the wand central conduit **78**. In one example, the wand body **162** can be formed from an extrusion of aluminum, and is illustrated as having an exterior rounded triangular geometric profile defining an outer periphery **168** (FIG. **12**). Wand connectors **42** can couple to the wand body **162** at each end **44** and **46**. A first wand connector **42** can couple the wand body **162** to the base assembly **34** and a second wand connector **42** can couple the wand body **162** to the hand-held portion **36** (FIG. **3**).
[0058] A decorative insert **166** can be coupled to at least a portion of the wand body **162**. In the illustrated example, the decorative insert **166** can be in the form of a flat plate and configured to couple to a recessed portion defining a face **164** of the triangular shaped wand body **162**. Optionally, the decorative insert **166** can included rounded edges to form smooth surface transitions between an outer surface of the decorative insert and a second face of the wand body. It is contemplated that the decorative insert **166** can be formed of plastic, including transparent or translucent plastic. Optionally, the decorative insert **166** can include logos or other markings or indicators for operations of the vacuum cleaner **10**, or locating features so as to couple a correct end of the wand body **162** to one of the base assembly **34** or hand-held portion **36** of the upright assembly **32**, for example.
[0059] FIG. **12** illustrates a sectional view of the wand **40**. It is contemplated that the wand body **162** can include an outer wall defining the outer periphery **168** with at least one inner partition **170**

defining the wand central conduit **78**. The outer wall defining the outer periphery **168** is further illustrated as including a hook **172** defining a corresponding recess **174** on either side of the face **164**. Protrusions **176** on either side of the decorative insert **166** can be received within the recesses **174**. It is contemplated that the protrusions **176**, or the entire decorative insert **166**, can have material flexibility such that the protrusions **176** can be "snap-fit" into the recesses **174** of the wand body **162**. In another non-limiting example, the protrusions **176** can be made of a material having higher elasticity than that of a remainder of the decorative insert **166**, such as a plastic decorative insert having rubber hooked portions configured to snap-fit or snugly insert into the recesses **174** of the wand body **162**.

[0060] FIG. **13** illustrates another embodiment of a wand assembly that can be utilized in the vacuum cleaner **10**. In the illustrated example, the wand body **162***a* can have a generally V-shaped geometric profile with an open face **163** on one side, such as by forming a V-shaped extrusion of aluminum. A tubular member **165** can be coupled within the wand body **162***a*. The tubular member **165** can have an inner surface defining the wand central conduit **78***a*, and an outer surface shaped to form a smooth surface transition between the tubular member **165** and the wand body **162***a*.

[0061] FIG. **14** illustrates a sectional view with the tubular member **165***a* assembled within the wand body **162***a*. The wand body **162***a* can have an outer wall **168***a* with at least one projection **176***a*. The tubular member **165***a* can have a corresponding at least one recess **172***c* formed by spaced walls **172***a* and **172***b*. The at least one recess **172***c* is configured to surround the at least one projection **176***a* to securely fix the tubular member **165***a* in place. In one example, the at least one projection **176***a* can be formed from an elastic material to provide "snap-fit" coupling between the tubular member **165***a* and wand body **162***a*. In another example, the wand body **162***a* can have sufficient elasticity such that the tubular member **165***a* can be press-fit into the wand body **162***a*, and the at least one projection **176***a* can "snap" into place within the corresponding at least one recess **172***c*.

[0062] The tubular member **165***a* can be formed from a transparent material such as extruded thermoplastic or polycarbonate material. In such a case, the assembled wand would include a transparent face defined by the exposed face of the tubular member **165***a* when assembled within the wand body **162***a*. In this configuration, a transparent tubular member would provide visibility within the wand central conduit **78***a*, such that dirt and debris moving through the conduit would be visible to a user during operation of the vacuum cleaner **10**. Additionally, potential obstructions or clogs within the tubular member could also be viewed in a facile manner through the transparent tubular member. A transparent section **167** has been illustrated in the tubular member **165***a* by way of non-limiting example.

