

(19)



(11)

**EP 4 740 810 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:

**13.05.2026 Bulletin 2026/20**

(51) International Patent Classification (IPC):

**A47L 5/30** (2006.01)**A47L 9/00** (2006.01)**A47L 9/04** (2006.01)(21) Application number: **25213502.5**

(52) Cooperative Patent Classification (CPC):

**A47L 9/0477; A47L 5/30; A47L 9/009**(22) Date of filing: **04.11.2025**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL  
NO PL PT RO RS SE SI SK SM TR**

Designated Extension States:

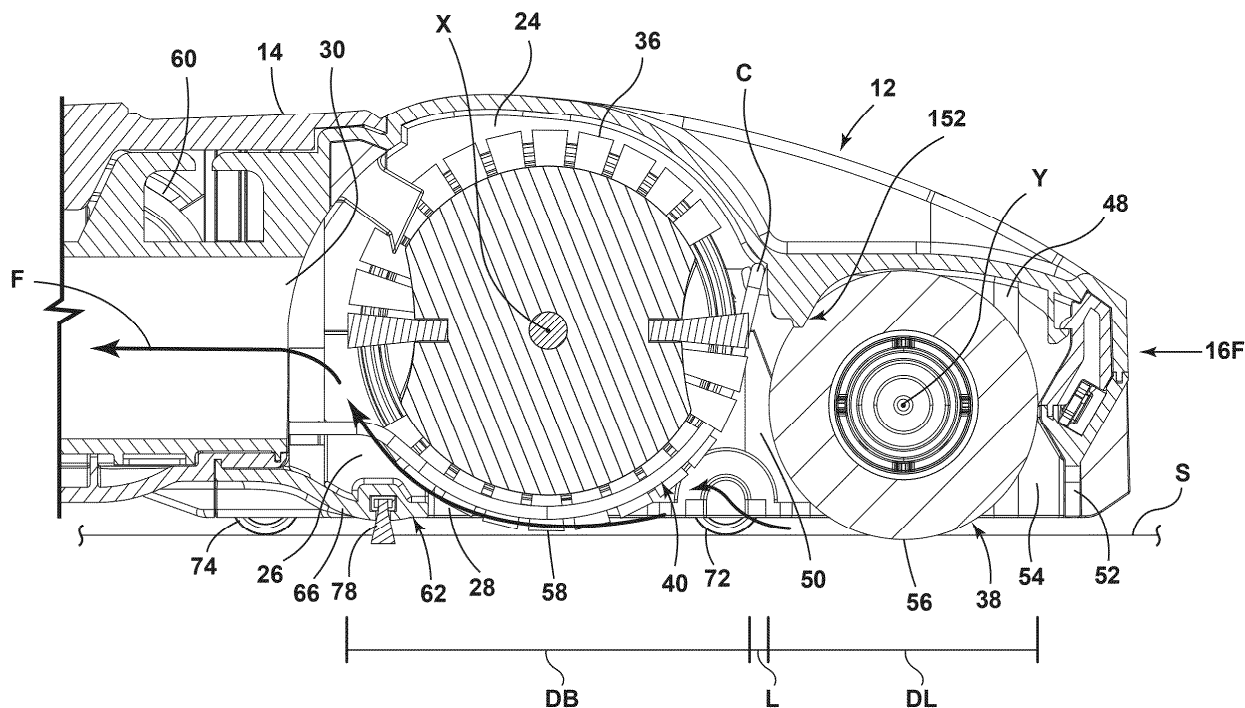
**BA**

Designated Validation States:

**GE KH LA MA MD TN**(71) Applicant: **Bissell Inc.****Grand Rapids, MI 49544 (US)**(72) Inventor: **BROUWERS, Andrew James****Grand Rapids (US)**(74) Representative: **Sandersons****D2 Knowledge Gateway****Nesfield Road****Colchester, Essex CO4 3ZL (GB)**(30) Priority: **07.11.2024 US 202463717326 P****03.10.2025 US 202519348983**(54) **VACUUM CLEANER WITH DUAL ROTATING AGITATORS AND CORD GUARD**

(57) A vacuum cleaner (10) includes a first agitator (36), a second agitator (38), a suction conduit (26), and a cord guard (40) that prevents large objects from being drawn into the suction conduit (26). The housing (14) can

have a removable sole plate (62). Methods for user disassembly of a vacuum cleaner (10) with dual agitators (36, 38) are also provided.

**FIG. 4****EP 4 740 810 A1**

## Description

### BACKGROUND

**[0001]** Vacuum cleaners generally include a suction conduit with an opening on the underside of a surface cleaning base for drawing air and debris into and through the cleaning base. A goal with vacuum cleaner design is to effectively loosen debris and capture the debris in the flow of air into the suction conduit. Vacuum cleaners generally use an agitator to aid in this goal. An agitator is often used in the suction conduit of a cleaning base proximate a suction inlet to cause agitated debris to flow into the suction conduit. If the agitator is unable to loosen the debris or if the debris is too small, the suction conduit may pass over the debris without removing the debris from the surface. In other cases, the surface cleaning head may push or plow larger debris forward without ever allowing the debris to be captured in the flow into the suction conduit. To combat these issues, some vacuum cleaners have dual agitators, with a front or leading agitator configured to prevent plowing of larger debris without scattering smaller debris and a rear or trailing agitator located in the suction conduit.

**[0002]** One of the challenges with dual agitator vacuum cleaners is accommodating two agitators within the cleaning base. The engagement of the suction conduit with a surface being cleaned is important to provide the desired amount of suction, but if the opening to suction conduit is too large, large objects (e.g., the power cord of the vacuum cleaner) may be drawn into the suction conduit. The vacuum cleaner may be damaged as a result. Cord guards have been proposed as one solution, but it remains challenging to implement a cord guard on a dual agitator vacuum cleaner.

### BRIEF SUMMARY

**[0003]** A vacuum cleaner with dual agitators and a cord guard is provided herein.

**[0004]** According to one aspect of the invention, a vacuum cleaner includes a housing defining an agitator chamber and a suction conduit with a suction conduit opening on an underside of the housing, a first agitator rotatably mounted to the housing within the agitator chamber with at least a portion of the first agitator extending through the suction conduit opening, the first agitator rotatable about a first agitator axis, a second agitator mounted to the housing in front of the first agitator and rotatable about a second agitator axis, a sole plate removably attached on an underside of the housing, and a cord guard hinged to the housing, wherein the cord guard is pivotally attached to the housing, wherein the cord guard is pivotable between a working position in which at least one crosspiece of the cord guard traverses the suction conduit opening and an open position in which the first agitator can be removed from the housing, and wherein an axis of rotation of the cord guard is intermedi-

ate the first agitator axis and the second agitator axis.

**[0005]** In this and other aspects of the invention, the cord guard is clamped between the housing and the sole plate to hold the cord guard in the working position.

**[0006]** In this and other aspects of the invention, the cord guard is formed at least partially of plastic coated rigid metal wire.

**[0007]** In this and other aspects of the invention, the cord guard axis is spaced farther from the surface to be cleaned than the axis of either agitator.

**[0008]** In this and other aspects of the invention, a hinge bracket on the housing pivotally connects the cord guard to the housing, and the hinge bracket is intermediate the first agitator and the second agitator.

**[0009]** In this and other aspects of the invention, the housing includes an agitator comb configured to remove debris from the second agitator, and the cord guard is pivotally attached to the agitator comb.

**[0010]** According to yet another aspect of the invention, a vacuum cleaner includes a housing defining an agitator chamber and a suction conduit with a suction conduit opening on an underside of the housing, a first agitator rotatably mounted to the housing within the agitator chamber with at least a portion of the first agitator extending through the suction conduit opening, the first agitator rotatable about a first agitator axis, a second agitator mounted to the housing in front of the first agitator and rotatable about a second agitator axis, and a sole plate removably attached on an underside of the housing. The sole plate includes a frame comprising at least a rear frame wall behind the first agitator axis, a bridge intermediate the first agitator axis and the second agitator axis, and a cord guard traversing the suction conduit opening to block the suction conduit, the cord guard comprising a plurality of crosspieces extending from the rear frame wall to the bridge to traverse the suction conduit opening, wherein removal of the sole plate from the underside of the housing simultaneously removes the cord guard from blocking the suction conduit.

**[0011]** In this and other aspects of the invention, the rear frame wall comprises a leading edge that defines a rear peripheral edge of the suction conduit opening, and the plurality of crosspieces are attached to the rear peripheral edge.

**[0012]** In this and other aspects of the invention, the bridge traverses the frame from a first side to a second side.

**[0013]** In this and other aspects of the invention, the bridge is spaced farther from the surface to be cleaned than the axis of either agitator.

**[0014]** In this and other aspects of the invention, the sole plate includes an agitator comb configured to remove debris from the second agitator. Optionally, the agitator comb is supported by the bridge.

**[0015]** According to still another aspect of the invention, a method for user disassembly of a vacuum cleaner with dual agitators is provided herein.

**[0016]** These and other features and advantages of the

present invention will become apparent from the following description of particular embodiments, when viewed in accordance with the accompanying drawings and appended claims.

[0017] Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited to the details of operation or to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention may be implemented in various other embodiments and of being practiced or being carried out in alternative ways not expressly disclosed herein. In addition, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof. Further, enumeration may be used in the description of various embodiments. Unless otherwise expressly stated, the use of enumeration should not be construed as limiting the invention to any specific order or number of components. Nor should the use of enumeration be construed as excluding from the scope of the invention any additional steps or components that might be combined with or into the enumerated steps or components. Any reference to claim elements as "at least one of X, Y and Z" is meant to include any one of X, Y or Z individually, and any combination of X, Y and Z, for example, X, Y, Z; X, Y, X, Z; and Y, Z.

#### DESCRIPTION OF THE DRAWINGS

##### [0018]

FIG. 1 is a side view of a vacuum cleaner including a cleaning base with dual agitators and a cord guard according to one aspect of the invention;  
 FIG. 2 is a bottom perspective view of the cleaning base of FIG. 1;  
 FIG. 3 is a front perspective view of the vacuum cleaner of FIG. 1;  
 FIG. 4 is a cross-sectional view of a portion of the cleaning base taken through line IV-IV of FIG. 3;  
 FIG. 5 is a bottom perspective, partially exploded view of the cleaning base of FIG. 1 showing a sole plate and a roller disassembled from the cleaning base;  
 FIG. 6 is an enlarged bottom perspective view of a portion of the cleaning base of FIG. 1 illustrating the cord guard and a brushroll of the cleaning base, where the sole plate and roller are removed for clarity;  
 FIG. 7 is a cross-sectional view of a portion of the cleaning base taken through line VII-VII of FIG. 3;  
 FIG. 8 is a perspective sectional view of a portion of the cleaning base taken through line VIII-VIII of FIG. 3;

FIG. 9 is a front perspective view of the sole plate;  
 FIG. 10 is a bottom perspective view of the cleaning base of FIG. 1, illustrating the removal of the roller from the cleaning base;

FIG. 11 is a bottom perspective view of the cleaning base of FIG. 1, illustrating the removal of the sole plate from the cleaning base;

FIG. 12 is a bottom perspective view of a front portion of the cleaning base of FIG. 1, illustrating the movement of the cord guard to the open position;

FIG. 13 is a bottom perspective view similar to FIG. 12, illustrating the removal of the brushroll from the cleaning base;

FIG. 14 is a cross-sectional view of a portion of a cleaning base with dual agitators and a cord guard integrated with a sole plate according to another aspect of the invention;

FIG. 15 is a bottom perspective view of the sole plate of FIG. 14; and

FIG. 16 is an enlarged view of a portion of FIG. 14, showing a comb integrated with the sole plate.

#### BRIEF DESCRIPTION

[0019] The invention generally relates to a vacuum cleaner with a cord guard. The cord guard is configured to prevent large objects (e.g., the power cord of the vacuum cleaner) from being drawn into the suction conduit and prevents damage to the vacuum cleaner as a result. Aspects of the invention described herein are further related to a vacuum cleaner with dual agitators and a cord guard. Aspects of the invention described herein are further related to a cleaning base with dual agitators and a cord guard.

[0020] As used herein, a "cleaning base" refers to a device configured to contact a surface for cleaning the surface by use of suction air flow, agitation, or a combination thereof. A cleaning base may be coupled with an upright body, wand, or handle for directing the base across the surface to be cleaned, and may be pivotably or steeringly coupled by a swivel connection to an upright body, wand, or handle. A cleaning base may also be operable without an upright body, wand, or handle.

[0021] As used herein, "seal" or "sealing" refers to preventing a substantial amount of air from passing through to the suction conduit but does not require an airtight seal.

[0022] As used herein, "agitator" refers to any element, member or structure capable of agitating a surface to facilitate movement of debris into a suction air flow in a surface cleaning base.

[0023] As used herein, "soft" and "softer" refer to the characteristics of a cleaning element being more compliant or pliable than another cleaning element.

[0024] As used herein, the term "flow path" refers to the path taken by air as it flows into a suction conduit when drawn in by suction.

[0025] As used herein, the terms "above" and "below"

and derivatives thereof are used relative to an orientation of the surface cleaning head on a surface to be cleaned and the terms "front" and "back" and derivatives thereof are used relative to a direction that a user pushes the surface cleaning base on a surface being cleaned (i.e., back to front).

**[0026]** As used herein, the term "leading" refers to a position in front of at least another component but does not necessarily mean in front of all other components.

**[0027]** As used herein, the term "user disassembly" refers to intentional disassembly by an end user of the vacuum cleaner without the user of destructive forces, including disassembly with or without the use of commonplace household tools. Unless otherwise noted, user disassembly of components from the vacuum cleaner includes the ability for such components to be reassembled to the vacuum cleaner.

**[0028]** As used herein, the term "debris" includes dirt, soil, dust, hair, stains, and other debris, unless otherwise noted.

**[0029]** Referring to FIGS. 1-2, a vacuum cleaner 10 according to one aspect of the present invention is shown and described. As discussed in further detail below, the vacuum cleaner 10 has a cleaning base 12 having dual agitators and a cord guard, which are described in further detail below. The vacuum cleaner 10 can include at least one cleaning system, including, but not limited to, a vacuum collection system that removes debris from the surface to be cleaned and stores the collected debris within the vacuum cleaner 10.