[0063] FIG. **15** illustrates one embodiment of a base assembly **34**. The base assembly **34** can extend between a first side **180** and a second side **182** and a cover **184** can at least partially define the agitator chamber **74** therebetween. An aperture **186** is located in a portion of the second side **182** and allows for insertion and removal of the brushroll **70**. A front bar **188** extends between the first side **180** and the second side **182** along a lower portion of the base assembly. The front bar **188** is configured to be located behind the cover **184** when the cover **184** is mounted. A headlight array **190** is illustrated as being located on the front bar **188** and extending along the width of the base assembly between the first side **180** and the second side **182**. The headlight array **190** can be any suitable illumination assembly including an LED headlight array. Even though the headlight array **190** is positioned under the cover **184** it can be considered to be positioned along an outer portion of the base assembly **34**. In one example, the cover **184** can include a transparent portion such that when installed, the transparent portion covers and protects the headlight array **190** and permits emitted light to shine through to the surface to be cleaned. In another example, the cover **184** can leave the headlight array **190** uncovered so as not to block emitted light from the headlight array **190**.

[0064] A brushroll **70** can be positioned within the agitator chamber **74** by sliding a first end

through the aperture **186** located at the second side **182** of the base assembly **34**. When fully inserted, a second end **70***b* of the brushroll **70** can be flush with the aperture **186**. In addition, the hose conduit **76** can fluidly couple the agitator chamber **74** to the wand central conduit **78** (FIG. **4**).
[0065] The base assembly **34** can include a brush drive assembly **192** positioned opposite the aperture **186** and configured to drive rotational motion of the agitator **26** (e.g. brushroll **70**) within the agitator chamber **74**. The brush drive assembly **192** can have components including, but not limited to, a brush motor **226**, a belt **228** within a belt housing **229**, and a brush drive gear **220**.
[0066] Additional details of the brushroll **70** are shown in FIG. **16**. The first end of the brushroll **70** can include an end plate **194** having projections **196**, such as teeth, configured to engage a portion of the brush drive assembly **192** (FIG. **15**). The brushroll **70** further includes a central shaft **222** coupled to brush bearings **224** (FIG. **17**) at each end. In the illustrated example, the brushroll **70** includes a bristled brushroll **70** with offset, swept tufts **202** extending along an outer surface of the brushroll **70**. The bristle tufts **202** can be positioned offset from a center line **204** of a tufting platform **206**, and the tufts **202** can also be non-orthogonal to the tufting platform **206**. In this manner, the bristled brushroll **70** can be configured to prevent hair from wrapping around the brushroll **70** during operation. Additional details of a similar brushroll are described in U.S. Publication No. 2018-0125315, which is incorporated herein by reference in its entirety.
[0067] The assembled base assembly **34** is shown in FIG. **17**, where the projections **196** of the end plate are coupled with the brush drive gear **220**. In this manner the brush drive gear **220** is also coupled to the shaft **222** by way of a drive gear bearing **229**. With additional reference to FIG. **15**, as the brush motor **226** drives rotation of the belt **228** and brush drive gear **220**, the brushroll **70** can be rotated at a variety of speeds depending on the selected suction mode (FIG. **5**). A brush removal endcap **230** at the second end of the brushroll **70** provides for unlocking or removal of the brushroll **70** from the agitator chamber **74**, such as for cleaning of the bristle tufts **202**.
[0068] It is contemplated that a variety of agitators **26** and brushrolls **70** can be utilized within the agitator chamber **74**. FIG. **18** illustrates a microfiber brushroll **210** that can be utilized. The microfiber brushroll **210** is similar to the bristled brushroll **70**; one difference is the outer surface includes a microfiber layer instead of bristles. Whereas bristles can be utilized to lift hair and debris from carpet fibers, the microfiber layer can lift dirt and debris from hard surfaces such as wood or tile. Each of the brushrolls can include a brush removal endcap **198** including fasteners **212**. In the illustrated example, the fasteners **212** include bayonet fasteners wherein a given brushroll is inserted through the aperture **186** and rotated, for example by 30 degrees, to lock the brushroll into place within the agitator chamber **74** (FIG. **19**) via corresponding fastener receivers **214**. It will be understood that other brushroll types not explicitly described can be utilized in the vacuum cleaner **10**.
[0069] FIG. **19** illustrates the base assembly **34** sitting on a surface to be cleaned, the surface to be cleaned defining a first plane **230**. As illustrated in cross-sectional view a center line of the headlight array **190** can be defined as a second plane **232**. The second plane **232** is spaced above the first plane defined by the surface to be cleaned by a height **234**. It has been determined that providing the headlight array **190** close to the first plane **230** and relatively low on the base assembly **34** provides unexpected benefits. The height can be any suitable small height that provides such benefits including, by way of non-limiting examples, spaced above the surface to be cleaned at not more than 30 mm, at less than 20 mm, and at 15.8 mm. Further still, by way of non-limiting example, the illuminance measurements as a delta from ambient values at 2 meters from the headlight array **190** can be 16 Lux and at 10 cm can be greater than 1000 Lux. In another example, the headlight array **190** can be aligned with the lower front edge of the front bar **188**.
[0070] More specifically, during operation of the vacuum cleaner **10** when the headlight array **190** provides illumination it has been determined that the placement of the headlight array **190** in this very low position across the front of the base assembly **34** illuminates the surface to be cleaned very well, including that dust and/or debris are illuminated exceptionally well. It has been