**[0030]** The cleaning base 12 is adapted to move over a surface to be cleaned and includes a housing 14 with a front side 16F, and a back side 16B, left and right sides 18L, 18R, an upper side 20, and a lower or underside 22 between the front side 16F and the back side 16B. The housing 14 defines a brush chamber 24 and a suction conduit 26 having an opening 28 on the underside 22 of the housing 14 (shown schematically in FIG. 1). The housing 14 may comprise a single housing piece, or multiple housing pieces coupled together.

**[0031]** The suction conduit 26 is fluidly coupled to a dirty air inlet 30, which leads to a suction motor 32 (shown schematically in FIG. 3) either in the base 12 or another location in the vacuum cleaner 10. The suction conduit 26 is the interior space defined by interior walls in the housing 14, which receives and directs air drawn in by suction, and the opening 28 is where the suction conduit 26 meets the underside 22 of the housing 14. The suction conduit 26 can pass through at least a portion of the brush chamber 24. Although an embodiment of the housing 14 is described herein for illustrative purposes, the housing 14 and components thereof may have other shapes and configurations.

**[0032]** The cleaning base 12 includes dual agitators, for example, a first agitator 36 and a second agitator 38 configured to rotate about first and second rotating axes X, Y, respectively, that generally extend perpendicular to the intended direction of the vacuuming movement of the

cleaning base 12 and/or generally parallel to the front side 16F. In at least some embodiments, the first agitator 36 is a brushroll 36 and the second agitator 38 is a leading roller 38, and will be referred to herein as such, although it is understood that alternative agitators are possible. The rotating brushroll 36 and/or the leading roller 38 may be coupled to, and rotated about the rotating axes, by one or more motors.

**[0033]** The cleaning base 12 includes a cord guard 40 configured to prevent large objects (e.g., a power cord) from being drawn into the suction conduit 26. The cord guard 40 is coupled to the housing 14 and traverses the opening 28 to the suction conduit 26. As used herein, "traverses" or "traversing" refers to extending across or over. As such, the cord guard 40 can block the opening 28, but does not seal the opening 28 against air and debris ingestion.

**[0034]** Referring to FIGS. 1 and 3, and consistent with an embodiment of the present invention, the vacuum cleaner 10 can be an upright vacuum cleaner having upright body 42 coupled with the cleaning base 12 to direct the base 12 over the surface to be cleaned. The various systems and components described for the vacuum cleaner 10 can be supported by either or both the base 12 and the upright body 42, except where expressly specified to the contrary. Alternatively or additionally to the upright body 42, the vacuum cleaner 10 can have a wand and/or handle.

**[0035]** The vacuum collection system can include the suction conduit 26, the dirty air inlet 30, the suction motor 32, which is in fluid communication with the suction conduit 26 for generating a working air stream, a collection container 44 for separating and collecting debris from the working airstream for later disposal, and a clean air outlet (not shown). When the suction motor 32 is activated, debris-laden working air is drawn in through the suction conduit 26 and into the downstream collection container 44, where the debris is substantially separated from the working air. The airstream then passes through the suction motor 32 prior to being exhausted from the vacuum cleaner 10 through the clean air outlet.

**[0036]** A separator (not shown) can be formed in a portion of the collection container 44 for separating entrained debris from the working airstream. The separator can include, but is not limited to, a cyclonic separator having one or more cyclonic separation stages, a bulk separator, a filter bag, or a combination thereof. The collection container 44 can be removable from the upright body 42 or from the base 12 for emptying collected debris.

**[0037]** The suction motor 32 and other electrical components of the vacuum cleaner 10 can be electrically coupled to a power source, such as a power cord 46 plugged into a household electrical outlet. Alternatively, the power source may be a battery. While not shown for clarity, the vacuum cleaner 10 may also include one or more controllers and/or sensors disposed within and/or coupled to the upright body 42 or the base 12.

**[0038]** Referring to FIG. 4, a cross-sectional view of a portion of the base 12 is shown on a surface to be cleaned S. The brushroll 36 is mounted to the housing 14 within the brush chamber 24, and can be at least partially disposed within the suction conduit 26, which can pass through at least a portion of the brush chamber 24. The brushroll 36 is exposed to the flow path (e.g., arrows F) into the opening 28 and through the suction conduit 26. At least a portion of the brushroll 36 can extend through the suction conduit opening 28 to engage the surface to be cleaned. In some embodiments, the suction conduit 26 can also define at least a portion of the brush chamber 24 itself, including, but not limited to, a lower portion of the brush chamber 24.

**[0039]** The leading roller 38 is mounted to the housing 14 in front of the brushroll 36. The leading roller 38 can preferably be positioned in front of and spaced from the brushroll 36 and at least substantially outside the suction conduit 26. In certain embodiments, at least some of the inner upper portion of the leading roller 38 may not be exposed to the flow path F into the opening 28 of the suction conduit 26 while at least an inside of the bottom portion of the leading roller 38 is exposed to the flow path F into the opening 28 of the suction conduit 26. The leading roller 38 is received in a leading roller chamber 48, which may prevent portions of the inside upper quadrant of the leading roller 38 from being exposed to the flow path F. Other variations are possible with different portions of the leading roller 38 being exposed and not exposed to the flow path. A space between lower portions of the leading roller 38 and the brushroll 36 forms an inter-roller air passageway 50 that may provide at least a portion of the flow path F into the opening 28 of the suction conduit 26 and allow debris to be carried into the suction conduit 26.

**[0040]** The leading roller 38 may be spaced apart a distance L (which is greater than 0 mm) from the brushroll 36 such that the leading roller 38 does not contact the brushroll 36. The distance L allows for the passageway 50 between lower portions of the brushroll 36 and the leading roller 38, which provides at least a portion of the flow path F into the opening 28 of the suction conduit 26. The passageway 50 allows for debris that is either picked up by (and/or removed from) the leading roller 38 to be entrained in the flow path F and/or to be picked up by the brushroll 36.

**[0041]** The housing 14 is open at the front side 16F such that a debris opening 52 is defined by a clearance between a lower end of the front side 16F and the surface S, wherein the clearance is greater than 0 mm, and optionally less than 15 mm, alternatively less than 11 mm. A space between an outside of the bottom portion of the leading roller 38 and the debris opening 52 forms a debris passageway 54 that allows debris to pass into the housing 14 and not be pushed or plowed forward. The roller 38 can substantially seal the debris passageway 54 from the flow path F into the opening 28 of the suction conduit 26 to mitigate, or prevent, suction loss at the front

side 16F of the housing 14. As discussed further below, in at least some embodiments the roller 38 is soft or compressible to roll over the debris that enters through the debris opening 52.

**[0042]** The leading roller 38 may be positioned within the housing 14 such that a bottom contact surface 56 thereof is disposed closer to the surface S compared to a bottom contact surface 58 of the brushroll 36. This arrangement allows the leading roller 38 to contact a surface (e.g., a hard surface) without the brushroll 36 contacting the surface. The brushroll 36 is intended to primarily contact a carpet surface. This arrangement allows the leading roller 38 to form a seal with the hard surface, thereby enhancing airflow and suction with the hard surface. As may be appreciated, the leading roller 38 may pick up some debris from surface while the brushroll 36 is intended to primarily move debris into the suction conduit 26.

**[0043]** The brushroll 36 may have bristles, fabric, or other cleaning elements, or any combination thereof around the outside of the brushroll 36. The size and shape of the bristles may be selected based on the intended application. For example, the brushroll 36 may include bristles having a length of between 15-19 mm, alternatively around 17 mm, and may be grouped in tufts having a diameter of around 6 mm at the outer end of the tuft. The bristles may be made on any material such as, but not limited to, nylon.

**[0044]** The leading roller 38 may include a relatively soft material (e.g., soft bristles, fabric, felt, nap or pile). The leading roller 38 may be selected to be substantially softer than the brushroll 36. The softness, length, diameter, arrangement, and resiliency of the bristles and/or pile of the leading roller 38 may be selected to form a seal with a hard surface (e.g., but not limited to, a hard wood floor, tile floor, laminate floor, or the like), whereas the bristles of the brushroll 36 may be selected to agitate carpet fibers or the like. Softness may be determined, for example, based on the pliability of the bristles or pile being used.

**[0045]** The size and shape of the bristles and/or pile for the leading roller 38 may be selected based on the intended application. For example, the leading roller 38 may include pile having a length of between 8-12 mm, alternatively around 10 mm, and may have a diameter of 0.01-0.04 mm. The pile may be made of any material such as, but not limited to, microfiber, silk, cotton, wool, synthetic fibers, or a combination of materials.

**[0046]** The leading roller 38 may have an outside diameter DL that is smaller than the outside diameter DB of the brushroll 36. For example, the roller diameter DL may be greater than zero and less than 1X the brushroll diameter DB, or in the range of 0.5X to 0.75X the brushroll diameter DB. As an illustrative example, the brushroll 36 may have an outside diameter of 50-80 mm, alternatively 57-70 mm, alternatively 67 mm and the leading roller 38 may have an outside diameter of 40-50 mm, alternatively 45 mm. In other embodiments, the roller diameter DL may

be equal to or greater than the brushroll diameter DB.

**[0047]** In at least one embodiment, the brushroll 36 and the leading roller 38 rotate in the same direction, for example clockwise when viewed from the perspective of FIG. 4. The brushroll 36 and the leading roller 38 may rotate at same speed or at different speeds.

**[0048]** The brushroll 36 and roller 38 are driven to rotate by at least one drive mechanism. In one non-limiting example of a drive mechanism, the brushroll 36 may be coupled to an electrical motor 60 (either AC or DC) to cause the brushroll 36 to rotate about the first rotating axis X. The drive motor 60 is partially visible in FIG. 4, and may be housed within the cleaning base 12.

**[0049]** A drive transmission can operably connect the motor 60 with the brushroll 36 and can comprise one or more drive belts, pulleys, gears, or the like for transmitting rotational motion of the motor 60 to the brushroll 36. The leading roller 38 may be driven from the same drive mechanism (e.g., motor 60) used to drive the brushroll 36, and may be coupled with the brushroll 36 by way of or more drive belts, pulleys, gears, or the like. Other drive mechanisms are possible and within the scope of the present invention. For example, the leading roller 38 may be rotated by a different motor.

**[0050]** Referring to FIGS. 2, 4, and 5, according to an embodiment, the cleaning base 12 includes a sole plate 62 removably attached on the underside 22 of the housing 14. The sole plate 62 defines at least a portion of the suction conduit 26, for example at least a portion of the opening 28 on the underside 22 of the housing 14. The sole plate 62 can be fully removable from the housing 14, or may be partially removable, such as by being hingedly coupled with the housing 14. The sole plate 62 faces the surface to be cleaned S (e.g., the floor, FIG. 4) when in a working position.

**[0051]** According to some embodiments, the sole plate 62 is removable by the use of simple tools, such as a screwdriver, or without the use of tools. The removability of the sole plate 62 with simple or no tools allows for the end user of the vacuum cleaner 10 to clean, service, and/or replace components of the cleaning base 12, rather than having a service expert perform such operations. For example, removable of the sole plate 62 can permit access to one or more of the brushroll 36, roller 38, brush chamber 24, suction conduit 26, leading roller chamber 48, and/or agitator drive mechanism(s). In one embodiment, the sole plate 62 is attached on the underside 22 of the housing 14 by one or more fasteners 64, e.g. screws (FIG. 5).

**[0052]** Referring to FIGS. 2 and 5, in one embodiment, the sole plate 62 includes a rear frame wall 66, a left side frame wall 68, and a right side frame wall 70, which can form a generally U-shaped frame that is open toward the front. The U-shaped frame is beneficial for a dual agitator cleaning base since the sole plate 62 does not block or impede airflow through the inter-roller air passageway 50. Although an embodiment of the sole plate 62 is described herein for illustrative purposes, the sole plate

62 may have other shapes and configurations.

**[0053]** The suction conduit opening 28 to the suction conduit 26 can be bordered by the rear frame wall 66 and the side frame walls 68, 70, and the space between the frame walls 66, 68, 70, can define the opening 28. The rear frame wall 66 can have a leading edge 66L that defines a rear peripheral edge of the suction conduit opening 28.

**[0054]** The rear frame wall 66 can, in some embodiments, extend partially below the brushroll 36. For example, as shown in FIG. 4, the brushroll 36 has a radius R from the first agitator axis X to an outer surface of the brushroll 36, and the rear frame wall 66 can extend beyond a trailing side of the brushroll 36 a distance less than or equal to the radius R, alternatively a distance less than the radius R and greater than 0.25R, alternatively about a distance of 0.25R to 0.5R.

**[0055]** The cleaning base 12 may include one or more wheels 72, 74, 76 for supporting the housing 14 on the surface to be cleaned and maneuvering the vacuum cleaner 10 over a surface to be cleaned. At least one set of wheels 72, 74 can be mounted to the sole plate 62 for rollably supporting the cleaning base 12 on the surface to be cleaned. In one embodiment, a set of wheels 72 are mounted to the sole plate 62 outboard of the suction conduit opening 28, such as being rotatably mounted within cavities formed in the side frame walls 68, 70. In this or an alternative embodiment, a set of wheels 74 are mounted to the sole plate 62 rear of the opening 28, such as being rotatably mounted within cavities formed in the rear wall 66. A set of larger wheels 76 can be mounted at or near the back side 18 of the housing 14. Other arrangements for the wheels of the vacuum cleaner 10 are possible.

**[0056]** The front wheel(s) 72, middle wheel(s) 74, and rear wheel(s) 76 may provide the primary contact with the surface being cleaned and thus primarily support the cleaning base 12. When the cleaning base 12 is positioned on the surface being cleaned, the cord guard 40 and/or the sole plate 62 may sit above the surface being cleaned. When the cleaning base 12 is positioned on the surface being cleaned, the leading roller 38 may also rest on the surface being cleaned. In other embodiments, the leading roller 38 may be positioned such that the leading roller 38 sits just above the surface being cleaned.