determined that performance is noticeably better as compared to when LEDs are mounted higher up and pointing downwardly at the surface to be cleaned. Because of the low position of the headlight array **190** and because the headlight array **190** faces forward and projects illumination at substantially a horizontal projection along the second plane **232** shadows are cast by debris on the surface to be cleaned and these shadows are very obvious to a user of the vacuum cleaner **10**. It will be understood that the beam provided by the headlight array **190** can be projected with a zero-degree angle that provides a beam that is parallel to the surface to be cleaned as defined by the first plane **230**.

[0071] To the extent not already described, the different features and structures of the various embodiments of the present disclosure may be used in combination with each other as desired. Thus, the various features of the different embodiments may be mixed and matched as desired to form new embodiments, whether or not the new embodiments are expressly described.

[0072] For example, various characteristics, aspects, and advantages of the present invention may also be embodied in the following technical solutions defined by the following clauses and may include any combination of the following concepts:

[0073] A vacuum cleaner, comprising a base assembly including a suction nozzle and adapted for movement along a surface to be cleaned; a hand-held portion having a handle grip and a suction source in fluid communication with the suction nozzle and configured for generating a working airstream; a working air path from the suction nozzle to an air outlet in the hand-held portion and including the suction source; and a headlight array located along a forward oriented portion of the base assembly, providing a beam that is substantially parallel to the surface to be cleaned and spaced above the surface to be cleaned at not more than 30 mm.

[0074] The vacuum cleaner of any previous clause wherein the headlight array includes a plurality of LEDs spaced along a width of the base assembly.

[0075] The vacuum cleaner of any previous clause wherein the plurality of LEDs have a centerline that is less than 20 mm above a plane defined by the surface to be cleaned.

[0076] The vacuum cleaner of any previous clause wherein the plurality of LEDs provide an illuminance measurement as a delta from ambient values of at least 16 Lux at 2 meters and greater than 1000 Lux at 10 cm.

[0077] The vacuum cleaner of any permutation of any of the previous clauses wherein the beam is at a zero-degree beam angle.

[0078] The vacuum cleaner of any permutation of any of the previous clauses wherein the working air path is at least partially defined by a wand operably coupled between the base assembly and the hand-held portion.

[0079] The vacuum cleaner of any of the previous clauses wherein the wand comprises an outer periphery having a triangular profile.