**[0057]** According to an embodiment, a sealing strip 78 is located on the sole plate 62 on a rear side of the opening 28 to the suction conduit 26. The sealing strip 78 may contact the surface to be cleaned behind the brushroll 36 to seal against the surface together with the leading roller 38 contacting the surface in front of the brushroll 36. The sealing strip 78 may include soft bristles, fabric material, rubber material, or other material capable of contacting the surface being cleaned to substantially prevent air flow into the opening 28 from the rear side. The sealing strip 78 may also include a combination of elements or materials. The sealing strip 78 may enhance sealing between the base 12 and the floor, thereby

enhancing the vacuum efficiency. Providing the sealing strip 78 on the removable sole plate 62 allows the sealing strip 78 to be cleaned, serviced, or replaced conveniently. In one embodiment, the sealing strip 78 extends from the rear frame wall 66 of the sole plate 62, and can be disposed on the rear frame wall 66 adjacent the leading edge 66L. Other arrangements for the sealing strip are possible.

**[0058]** The sole plate 62 can secure the brushroll 36 and/or the cord guard 40 in a working position on the housing 14. As described in further detail below, in one embodiment the leading roller 38 can be removed from housing 14 without removing the sole plate 62, although in other embodiments the sole plate 62 can also secure the roller 38 in a working position on the housing 14.

**[0059]** In one embodiment, to secure the brushroll 36 in a working position on the housing 14, the sole plate 62 may include at least one cradle 80, 82 that presses against a non-rotating portion of the brushroll 36 to support the brushroll 36 horizontally and hold the brushroll 36 in its working position within the brush chamber 24 and/or suction conduit 26. As described in further detail below, removal of the sole plate 62 from the housing 14 permits the brushroll 36 to thereafter be removed from the housing 14. In one embodiment, a left cradle 80 is formed on or otherwise coupled with the left side frame wall 68 of the sole plate 62 and supports a left end of the brushroll 36 and a right cradle 82 is formed on or otherwise coupled with the right side frame wall 70 of the sole plate 62 and supports a right end of the brushroll 36.

**[0060]** The sole plate 62 may further include a belt guard 84 configured to protect a drive belt of the drive transmission for the brushroll 36. In one embodiment, the belt guard 84 can be an extension of the right side wall 70, or can be formed on or otherwise coupled to the sole plate 62.

**[0061]** The cord guard 40 can be at least partially removable from the housing 14 for accessing and/servicing the brushroll 36. In one embodiment, the cord guard 40 is pivotable between a closed or working position and an open position. In the open position, the brushroll 36 can be removed from the housing 14. One non-limiting example of the closed position is shown in FIGS. 2 and 4 and one non-limiting example of the open position is shown in FIGS. 12 and 13.

**[0062]** The cord guard 40 may remain attached to the housing 14 in the open position. In one aspect of the invention, the cord guard 40 is hinged to the housing 14, and pivots between the working position and the open position.

**[0063]** One embodiment of the pivotal cord guard 40 is shown in FIG. 6 and includes a first end 86, a second end 88, and at least one crosspiece 90 extending between the first end 86 and the second end 88. The first end 86 of the cord guard 40 is pivotally attached to the housing 14 and defines an axis of rotation C of the cord guard 40, also referred to herein as the cord guard axis C. The second end 88 of the cord guard 40 is pivotable between the

working position, e.g., in which the at least one cross-piece 90 traverses the suction conduit opening 28, and the open position in which the brushroll 36 can be removed removably from the housing 14.

**[0064]** With reference to FIG. 7, in one aspect of the invention, the cord guard axis C is intermediate the first agitator axis X and the second agitator axis Y. As such, the cord guard axis C is rear of the second agitator axis Y, and may further preferably be spaced rearward of the leading roller 38. Thus, the cord guard 40 can be moved between the working and open positions irrespective of the presence or absence of the leading roller 38.

**[0065]** When the housing 14 is supported on the surface to be cleaned S, the first agitator axis X has a first clearance H1 from the surface S, the second agitator axis Y has a second clearance H2 from the surface S, and the cord guard axis C has a third clearance H3 from the S. In one embodiment, the third clearance H3 is greater than the first clearance H1 and greater than the second clearance H2. This spaces the pivotal coupling of the cord guard 40 farther from the surface to be cleaned S, and substantially outside the flow path F, so that the pivotal coupling of the cord guard 40 does not block or impede airflow through the inter-roller air passageway 50. This can also minimize the accumulation of debris around the cord guard axis C and reduce wear on the pivotal coupling.

**[0066]** With continued reference to FIG. 7, in one aspect of the invention, the cord guard 40 traverses the opening 28 below the first axis X of the brushroll 36, and does not pass below the second axis Y of the leading roller 38. In one embodiment, the cord guard comprises a plurality of crosspieces 90 that traverse the opening 28 below the first axis X of the brushroll 36.

**[0067]** In one embodiment, the brushroll 36 has a plurality of bristles 92 that extend radially outward from a sidewall 94 of the brushroll 36. For example, the bristles 92 may extend radially up to 19 mm beyond the sidewall 94, e.g., between 15 mm and 19 mm beyond the sidewall 94. The bristles 92 extend beyond (e.g., below) the crosspieces 90 and the sidewall 94 does not contact the crosspieces 90. For example, the bristles 92 may extend up to 3 mm beyond the crosspieces 90, e.g., between 1.0 mm and 3.0 mm beyond the sidewall 94. The sidewall 94 may be a continuous sidewall of the brushroll 36, e.g. a circumferential sidewall.

**[0068]** The cord guard 40 can wrap around a portion of the circumference of the brushroll 36 that is greater than 0 degrees and less than 180 degrees, alternatively greater than 90 degrees and less than 180 degrees, alternatively greater than 120 degrees and less than 180 degrees. Depending on the degree of wrap, the crosspieces 90 can pass below the brushroll 36 and extend somewhat around the front or leading side of the brushroll 36 and/or somewhat around the rear or trailing side of the brushroll 36. In one embodiment, on the leading side of the brushroll 36 the crosspieces 90 extend around the circumference of the brushroll 36 to a point 96 that is at or beyond a

plane P that is coincident with the first agitator axis X and parallel to the surface to be cleaned S. On the trailing side of the brushroll 36 the crosspieces 90 extend around the circumference of the brushroll 36 to a point 98 that is below the plane P, e.g. spaced away from the side of the plane P closer to the surface to be cleaned S.

**[0069]** With the cord guard 40 wrapping around more of the leading portion of the brushroll 36 than the trailing portion, the clearance of the cord guard 40 can vary from front to back. For example, when the housing 14 is supported on the surface to be cleaned S, the second end 88 of the cord guard 40 has a clearance H4 from the surface S. The clearance H3 of the cord guard axis C is greater than the clearance H4 at the second end 88. As such, the second end 88 of the cord guard 40 can be disposed at the lower end of, or substantially below, the dirty air inlet 30, which lies on the trailing portion side of the brushroll 36, to prevent large objects from reaching the dirty air inlet 30. The crosspieces 90 can have a clearance H5 from the surface to be cleaned S that is greater than 0 mm, alternatively between 1.0 and 3.0 mm, alternatively 1.5 mm so that the crosspieces 90 do not drag against the surface S and so that the suction conduit opening 28 and dirty air inlet 30 are close to the surface S.

**[0070]** Referring to FIG. 6, the cord guard 40 may preferably comprise a plurality of crosspieces 90 extending between the first end 86 and the second end 88 in order to block the suction conduit 26, creating a gap 100 in between adjacent crosspieces 90 that are wide enough for debris to enter the suction conduit 26 without clogging the opening 28, but narrow enough to prevent undesired large objects (e.g., the power cord of the vacuum cleaner) from being drawn into the suction conduit 26. For example, the gap 100 may have a width, measured parallel to the cord guard axis C, which is greater than 50 mm, alternatively between 50 and 110 mm, alternatively around 80 mm.

**[0071]** Various configurations for the crosspieces 90 are possible. In one embodiment, one or more adjacent crosspieces 90 can be attached to each other at the ends thereof by a first traverse segment 102 defining at least a portion of the first end 86 and a second traverse segment 104 defining at least a portion of the second end 88. The traverse segments 102, 104 can extend centrally between a plurality of the crosspieces 90, for example between two crosspieces 90. The first end 86 can include a bend, e.g. an approximately 90 degree bend, where the transverse segment 102 meets or transitions to each crosspiece 90 and the second end 88 can include a bend, e.g. an approximately 90 degree bend, where the transverse segment 104 meets or transitions to each crosspiece 90.

**[0072]** In the present embodiment, two adjacent crosspieces 90 are attached together by transverse segments 102, 104 to define a cord guard frame 106A, 106B, and the cord guard 40 comprises two cord guard frames 106A, 106B for a total of four crosspieces 90. The frames 106A, 106B are spaced laterally from each other to

provide protection across the width of the suction conduit opening 28. The frames 106A, 106B may be pivoted independently of each other, or may be connected such that all crosspieces 90 pivot as one. The cord guard 40 may have other shapes and configurations.

**[0073]** The first traverse segment 102 is pivotally coupled to the housing 14 and can include at least one portion elongated along the cord guard axis C forming a hinge shaft 108. The hinge shaft 108 can be connected to a hinge bracket 110, as described in further detail below.

**[0074]** The first traverse segment 102 can further have at least one bent portion 112 offset from the cord guard axis C. In one embodiment, the first traverse segment 102 can have two hinge shafts 108 that are laterally spaced from each other along the axis C, with the bent portion 112 extending centrally therebetween. The bent portion 112 prevents axial movement of the cord guard 40, e.g. movement along axis C.

**[0075]** The hinge bracket 110 on the housing 14 pivotally connects the first end 86 of the cord guard 40 to the housing 14. The hinge bracket 110 can be intermediate the brushroll 36 and the leading roller 38. Where the first end 86 includes one or more elongated hinge shafts 108, the housing 14 can have a corresponding number of hinge brackets 110 that each receive one of the hinge shafts 108 to establish the pivot connection between the cord guard 40 and housing 14. Other pivotal couplings for the cord guard are possible.

**[0076]** Referring to FIG. 8, in one embodiment, the hinge bracket 110 may form a C-shaped groove 114, running over approximately the entire axial length of the bracket 110 and defining a longitudinal opening. In the embodiment of FIG. 8, the groove 114 has a substantially circular cross-section, which affords a wire cord guard, described in further detail below, the ability to pivot smoothly with respect to the bracket 110. The hinge shaft 108 may have an interference fit with the groove 114 and may snap into the bracket 110.

**[0077]** The longitudinal opening of the groove 114 may open upwardly, e.g., in a direction away from the surface to be cleaned S when the housing 14 is on is supported on the surface to be cleaned S in the working position shown in FIGS. 7-8, so that the hinge shaft 108 can be inserted downwardly into the groove 114 through the longitudinal opening. With this orientation, the closed side of the hinge bracket 110 faces the surface to be cleaned S while cleaning, protecting the pivotal coupling from accumulating debris around the cord guard axis C and preventing the cord guard 40 from accidentally dislodging at the first end 86 during cleaning.

**[0078]** The housing 14 may have a support 116 for the hinge bracket 110. The support 116 can protect into one or both of the brush chamber 24 and the leading roller chamber 48 to position the hinge bracket 110 intermediate the brushroll 36 and leading roller 38, facing the brushroll 36. The longitudinal opening of the groove 114 may face in a direction away from the support 116 so that the hinge shaft 108 can be inserted into the groove 114



through the longitudinal opening.

**[0079]** Moving from the closed position to the open position, the cord guard 40 can pivot greater than 0 degrees and less than 180 degrees about guard axis G, alternatively at least 60 degrees and less than 120 degrees. In some embodiments, pivotable coupling between the cord guard 40 and housing 14 allows for a rotation of about 45 degrees to 90 degrees of the cord guard 40, which provides enough clearance for the brushroll 36 to be removed from or installed into the suction conduit 26, but minimizes the chance for detaching the cord guard 40 from the housing 14.

**[0080]** The cord guard 40 can be formed at least partially from of rigid metal wire that can maintain its shape during operation of the vacuum cleaner, offering formability, rigidity, and longevity to the cord guard 40. Alternatively, the cord guard can be substantially or entirely made from rigid metal wire. For example, at least one of the first end 86, second end 88, crosspieces 90, or any combination thereof, can be formed of rigid metal wire. As an illustrative example, the wire of the cord guard 40 may have an outside diameter of 2.0 to 3.0 mm, alternatively about 2.2 mm. The wire can be a coated rigid metal wire have a low friction coating that allows the cord guard 40 to easily rotate within the hinge bracket 110 between the working and open positions. In one embodiment, the wire is stainless steel or a plated spring metal.

**[0081]** For an embodiment of the cord guard 40 comprising a plurality of frames 106, each frame 106 can comprise a coated rigid metal wire frame that will maintain its shape during operation of the vacuum cleaner. The wire frame 106 can be formed as a loop of coated rigid metal wire, such that the crosspieces 90 and transverse segments 102, 104 are arranged in a continuous, closed shape.

**[0082]** The sole plate 62 can secure the cord guard 40 in a working position on the housing 14. For a pivotable cord guard 40 as shown, the sole plate 62 can secure the second end 88 against the housing 14 in the working position. Removal of the sole plate 62 from the housing 14 exposes the second end 88 of the cord guard 40, whereby the user can grip the cord guard 40, for instance by the second end 88 or by one of the crosspieces 90, and pivot the cord guard 40 to the open position. As discussed above, in the open position, the cord guard may remain attached to the housing 14 by the first end 86.

**[0083]** In one embodiment, at least the second end 88 of the cord guard 40 is clamped between the housing 14 and the sole plate 62 to hold the cord guard 40 in the working position. The clamping action can be effected by the action of the sole plate 62 and the fasteners 64 (FIG. 5) for the sole plate 62 in pulling the sole plate 62 toward the housing 14 to clamp the cord guard 40 between the sole plate 62 and the housing 14.

**[0084]** Referring to FIG. 9, the sole plate 62 can be formed with one or more installation holes 120 for fastening the sole plate 62 to the housing 14 using the fastener(s) 64. Each fastener 64 passes through one of the

installation holes 120 and engages the housing 14 for fastening the sole plate 62 to the housing 14 in a working position in which an exterior of the sole plate 62 faces the surface to be cleaned S (e.g., the floor, FIG. 4). The housing 14 can have mounting features for the sole plate 62, for example screw bosses 122 used for attaching the sole plate 62 by the fasteners 64. One or more of the fasteners 64 can be attached over the second end 88 of the cord guard 40 to distribute the fastening force of the fastener(s) to the cord guard 40.

**[0085]** Referring to FIGS. 6-9, in one aspect of the invention, a portion of the cord guard 40, such as at least the second end 88 thereof, is clamped between the housing 14 and the sole plate 62 to hold the cord guard 40 in the working position. The housing 14 can have an interior side 124 that confronts the sole plate 62 when the sole plate 62 is attached to the housing 14 and the sole plate 62 can have an interior side 126 that confronts an interior side 124 of the housing 14 when the sole plate 62 is attached to the housing 14. One or both of the interior sides 124, 126 can include a clamp feature configured to clamp down on at least the second end 88 of the cord guard 40 when the sole plate 62 is attached to the housing 14 to securely hold the cord guard 40 between the housing 14 and the sole plate 62, effectively locking the cord guard 40 in the working position and preventing the cord guard 40 from pivoting to the open position.

**[0086]** In one embodiment, the sole plate 62 has a clamp 128 that receives a portion of the second end 88 of the cord guard 40, e.g., the second traverse segment 104. The clamp 128 can support an underside of the second end 88 substantially horizontally, or parallel to the surface S. Portions of the clamp 128 can extend partially around the second end 88, e.g. around front and rear sides of the second traverse segment 104, to cradle the second end 88 and minimize front-to-rear movement of the cord guard 40 in the working position.

**[0087]** The clamp 128 can project from the interior side 126 of the sole plate 62 to hold the second end 88 against the interior side 124 of the housing 14. Thus, the second end 88 is held slightly away from the interior side 126 of the sole plate 62. The second traverse segment 104 is thereby clamped between the clamp 128 and the interior side 124 of the housing 14 when the cord guard 40 is in the working position and the sole plate 62 is attached to the housing 14. Other ways of clamping or otherwise holding the cord guard 40 in the working position are also possible and within the scope of the present invention, including, but not limited to, holding the cord guard directly against the interior side 126 of the sole plate 62.

**[0088]** The interior side 124 of the housing 14 can be defined by the underside 22 of the housing 14. In another embodiment, the housing 14 can have an accommodation groove 130 recessed in the underside 22, and the interior side 124 can form a side of the recessed accommodation groove 130. The accommodation groove 130 can receive the second end 88 of the cord guard 40 in the working position, so that the second end 88 is held above

the underside 22 of the housing 14. The accommodation groove 130 can be covered by the sole plate 62 when the sole plate 62 is attached to the housing 14 to enclose the at least the second end 88 of the cord guard 40 within the accommodation groove 130.

**[0089]** Referring to FIG. 6, the accommodation groove 130 can be formed to accommodate the second end 88, including the second transverse segment 104, rearward of the brushroll 36. In addition to the interior side 124, and accommodation groove 130 can include at least one pair of guide walls 132, 134 between which a portion of the second end 88, e.g. the transverse segment 104, is inserted in the working position. The guide walls 132, 134 include a front guide wall 132 and a rear guide wall 134, and multiple pairs of guide walls 132, 134 may be spaced laterally along the interior side 124.

**[0090]** The accommodation groove 130 can further be formed to route the cord guard 40 around other components of the base 12, for example around the screw bosses 122 used for attaching the sole plate 62. Routing the cord guard 40 around the point of attachment for the sole plate 62 can help distribute the force of the fasteners 64. In one embodiment, the second transverse segment 104 comprises at least one bend 136 accommodating the fastener 64 attaching the sole plate 62 to the underside of the housing 14. In one embodiment, the screw boss 122 is provided within the accommodation groove 130 and can extend from the interior side 124. Pairs of guide walls 132, 134 may be located on either side of the screw boss 122 to receive the transverse segment 104 laterally outwardly of the bend 136.

**[0091]** Referring to FIG. 8, as previously described, the crosspieces 90 traverse the suction conduit opening 28, and therefore may be in or adjacent to the suction conduit 26 and/or in or adjacent to the brush chamber 24. Another portion of the cord guard 40, such as the second end 88, can be disposed outside the suction conduit 26 and/or the brush chamber 24. In one embodiment, the housing 14 comprises a wall 138, and the wall 138 can be formed with at least one guard opening 140 for the cord guard 40. In embodiments with multiple crosspieces 90, the wall 138 can have multiple guard openings 140. The guard openings 140 minimize suction loss around the location or locations where the cord guard 40 emerges to traverse the suction conduit opening 28.

**[0092]** In the working position, the second end 88 is disposed on first side of the wall 138 and the first end 86 and a majority of the crosspieces 90 are disposed on second side of wall 138, with the crosspieces 90 passing through the guard opening 140 in the rear wall 138. In at least some embodiments, the wall 138 can be a rear wall that defines a portion of one or both of the brush chamber 24 and suction conduit 26, with the rear wall 138 rear of the brushroll 36. The rear wall 138 can include a portion of or the entire dirty air inlet 30.

**[0093]** The guard openings 140 may be formed entirely in the rear wall 138 of the housing 14, or may be formed by a combination the rear wall 138 and the sole plate 62. In

one embodiment, the sole plate 62 can have at least one edge 142 that closes an open bottom of one or more of the guard openings 140 to enclose the crosspieces 90. The edge 142 may also help clamp the cord guard 40 in place in the working position by applying a clamping force to the crosspieces 90.

**[0094]** FIGS. 10-13 show one example of a user disassembly process for the cleaning base 12. One or both of the brushroll 36 and the leading roller 38 may be removable from the base 12, such as by being removably mounted to the housing 14 of the base 12. For example, referring to FIG. 10, to remove the leading roller 38, one end of the roller 38 may be unsecured/uncoupled from the rest of the housing 14, thereby allowing the other end of the leading roller 38 to disengage from a drive coupling 144, which is operably coupled with the motor 60 (FIG. 4), and allowing the leading roller 38 to be removed from a leading roller chamber 48. One embodiment of a roller release mechanism for releasing the leading roller 38 from the housing 14 of the cleaning base 12 includes a user accessible push button 146, which may be located on either side 18R, 18L of the housing 14, and is preferably located on a side opposite that corresponding to the drive coupling 144. To remove the leading roller 38, the user may apply a force to the push button 146 to disengage an internal block (not shown) from mechanical engagement with the roller 38, thereby allowing the leading roller 38 to be removed from the chamber 48. Other ways of removably coupling the leading roller 38 within the housing 14 are also possible and within the scope of the present invention, including, but not limited to, requiring removal of the sole plate 62 prior to removal of the leading roller 38.

**[0095]** Referring to FIG. 11, to remove the brushroll 36, the sole plate 62 is detached from the housing 14 (e.g. by unscrewing fasteners 64). This exposes the second end 88 and unclamps the sole plate 62 from the housing 14.

**[0096]** Next, and referring to FIG. 12, the cord guard 40 is moved to the open position. In one example, the user grips the cord guard 40 and lifts the cord guard 40 away from the underside 22 in a pivoting movement about the axis C to the open position.

**[0097]** Once the cord guard 40 is in the open position, the brushroll 36 can be removed from the housing 14. For example, to remove the brushroll 36, one end 148 of the brushroll 36 may be unsecured/uncoupled from the rest of the housing 14, thereby allowing the other end of the brushroll 36 to disengage from a drive coupling 150, which is operably coupled with the motor 60 (FIG. 4), and allowing the brushroll 36 to be removed from the brush chamber 24 and suction conduit 26. Other ways of removably coupling the brushroll 36 within the housing 14 are also possible and within the scope of the present invention.

**[0098]** Referring to FIG. 7, according to an embodiment, the cleaning base 12 includes one or more agitator combs 152, 154 configured to remove debris (such as, but not limited to, hair, string, and the like) that may be

wrapped around and/or entrained in/on one or more of the agitators as the cleaning base 12 is being operated to clean a surface and without the user having to manually remove the debris from the agitators. For example, a brushroll comb 152 may be configured to contact the brushroll 36 and a roller comb 154 may be configured to contact the leading roller 38. While combs 152, 154 are provided both the brushroll 36 and roller 38 in the illustrated embodiment, other variations are possible such as only the leading roller 38 having a comb or only the brushroll 36 having a comb.

**[0099]** In this embodiment, the combs 152, 154 may include a plurality of teeth 156, 158 (e.g., spaced projections or tines). The plurality of teeth 156, 158 may provide numerous contact points with the brushroll 36 and roller 38, respectively, to remove debris therefrom, while also reducing potential damage to the bristles and/or pile thereof. The leading comb 154 may also substantially prevent air flow to a top of the leading roller 38 such that the top of the leading roller 38 is not exposed to the flow path F to the suction conduit 26.

**[0100]** The comb 152 for the brushroll 36 may be located within the suction conduit 26, such that the teeth 156 contact the brushroll 36 in a region where the bristles of the brushroll 36 are moving generally upward (e.g., away from the surface to be cleaned). For example, the comb 152 may be disposed proximate to an upper portion of the dirty air inlet 30. In at least one embodiment, the brushroll 36 may be removable from the housing 14 and the comb may be coupled to the housing 14 such that the comb 152 remains with the housing 14 when the brushroll 36 is removed from the housing 14.

**[0101]** The teeth 156 may have angled or hooked ends to aid in capturing debris. The teeth 156 are spaced from each other and extend from a supporting surface 160. The supporting surface 160 can define a portion of the brush chamber 24 and/or suction conduit 26. Alternatively the supporting surface 160 can be mounted within the brush chamber 24 or can be mounted outside the brush chamber 24 with the teeth 156 projecting into the brush chamber 24 to contact the brushroll 36.

**[0102]** The teeth 156 of the brushroll comb 152 may be configured to contact the bristles 92 and/or the sidewall 94 as the brushroll 36 is rotated about the axis X. Alternatively, the teeth 156 may be configured to pass between the bristles 92 and out of contact with the sidewall 94 as the brushroll 36 rotates.

**[0103]** The comb 154 for the leading roller 38 includes teeth 158 extending into contact with a surface of the roller 38. The teeth 158 may have angled or hooked ends to aid in capturing debris. The teeth 158 are spaced from each other and extend from a supporting surface 162. The supporting surface 162 can define a portion of the leading roller chamber 48. Alternatively the supporting surface 162 can be mounted within the leading roller chamber 48 or can be mounted outside the leading roller chamber 48 with the teeth 158 projecting into the chamber 48 to contact the roller 38.

**[0104]** The combs 152, 154 contact a surface of the brushroll 36 and the leading roller 38, respectively, at a distance T1, T2 (FIG. 7) above the bottom contact surface 56, 58 thereof to facilitate debris removal. For the brushroll 36, the distance T1 may be greater than a distance H1 of the first axis X above the surface S. For the roller 38, the distance T2 may be greater than a distance H2 of the second axis Y above the surface S. As shown in FIG. 7, the comb 152, 154 may be disposed on an upper half and/or a rear side of the brushroll 36 and leading roller 38, respectively. The contact point of the combs 152, 154 with the agitators 36, 38 may be measured at the bottommost point of the teeth 156, 158 that is in contact with a surface of the agitator 36, 38.

**[0105]** Referring to FIG. 8, in one embodiment, the first end 86 of the cord guard 40 is pivotally attached to the comb 154 for the leading roller 38. The comb 154 can have a leading side 164 facing the roller 38 and a trailing side 166 facing the brushroll 36, wherein the leading side 164 comprises the plurality of teeth 158 configured to contact to the surface of the roller 38 and the first end 86 of the cord guard 40 is pivotally attached to the trailing side 166. As one example, the support 116 for the hinge bracket 110 is formed by a trailing side 166 of the comb 154.

**[0106]** According to another aspect of the disclosure, a method of user disassembly may comprise providing any of the devices according to optional aspect described above, removing the sole plate 62, and pivoting the cord guard 40 away from the housing 14. Optionally, the method further comprises removing the brushroll 36 after pivoting the cord guard 40 away from the housing 14. Optionally, the method further comprises removing the leading roller 38 before removing the sole plate 62 and/or before pivoting the cord guard 40 away from the housing 14. Alternatively, the method further comprises removing the leading roller 38 after removing the sole plate 62 and/or after pivoting the cord guard 40 away from the housing 14. The removing may optionally comprise unscrewing the sole plate 62 from the underside 22 of the housing 14. The pivoting optionally may comprise pivoting one end of cord guard 40 with respect to the housing 14 while another end of the cord guard 40 remains mounted to the housing 14, pivoting the cord guard 40 about an axis C substantially parallel to the axes X, Y of the agitators 36, 38, and/or pivoting the cord guard 40 about an axis C intermediate the first and second agitator axes X, Y. The pivoting also may optionally comprise pivoting the cord guard 40 within a hinge bracket 110 within the housing 14.

**[0107]** Referring to FIGS. 14-16, a vacuum cleaner 10' according to another aspect of the present invention is shown and described, and like elements are referred to with the same reference numerals bearing a prime (') symbol. The vacuum cleaner 10' has a sole plate 168 removably attached on the underside 22' of the housing 14' and comprising a cord guard 170, such that removal of the sole plate 168 from the underside 22' of the housing

14' simultaneously removes the cord guard 170 from blocking the suction conduit 26'.

**[0108]** In "comprising" the cord guard 170, the cord guard 170 may be coupled with or attached to the sole plate 168. In this regard, the terms "coupled" and "attached" are used herein in their broadest sense to mean and encompass the notions of the cord guard 170 being separately formed and joined to the sole plate 168 or being internally formed with the sole plate 168 or with a portion of the sole plate 168.

**[0109]** The sole plate 168 defines at least a portion of the suction conduit opening 28'. In one embodiment, the sole plate 168 includes a frame 172 comprising at least a rear frame wall 174 behind the first agitator axis X', and a bridge 176 intermediate the first agitator axis X' and the second agitator axis Y'. The sole plate 168 further includes the cord guard 170, which traversing the suction conduit opening 28' to block the suction conduit 26'.

**[0110]** The cord guard 170 can include a plurality of crosspieces 178 extending from the rear frame wall 174 to the bridge 176 to traverse the suction conduit opening 28' and the plurality of crosspieces 178 can pass below the first agitator axis X'. In the illustrated example, crosspieces 178 are integrally formed with the sole plate 168 and, thus, would be considered as being "coupled to the sole plate 168" during the formation process of the sole plate 168, which can, for example, be an injection molding process or an additive manufacturing process.