[0080] The vacuum cleaner of any of the previous clauses wherein the wand includes a decorative insert operably coupled to a recess within a wand body and the decorative insert and the wand body together form the outer periphery or wherein the wand includes a tubular insert operably coupled within a recess of a wand body and the tubular insert and the wand body together form the outer periphery.

[0081] The vacuum cleaner of any of the previous clauses further comprising a swivel joint moveably coupling a lower end of the wand to the base assembly.

[0082] The vacuum cleaner of any of the previous clauses wherein the hand-held portion further comprises a debris removal assembly including a recovery container provided in fluid communication with the suction source.

[0083] The vacuum cleaner of any of the previous clauses wherein the suction source includes a motor/fan assembly operably coupled to the debris removal assembly to form a single, hand-carriable unit.

[0084] The vacuum cleaner of any of the previous clauses wherein the hand grip extends away

from at least one of the motor/fan assembly or the recovery container to define a handle opening and where the handle grip is adapted to be gripped by a user.
[0085] The vacuum cleaner of any of the previous clauses further comprising a pre-motor filter assembly mounted to the hand-held portion and defining a portion of the working air path, the pre-motor filter assembly comprising at least one pre-motor filter received within a filter chamber at an upper end of the recovery container.
[0086] The vacuum cleaner of any of the previous clauses wherein the debris removal assembly comprises a cyclonic separator chamber for separating contaminants from the working air path and a collection chamber for receiving contaminants separated in the separator chamber, the collection chamber defined at least in part by the recovery container.
[0087] The vacuum cleaner of any of the previous clauses wherein the debris removal assembly further comprises a second downstream cyclonic separator chamber and a second collection chamber for receiving contaminants separated in the second separator chamber.
[0088] The vacuum cleaner of any of the previous clauses wherein the second downstream cyclonic separator chamber is located concentrically within the cyclonic separator chamber.
[0089] The vacuum cleaner of any of the previous clauses wherein an inner housing is selectively receivable within the recovery container and the inner housing defines the second downstream cyclonic separator chamber and the second collection chamber.
[0090] The vacuum cleaner of any of the previous clauses, further comprising an annular wiper configured to slidably contact a portion of the inner housing.
[0091] The vacuum cleaner of any permutation of the previous clauses wherein the base assembly further comprises an agitator chamber at the suction nozzle and a removable brushroll selectively located therein.
[0092] A vacuum cleaner, comprising a base assembly including a suction nozzle and adapted for movement along a surface to be cleaned; a hand-held portion having a handle grip, a recovery container with a collector axis defined through a center thereof, and a suction source in fluid communication with the suction nozzle and the recovery container and configured for generating a working airstream; and a wand operably coupled between the base assembly and the hand-held portion and defining at least a portion of a working air path extending from the suction nozzle to an air outlet in the hand-held portion and including the suction source and wherein a wand axis is defined through a center of the wand and wherein the wand axis and the collector axis are parallel.
[0093] The vacuum cleaner of any of the previous clauses wherein the suction source includes a motor/fan assembly operably coupled to the recovery container to form a single, hand-carriable unit and the motor/fan assembly defines a motor axis that is parallel to the wand axis and the collector axis.
[0094] The vacuum cleaner of any permutation of any of the previous clauses wherein a grip axis is defined through a center of the handle grip and forms an acute angle with respect to the collector axis.
[0095] The vacuum cleaner of any of the previous clauses, further comprising a battery pack located on the hand-held portion and wherein a battery axis is defined through the center of the battery pack and intersects the grip axis at an orthogonal angle.
[0096] While aspects of the present disclosure have been specifically described in connection with certain specific embodiments thereof, it is to be understood that this is by way of illustration and not of limitation. Reasonable variation and modification are possible within the scope of the forgoing disclosure and drawings without departing from the spirit of the present disclosure which is defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