**[0111]** In some embodiments, the sole plate 168 has, in addition to the rear frame wall 174 and the bridge 176, a first or left side frame wall 180 extending transversely to the rear frame wall 174 and a second or right side frame wall 182 spaced laterally from the left side frame wall 180 and extending transversely to the rear frame wall 174. The bridge 176 can traverse the frame 172 from the first side frame wall 180 to the second side frame wall 182. For example, the bridge 176 can be coupled with the side frame walls 180, 182 by extensions 184, 186, respectively, that extend upwardly from the side frame walls 180, 182 to offset the bridge 176 relative to the side frame walls 180, 182. The rear and side frame walls 174, 180, 182 can form a generally U-shaped frame 172 that is generally open toward the front, with the bridge 176 disposed above the frame 172 by the extensions 184, 186. In one non-limiting embodiment, the frame 172 can be disposed below the plane P' that is coincident with the first agitator axis X' and parallel to the surface to be cleaned S', e.g. the frame 172 can be spaced away from the side of the plane P' closer to the surface S', and the bridge 176 can be disposed closer to the plane P', including being below, at, or above the plane P'.

**[0112]** The offset bridge 176 provides the sole plate 168 with a higher clearance from the surface to be cleaned, as described in further detail below, and such that the frame 172 is substantially open to air and debris flow at its front. The open-fronted frame 172 is beneficial for a dual agitator cleaning base since the inter-roller air passageway 50' providing at least a portion of the flow

path F' into the opening 28' is not blocked or impeded. Although an embodiment of the sole plate 168 is described herein for illustrative purposes, the sole plate 168 may have other shapes and configurations.

**[0113]** The opening 28' to the suction conduit 26' can be bordered by the rear frame wall 174 and side frame walls 180, 182, and the space between the frame walls 174, 180, 182, can define the opening 28'. The rear frame wall 174 can have a leading edge 174L that defines a rear peripheral edge of the suction conduit opening 28'.

**[0114]** The rear frame wall 174 can, in some embodiments, extend partially below the brushroll 36'. For example, the brushroll 36' has a radius R' from the first agitator axis X' to an outer surface of the brushroll 36', and the rear frame wall 174 can extend beyond a trailing side of the brushroll 36' a distance less than or equal to the radius R', alternatively a distance less than the radius R' and greater than 0.25R', alternatively about a distance of 0.25R' to 0.5R'.

**[0115]** With reference to FIG. 14, in one aspect of the invention, the bridge 176 is intermediate the first agitator axis X' and the second agitator axis Y'. As such, the bridge 176 is rear of the second agitator axis Y', and may further preferably be spaced rearward of the leading roller 38'. When the housing 14' is supported on the surface to be cleaned S', the bridge 176 has a clearance H6 from the surface S' that is greater than the clearance H1' of the brushroll 36' and greater than the clearance H2' of the leading roller 38'. This spaces the bridge 176 of the cord guard 170 farther from the surface to be cleaned S', and substantially outside the flow path F', which can minimize the accumulation of debris around the bridge 176.

**[0116]** With continued reference to FIG. 14, in one aspect of the invention, the cord guard 170 traverses the opening 28' below the first axis X' of the brushroll 36', and does not pass below the second axis Y' of the leading roller 38'. The crosspieces 178 extending between rear wall 174 and bridge 176 in order to block the opening 28', creating gaps 188 in between adjacent crosspieces 178 that are wide enough for debris to enter the suction conduit 26' without clogging the opening 28', but narrow enough to prevent undesired large objects (e.g., the power cord of the vacuum cleaner) from being drawn into the suction conduit 26'. For example, the gaps 188 may have a width, measured parallel to the axis X' of the brushroll 36', which is greater than 50 mm, alternatively between 50 and 110 mm. The bristles 92' of the brushroll 36' can extend beyond (e.g., below) the crosspieces 178 and the sidewall 94' does not contact the crosspieces 178.

**[0117]** Various configurations for the crosspieces 178 are possible. In one embodiment, the plurality of crosspieces 178 includes one or more crosspieces 178 having a leading end 190 coupled to the bridge 176 and a trailing end 192 coupled to the rear frame wall 174. For example, the trailing end 192 or another portion of the crosspiece 178 can attach to the leading edge 174L of the rear frame

wall 174 that defines a rear peripheral edge of the suction conduit opening 28'. Alternatively, the crosspieces 178 can attach to an underside of the rear frame wall 174 facing the surface to be cleaned S or to an interior side of the rear frame wall 174 facing an interior of the housing 14'. Likewise, the leading end 190 or another portion of the crosspiece 178 can attach to an edge, underside, or interior side of the bridge 176 that defines a rear peripheral edge of the suction conduit opening 28'.

**[0118]** The cord guard 170 can wrap around a portion of the circumference of the brushroll 36' that is greater than 0 degrees and less than 180 degrees, alternatively greater than 90 degrees and less than 180 degrees, alternatively greater than 120 degrees and less than 180 degrees. Depending on the degree of wrap, the crosspieces 178 can pass below the brushroll 36' and extend somewhat around the front or leading side of the brushroll 36' and/or somewhat around the rear or trailing side of the brushroll 36'. In one embodiment, on the leading side of the brushroll 36' the crosspieces 178 extend around the circumference of the brushroll 36' to a point, e.g. at leading end 190, that is at or beyond a plane P' that is coincident with the first agitator axis X' and parallel to the surface to be cleaned S'. On the trailing side of the brushroll 36' the crosspieces 178 extend around the circumference of the brushroll 36' to a point, e.g. at trailing end 192 that is below the plane P or on the side of the plane P' that is closer to the surface to be cleaned S'.

**[0119]** As mentioned above, when the housing 14' is supported on the surface S', the bridge 176 can preferably have a higher clearance from the surface S' than the rear frame wall 174, which can have a clearance H7 from the surface S' greater than 0 mm, alternatively between 1.0 and 3.0 mm, so that the sole plate 168 does not drag against the surface to be cleaned and so that the suction conduit opening 28' and dirty air inlet 30' are close to the surface S'. With a higher clearance H6, the bridge 176 does not block or impede airflow through the inter-roller air passageway 50'.

**[0120]** It is noted that the clearance of the crosspiece 178 at the leading end 190 may be the same or substantially the same as the clearance H6 of the bridge 176 and the clearance of the crosspiece 178 at the trailing end 192 may be the same or substantially the same as the clearance H7 of the rear frame wall 174, depending on how the ends 190, 192 are coupled to the bridge 176 and rear frame wall 174. Thus, for purposes of description related to FIG. 14, the clearance of the leading end 190 is H6 and the clearance of the trailing end 192 is H7. In other embodiments, the bridge 176 can have a different clearance than the leading end 190 and/or the rear frame wall 174 can have a difference clearance than the trailing end 192.

**[0121]** With the cord guard 170 wrapping around more of the leading portion of the brushroll 36' than the trailing portion, the clearance of the cord guard 170 can vary from front to back. For example, when the housing 14' is supported on the surface to be cleaned S', the clearance

H6 at the leading end 190 of the crosspieces 178 is greater than the clearance H7 at the trailing end 192. As such, the trailing end 192 of the crosspieces 178 can be disposed at the lower end of, or substantially below, the dirty air inlet 30', which lies on the trailing portion side of the brushroll 36', to prevent large objects from reaching the dirty air inlet 30'. Intermediate the leading and trailing ends 190, 192 and below the brushroll axis X', the crosspieces 178 can have a third clearance H8 from the surface to be cleaned S' that is greater than 0 mm, alternatively between 1.3 and 3.0 mm so that the crosspieces 178 do not drag against the surface S' and so that the suction conduit opening 28' and dirty air inlet 30' are close to the surface S'.

**[0122]** The cord guard 170 can be formed at least partially from of rigid plastic that can maintain its shape during operation of the vacuum cleaner. For example, the sole plate 168 can be a molded plastic part, with the cord guard 170 integrally formed therewith. In one non-limiting example, the frame of sole plate 168 can be a unitary, monolithic part and the cord guard 170 is integrally formed with the frame, such as by plastic injection molding. Alternatively, the cord guard 170 can be substantially or entirely made from rigid metal wire that is attached to a metal or plastic frame of the sole plate 168. Other materials and manufacturing techniques are possible.

**[0123]** In some embodiments, the sole plate 168 has, in addition to the cord guard 170, one or more wheels 198, 200, a sealing strip 202, at least one cradle 204, 206 that presses against a non-rotating portion of the brushroll 36', or a belt guard 208, or any combination thereof, and these components of the sole plate 168 may be substantially similar in configuration, placement, and/or function to the wheels 72, 74, sealing strip 78, cradles 80, 82, and belt guard 84 described with respect to FIG. 5 above. In one embodiment, the cradle 204, 206 and belt guard 208 are integrally formed with the sole plate 168, and the wheels 198, 200 and sealing strip 202 are separate parts that are attached to the sole plate 168, for example, after molding the sole plate 168.

**[0124]** The sole plate 168 can secure the brushroll 36' in a working position on the housing 14. Removal of the sole plate 168 from the housing 14' permits the brushroll 36' to thereafter be removed from the housing 14'. The cord guard 170 is removable from the housing 14' with the sole plate 168 for accessing and/servicing the brushroll 36'. As described above, in one embodiment the leading roller 38' can be removed from housing 14' without removing the sole plate 168, although in other embodiments the sole plate 168 can also secure the roller 38' in a working position on the housing 14'.

**[0125]** In one embodiment, the sole plate 168 is attached on the underside 22' of the housing 14' by one or more fasteners, e.g. screws 210. The sole plate 168 can be formed with one or more installation holes 212 and each fastener 210 that passes through one installation hole 212 and engages the housing 14' for fastening the sole plate 168 to the housing 14' in a working position in

which an exterior of the sole plate 168 faces the surface to be cleaned S' (e.g., the floor). The housing 14' can have mounting features for the sole plate, for example screw bosses 214 used for attaching the sole plate 168 by the fasteners 210. One or more of the fasteners 210 can be attached through the bridge 176 to a portion of the housing 14' (e.g., screw boss 214) adjacent the bridge 176.

**[0126]** In some embodiments, the sole plate 168 has, in addition to the cord guard 170, at least one agitator comb 216 configured to remove debris (such as, but not limited to, hair, string, and the like) that may be wrapped around and/or entrained in/on one or more of the agitators as the cleaning base 12' is being operated to clean a surface and without the user having to manually remove the debris from the agitators. The comb 216 and cord guard 170 can coexist on the removable sole plate 168, allowing the user to access, maintain, or replace the agitators and/or drive components for the agitators.

**[0127]** For example, the comb 216 can be configured to contact the leading roller 38' to prevent debris from collecting on the leading roller 38'. While one comb 216 is provided, other variations are possible such as the base 12' including another comb for the brushroll 36' having a comb. The comb 216 is beneficial to prevent debris from collecting on the leading roller 38'.

**[0128]** In this embodiment, the comb 216 may include a plurality of teeth 218 (e.g., spaced projections or tines). The plurality of teeth 218 may provide numerous contact points with the roller 38' to remove debris therefrom, while also reducing potential damage to the bristles and/or pile thereof. The comb 216 may also substantially prevent air flow to a top of the leading roller 38' such that the top of the leading roller 38' is not exposed to the flow path F' to the suction conduit 26'.

**[0129]** The teeth 218 may have angled or hooked ends extending into contact with a surface of the roller 38'. The teeth 218 are spaced from each other and can be mounted within the leading roller chamber 48' or can project into the chamber 48' to contact the roller 38'.

**[0130]** The comb 216 contacts a surface of the leading roller 38', respectively, at a distance T3 above the surface S' thereof to facilitate debris removal. The distance T3 may be greater than the distance H2' of the second axis Y' above the surface S'. As shown in FIG. 15, the comb 216 may be disposed on an upper half and/or a rear side of the leading roller 38'. The contact point of the comb 216 with the roller 38' may be measured at the bottommost point of the teeth 218 that is in contact with a surface of the roller 38'.

**[0131]** In one embodiment, the comb 216 is supported by the bridge 176. For example, the teeth 218 can be supported by the bridge 176. The bridge 176 can have an upper surface 222 that confronts an interior side 224 of the housing 14' when the sole plate 168 is attached to the housing 14' and a lower surface 226 that faces away from the housing 14', with the teeth 218 extending from the lower surface 226.

**[0132]** The teeth 218 can have a leading side 228 facing the roller 38' and a trailing side 230 facing the brushroll 36'. The crosspieces 178 can be attached to the bridge 176 on the trailing side 230 of the teeth 218. The leading side 228 can include angled or hooked ends extending into contact with a surface of the roller 38'. The leading end 190 of the crosspiece 178 can attach to bridge 176 at the trailing side 230 of the teeth 218.

**[0133]** With the comb 216 supported by the bridge 176, and bridge 176 having a clearance (e.g., clearance H6) from the surface S', the comb 216 is also spaced from the surface S' and/or from a bottommost underside of the sole plate 168. Spacing the comb 216 from the surface to be cleaned and/or from a bottommost underside of the sole plate 168 allows large debris to be ingested without blocking them by the comb 216. Another benefit is that removal of the sole plate 168 from the housing 14' simultaneously removes the comb 216 and any debris captured on the teeth 218 from the housing 14' and the comb 216 can be cleaned off over a waste receptacle for convenient disposal of the debris.

**[0134]** The comb 216 can be a separate part that is attached to the sole plate 168, or can be built directly into the sole plate 168. In one non-limiting example, the sole plate 168 can be a unitary, monolithic part and the comb 216 is integrally formed with the sole plate 168, such as by plastic injection molding.

**[0135]** Although specific embodiments of the cleaning base with dual agitators and a cord guard are shown, other embodiments of the cleaning base with dual agitators and a cord guard are within the scope of the present invention. The cleaning base with dual agitators and a cord guard may be used in different types of vacuum cleaners including, without limitation, an "all in the head" type vacuum, upright vacuum cleaners having a cleaning base and an upright body for directing the base across the surface to be cleaned, canister vacuum cleaners having a cleaning implement connected to a wheeled base by a vacuum hose, stick vacuum cleaners, portable vacuum cleaners adapted to be hand carried by a user for cleaning relatively small areas, robotic vacuum cleaners, and central vacuum systems. The cleaning base with dual agitators and a cord guard may also be used in vacuum cleaners having liquid and/or steam delivery. The cleaning base may be similarly removable.

**[0136]** The terms "comprising" or "comprise" are used herein in their broadest sense to mean and encompass the notions of "including," "include," "consist(ing) essentially of," and "consist(ing) of." The use of "for example," "e.g.," "such as," and "including" to list illustrative examples does not limit to only the listed examples. Thus, "for example" or "such as" means "for example, but not limited to" or "such as, but not limited to" and encompasses other similar or equivalent examples.

**[0137]** The above description relates to general and specific embodiments of the invention. However, various alterations and changes can be made without departing from the invention as defined in the appended claims,

which are to be interpreted in accordance with the principles of patent law including the doctrine of equivalents. As such, this disclosure is presented for illustrative purposes and should not be interpreted as an exhaustive description of all embodiments of the invention or to limit the scope of the claims to the specific elements illustrated or described in connection with these embodiments. Any reference to elements in the singular, for example, using the articles "a," "an," "the," or "said," is not to be construed as limiting the element to the singular.

**[0138]** Likewise, it is also to be understood that the appended claims are not limited to express and particular compounds, compositions, or methods described in the detailed description, which may vary between particular embodiments that fall within the scope of the appended claims. With respect to any Markush groups relied upon herein for describing particular features or aspects of various embodiments, different, special, and/or unexpected results may be obtained from each member of the respective Markush group independent from all other Markush members. Each member of a Markush group may be relied upon individually and or in combination and provides adequate support for specific embodiments within the scope of the appended claims.

## Claims

### 1. A vacuum cleaner (10) comprising:

a housing (14) having a front side (16F) and a back side (16B), the housing (14) defining an agitator chamber (24) and a suction conduit (26) with a suction conduit opening (28) on an underside (22) of the housing (14) between the front side (16F) and the back side (16B) and facing a surface to be cleaned, wherein the suction conduit (26) passes through at least a portion of the agitator chamber (24);  
 a first agitator (36) rotatably mounted to the housing (14) within the agitator chamber (24) with at least a portion of the first agitator (36) extending through the suction conduit opening (28), the first agitator (36) rotatable about a first agitator axis (X);  
 a second agitator (38) mounted to the housing (14) in front of the first agitator (36) and rotatable about a second agitator axis (Y);  
 a sole plate (62) removably attached on the underside (22) of the housing (14), the sole plate (62) defining at least a portion of the suction conduit opening (28); and  
 a cord guard (40) hinged to the housing (14), the cord guard (40) comprising a first end (86), a second end (88), and at least one crosspiece (90) extending between the first end (86) and the second end (88);

wherein the first end (86) of the cord guard (40) is pivotally attached to the housing (14) and defines an axis of rotation (C) of the cord guard (40);

wherein the second end (88) of the cord guard (40) is pivotable between a working position in which the at least one crosspiece (90) traverses the suction conduit opening (28) and an open position in which the first agitator (36) can be removed from the housing (14); and

wherein the axis of rotation (C) of the cord guard (40) is intermediate the first agitator axis (X) and the second agitator axis (Y).

2. The vacuum cleaner (10) of claim 1, wherein at least the second end (88) of the cord guard (40) is clamped between the housing (14) and the sole plate (62) to hold the cord guard (40) in the working position, optionally comprising a plurality of fasteners (64) attaching the sole plate (62) to the underside (22) of the housing (14), wherein the plurality of fasteners (64) comprises at least one fastener attached over the second end (88) of the cord guard (40) to distribute the fastening force of the at least one fastener to the cord guard (40).

3. The vacuum cleaner (10) of any one of claims 1-2, wherein the housing (14) comprises an accommodation groove (130) recessed in the underside (22) thereof, wherein the second end (88) of the cord guard (40) is received in the accommodation groove (130) in the working position, and wherein the accommodation groove (130) is covered by the sole plate (62) when the sole plate (62) is attached to the housing (14) to enclose the at least the second end (88) of the cord guard (40) within the accommodation groove (130), optionally wherein the sole plate (62) comprises an interior side (126) that confronts an interior (124) of the housing (14) when the sole plate (62) is attached to the housing (14) and a clamp (128) on the interior side (126), wherein the clamp (128) receives a portion of the second end (88) of the cord guard (40) when the sole plate (62) is attached to the housing (14) to clamp at least the second end (88) of the cord guard (40) between the housing (14) and the sole plate (62) to hold the cord guard (40) in the working position.

4. The vacuum cleaner (10) of any one of claims 1-3, wherein, the housing (14) comprises a wall (138) defining a rear wall of the agitator chamber (24), the rear wall is formed with at least one guard opening (140) for the cord guard (40), the suction conduit (26) passes through the rear wall, and the at least one crosspiece (90) passes through the guard opening in the rear wall.

5. The vacuum cleaner (10) of any one of claims 1-4, wherein the at least one crosspiece (90) extending between the first end (86) and the second end (88) comprises a plurality of crosspieces (90) extending between the first end (86) and the second end (88), optionally wherein the first end (86) comprises a first traverse segment (102) extending centrally between the plurality of crosspieces (90) and the second end (88) comprises a second traverse segment (104) extending centrally between the plurality of crosspieces (90).
6. The vacuum cleaner (10) of any one of claims 1-5, wherein the cord guard (40) comprises a first cord guard frame (106A) and a second cord guard frame (106B) lateral to the first cord guard frame (106A), wherein each cord guard frame comprises a plurality of crosspieces (90).
7. The vacuum cleaner (10) of any one of claims 1-6, wherein the cord guard (40) is formed at least partially of plastic coated rigid metal wire having a diameter of 2.0-3.0 mm.
8. The vacuum cleaner (10) of any one of claims 1-7, wherein the sole plate (62) comprises frame including a rear frame wall (66), a first side frame wall (68), a second side frame wall (70), the suction conduit opening (28) being bordered by the rear frame wall (66), the first side frame wall (68), and the second side frame wall (70), wherein the rear frame wall (66) comprises a leading edge (66L) that defines a rear peripheral edge of the suction conduit opening (28), optionally comprising a plurality of wheels (72, 74) rotatably coupled to an underside of the sole plate (62).
9. The vacuum cleaner (10) of any one of claims 1-8, wherein:
  - the first agitator axis (X) has a first clearance (H1) from the surface to be cleaned when the housing (14) is supported on the surface to be cleaned;
  - the second agitator axis (Y) has a second clearance (H2) from the surface to be cleaned when the housing (14) is supported on the surface to be cleaned;
  - the axis of rotation (C) of the cord guard (40) has a third clearance (H3) from the surface to be cleaned when the housing (14) is supported on the surface to be cleaned; and
  - the third clearance is greater than the first clearance and greater than the second clearance.
10. The vacuum cleaner (10) of any one of claims 1-9, comprising at least one hinge bracket (110) on the housing (14) pivotally connecting the first end (86) of the cord guard (40) to the housing (14), wherein the hinge bracket (110) is intermediate the first agitator (36) and the second agitator (38).
11. The vacuum cleaner (10) of any one of claims 1-10, wherein the axis of rotation (C) of the cord guard (40) has a first clearance (H3) from the surface to be cleaned when the housing (14) is supported on the surface to be cleaned, wherein the second end (88) of the cord guard (40) has a second clearance (H4) from the surface to be cleaned when the housing (14) is supported on the surface to be cleaned, and wherein the first clearance is greater than the second clearance.
12. The vacuum cleaner (10) of any one of claims 1-11, wherein the at least one crosspiece (90) wraps around a portion of a circumference of the first agitator (36) that is greater than 90 degrees and less than 180 degrees.
13. The vacuum cleaner (10) of any one of claims 1-12, wherein the first agitator (36) has a plurality of bristles (92) that extend radially outward from a sidewall (94) of the first agitator (36), wherein the plurality of bristles extend beyond the at least one crosspiece (90) in the working position and the sidewall does not contact the at least one crosspiece (90) in the working position.
14. The vacuum cleaner (10) of any one of claims 1-13, wherein the housing (14) comprises an agitator comb (154) configured to remove debris from the second agitator (38), wherein the first end (86) of the cord guard (40) is pivotally attached to the agitator comb (154), optionally wherein the agitator comb (154) has a leading side (164) facing the second agitator (38) and a trailing side (166) facing the first agitator (36), wherein the leading side (164) comprises a plurality of teeth (158) configured to contact to the surface of the second agitator (38) and the first end (86) of the cord guard (40) is pivotally attached to the trailing side (166) of the agitator comb (154).
15. A vacuum cleaner (10) comprising:
  - a housing (14) having a front side (16F) and a back side (16B), the housing (14) defining an agitator chamber (24) and a suction conduit (26) with a suction conduit opening (28) on an underside (22) of the housing (14) between the front side (16F) and the back side (16B) and facing a surface to be cleaned, wherein the suction conduit (26) passes through at least a portion of the agitator chamber (24);
  - a first agitator (36) rotatably mounted to the housing (14) within the agitator chamber (24)



with at least a portion of the first agitator (36) extending through the suction conduit opening (28), the first agitator (36) rotatable about a first agitator axis (X);  
 a second agitator (38) mounted to the housing (14) in front of the first agitator (36) and rotatable about a second agitator axis (Y); and  
 a sole plate (62) removably attached on the underside (22) of the housing (14), the sole plate (62) defining at least a portion of the suction conduit opening (28), the sole plate (62) comprising:

a frame (172) comprising at least a rear frame wall (174) behind the first agitator axis (X);  
 a bridge (176) intermediate the first agitator axis (X) and the second agitator axis (Y); and  
 a cord guard (40) traversing the suction conduit opening (28) to block the suction conduit (26), the cord guard (40) comprising a plurality of crosspieces (90) extending from the rear frame wall (174) to the bridge (176) to traverse the suction conduit opening (28), wherein the plurality of crosspieces (90) pass below the first agitator axis (X); wherein removal of the sole plate (62) from the underside (22) of the housing (14) simultaneously removes the cord guard (40) from blocking the suction conduit (26).