Claims

1. A surface cleaning apparatus, comprising: a base assembly including a suction nozzle and adapted for movement along a surface to be cleaned; a hand-held portion having, a recovery container with a collector axis defined through a center thereof, a suction source in fluid communication with the suction nozzle and the recovery container and configured for generating a working airstream, a hand grip assembly, and a battery pack located adjacent to the hand grip assembly, and wherein the hand grip assembly comprises: a grip body including an upper grip defining an upper surface; and a user interface provided at the upper surface, the user interface having at least one status indicator configured to display a status for at least one component of the surface cleaning apparatus; and a wand operably coupled between the base assembly and the hand-held portion and defining at least a portion of a working air path extending from the suction nozzle to an air outlet in the hand-held portion and including the suction source and wherein a wand axis is defined through a center of the wand and wherein the wand axis and the collector axis are parallel.
2. The surface cleaning apparatus of claim 1, wherein the grip body defines a stem forming the upper surface and an arm and wherein the stem and the arm are connected by a shoulder.
3. The surface cleaning apparatus of claim 2 wherein the arm defines a grip axis and the grip axis forming a grip angle with respect to the stem.
4. The surface cleaning apparatus of claim 3, wherein the grip axis forms an acute angle with respect to the collector axis.
5. The surface cleaning apparatus of claim 4, wherein a battery axis is defined through the center of the battery pack and intersects the grip axis at an orthogonal angle.
6. The surface cleaning apparatus of claim 2, wherein the grip body further comprises a lower grip and wherein the upper grip and the lower grip couple to form the grip body.
7. The surface cleaning apparatus of claim 6, wherein the user interface further comprises a printed circuit board provided between the lower grip and the upper grip, wherein an LED is located on a surface of the printed circuit board and wherein when assembled the surface of the printed circuit board is positioned in a direction away from the at least one status indicator.
8. The surface cleaning apparatus of claim 2, wherein an aperture is located within the upper grip and forms an orifice in the upper surface.
9. The surface cleaning apparatus of claim 8, wherein the user interface further comprises a power button at least partially located within the aperture.
10. The surface cleaning apparatus of claim 9, wherein the at least one status indicator is separate from the power button.
11. The surface cleaning apparatus of claim 10, wherein the at least one status indicator indicates suction level, battery level, filter clogging, or an indication to clean or inspect said component.
12. The surface cleaning apparatus of claim 1, wherein the grip body extends away from at least one of the suction source or the recovery container to define a handle opening.
13. The surface cleaning apparatus of claim 1, wherein the suction source includes a motor/fan assembly operably coupled to the recovery container to form a single, hand-carriable unit and the motor/fan assembly defines a motor axis that is parallel to the wand axis and the collector axis.
14. The surface cleaning apparatus of claim 1, further comprising a headlight array located along a forward oriented portion of the base assembly, providing a beam that is substantially parallel to the surface to be cleaned and spaced above the surface to be cleaned at not more than 30 mm.
15. The surface cleaning apparatus of claim 1, further comprising a swivel joint moveably coupling a lower end of the wand to the base assembly.
16. The surface cleaning apparatus of claim 1, wherein the hand-held portion further comprises a pre-motor filter assembly defining a portion of the working air path, the pre-motor filter assembly comprising at least one pre-motor filter received within a filter chamber at an upper end of the

recovery container.

17. The surface cleaning apparatus of claim 16, wherein the hand-held portion further comprises a debris removal assembly, the debris removal assembly comprising a cyclonic separator chamber for separating contaminants from the working air path and a collection chamber for receiving contaminants separated in the separator chamber, the collection chamber defined at least in part by the recovery container.

18. The surface cleaning apparatus of claim 17, wherein the debris removal assembly further comprises a second cyclonic separator chamber that is downstream from the collection chamber and a second collection chamber for receiving contaminants separated in the second cyclonic separator chamber.

19. The surface cleaning apparatus of claim 1, wherein the at least one status indicator is separate from a power button and wherein the at least one status indicator includes multiple status indicators.

20. The surface cleaning apparatus of claim 19, wherein the multiple status indicators include at least three chosen from a group of: suction level, battery level, filter clogging, clean said component, and inspect said component.