35

40

45

50

55

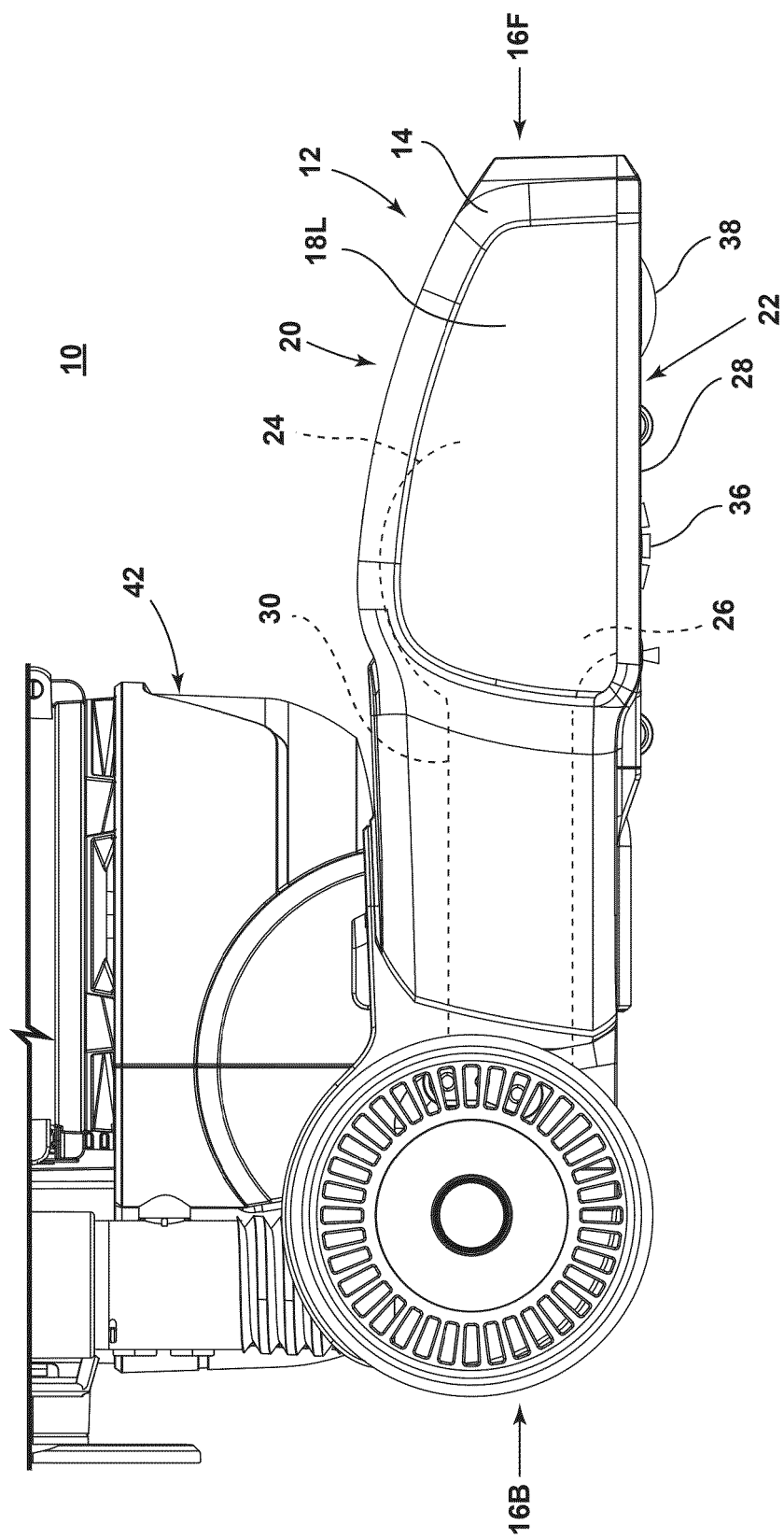


FIG. 1

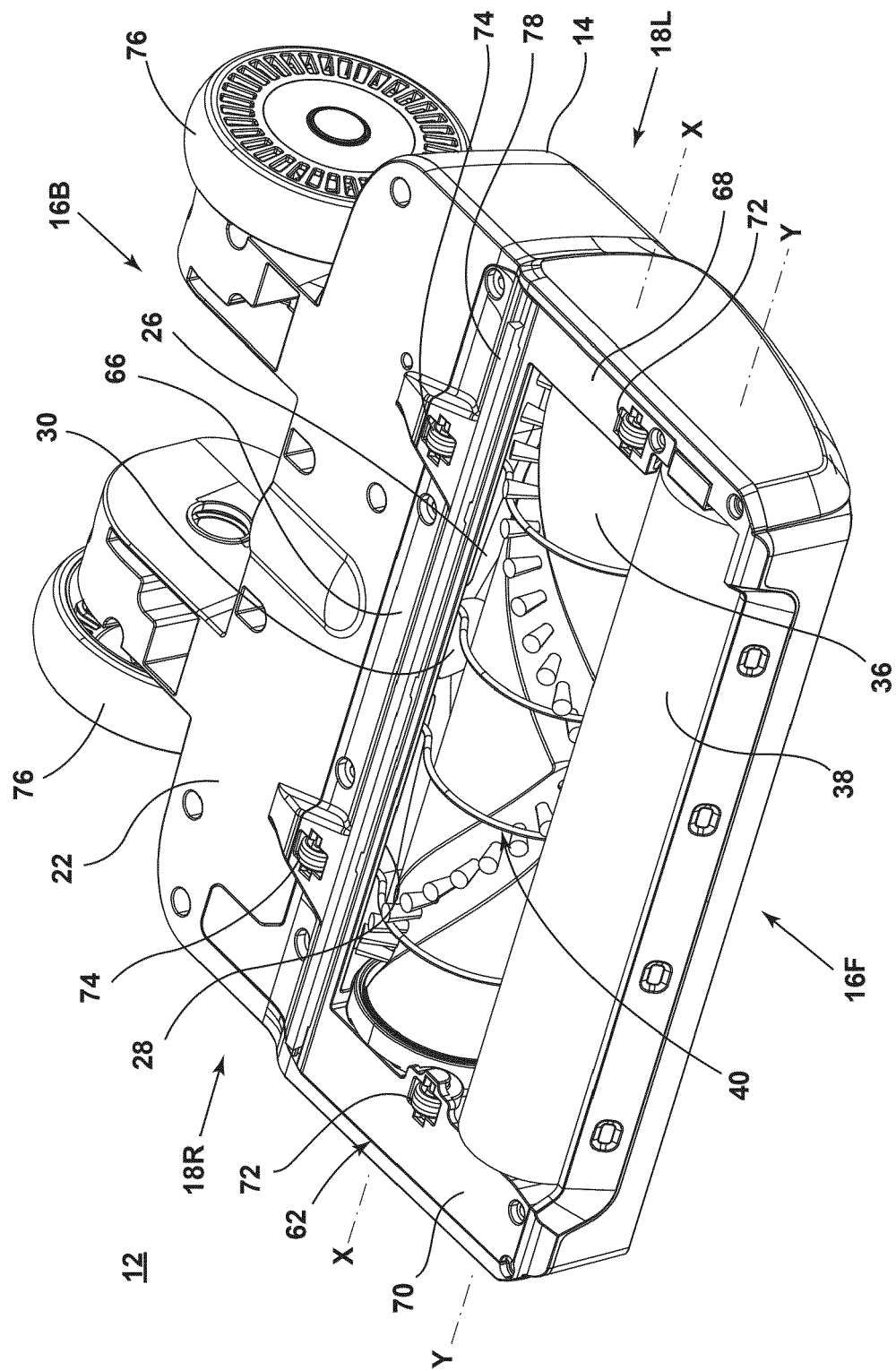


FIG. 2

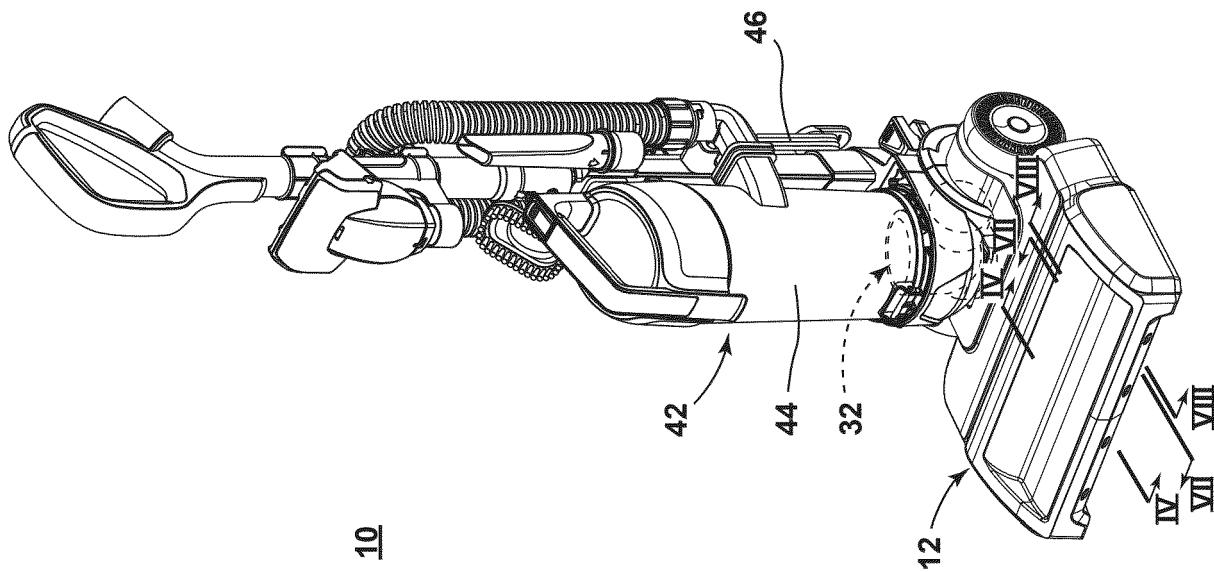


FIG. 3

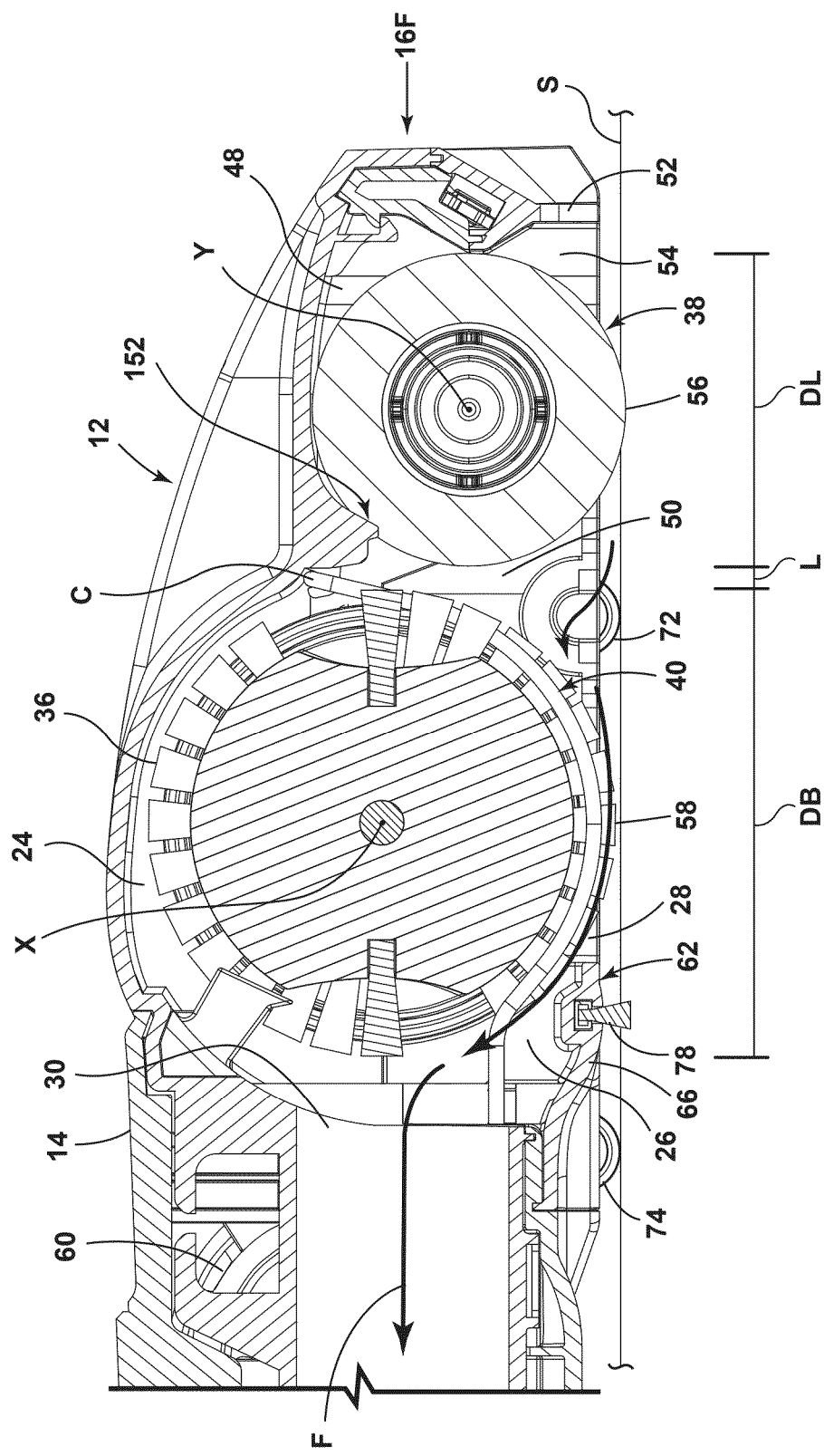


FIG. 4

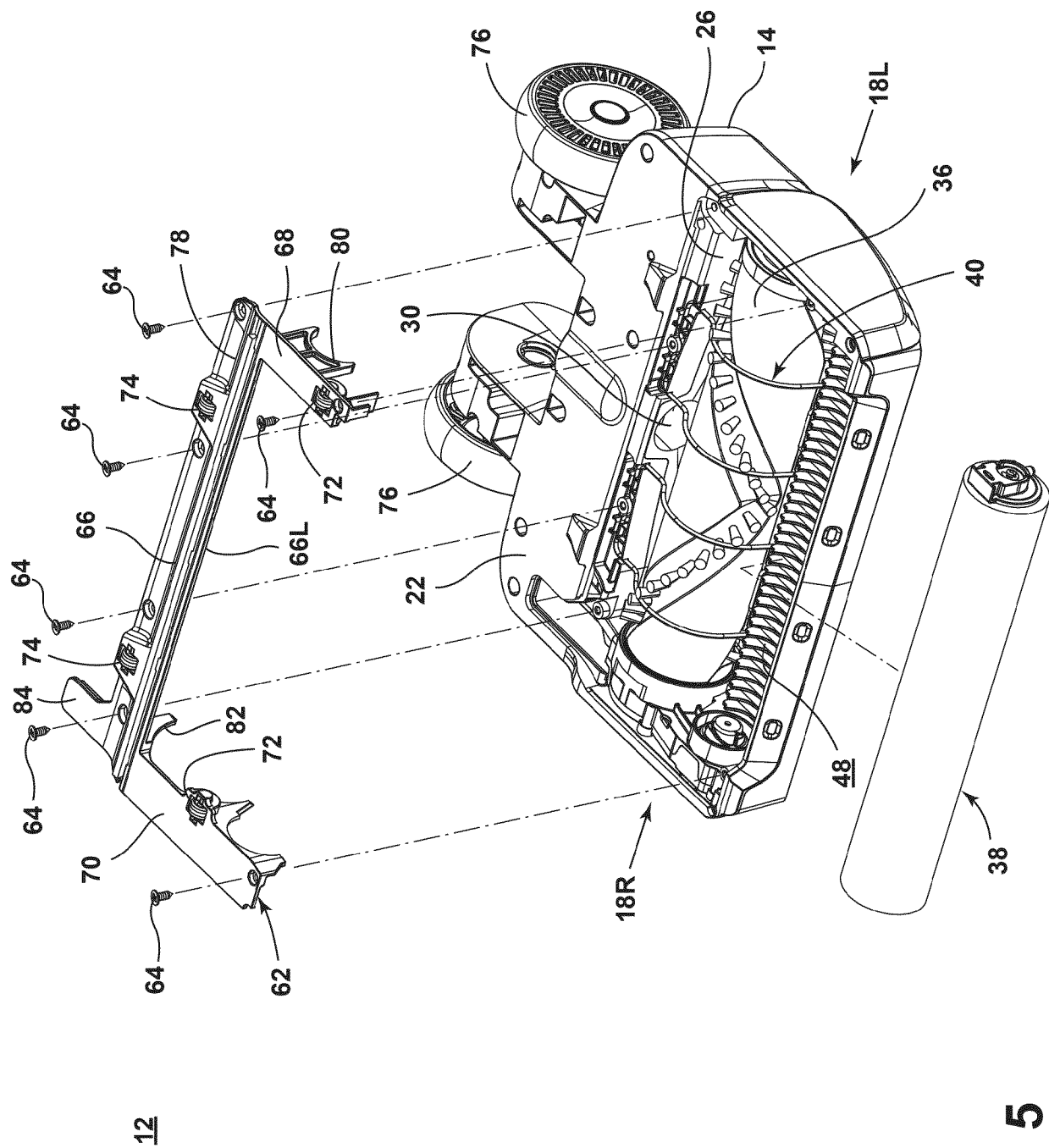


FIG. 5

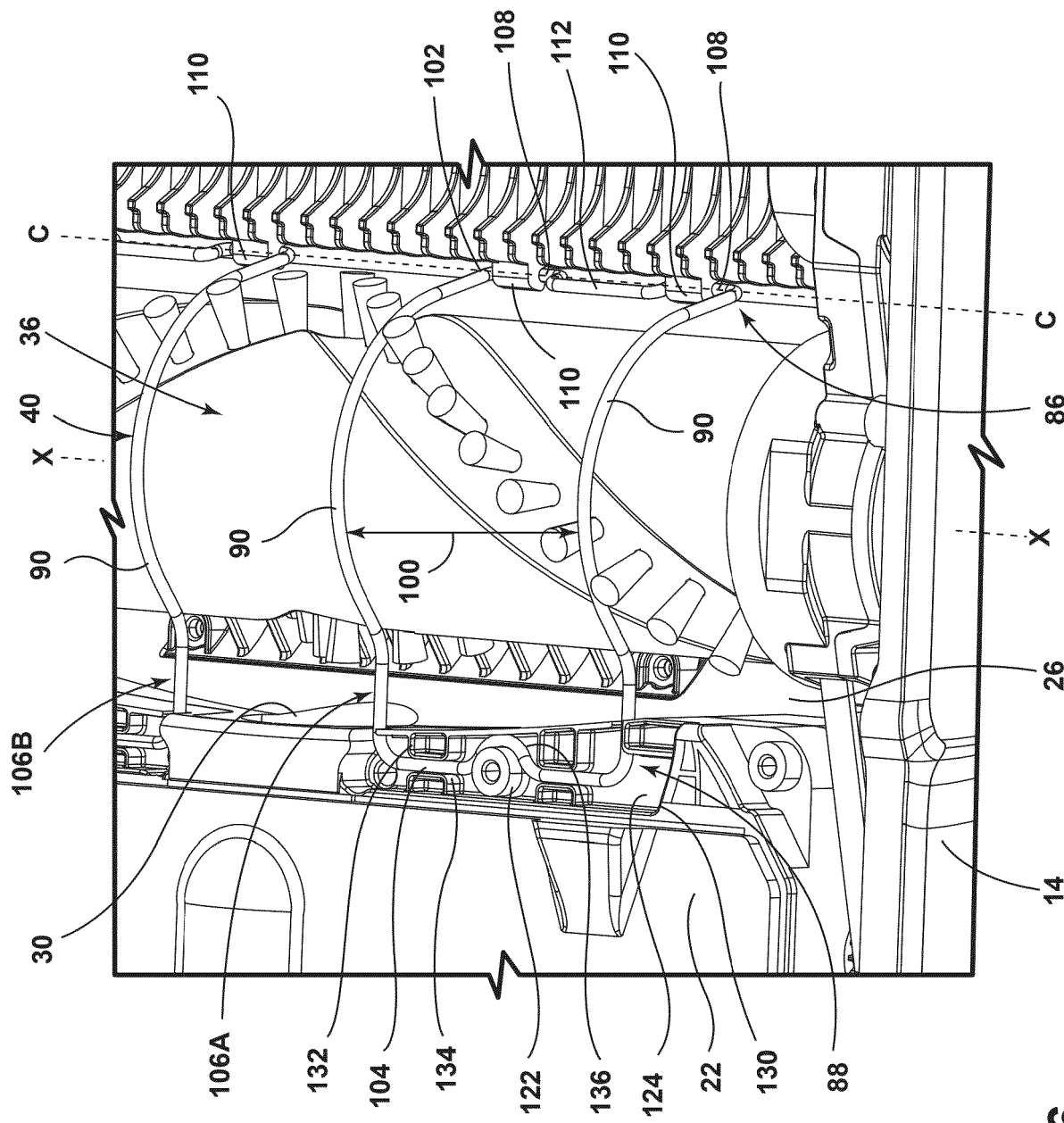


FIG. 6

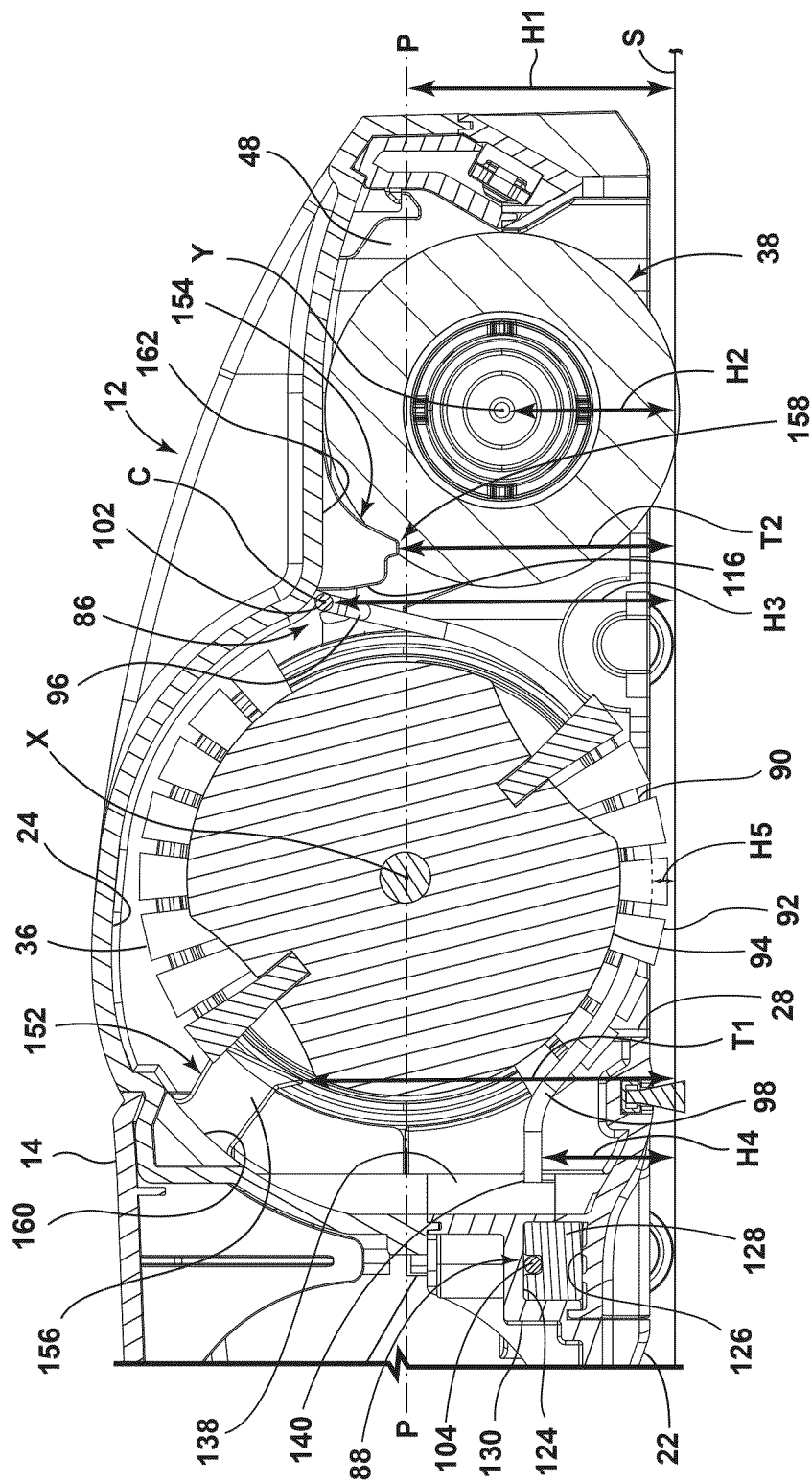
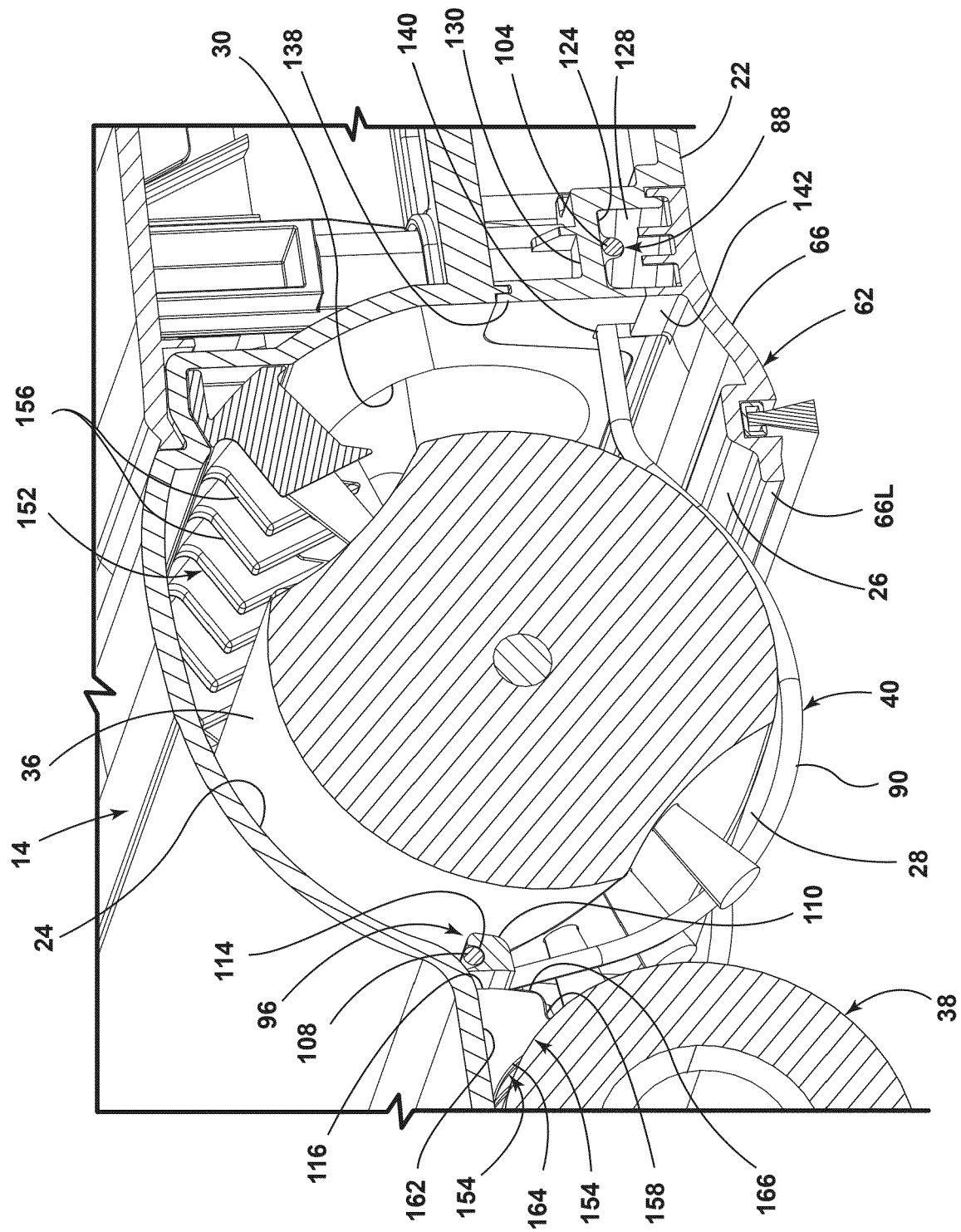


FIG. 7





8  
G  
E

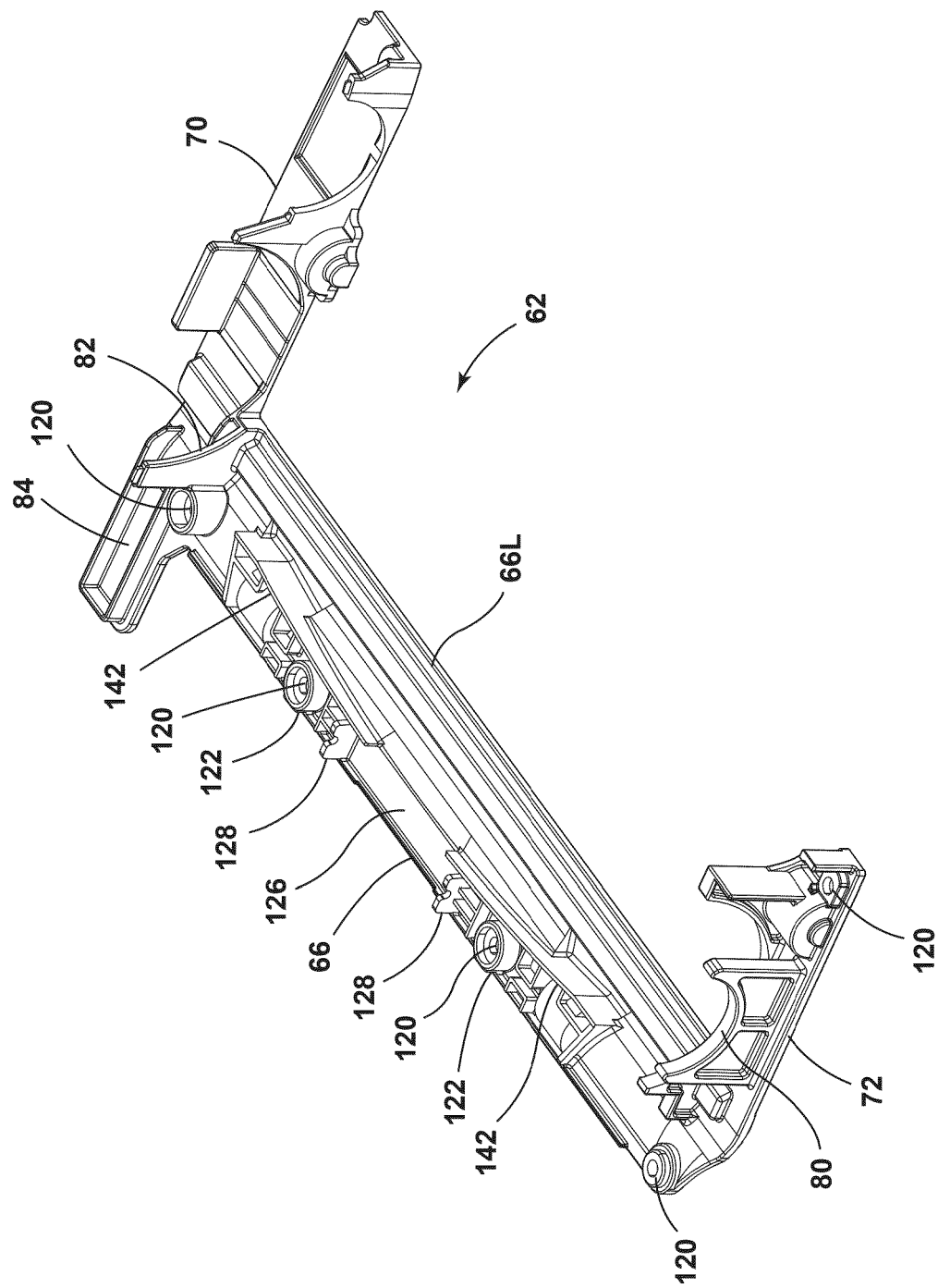


FIG. 9

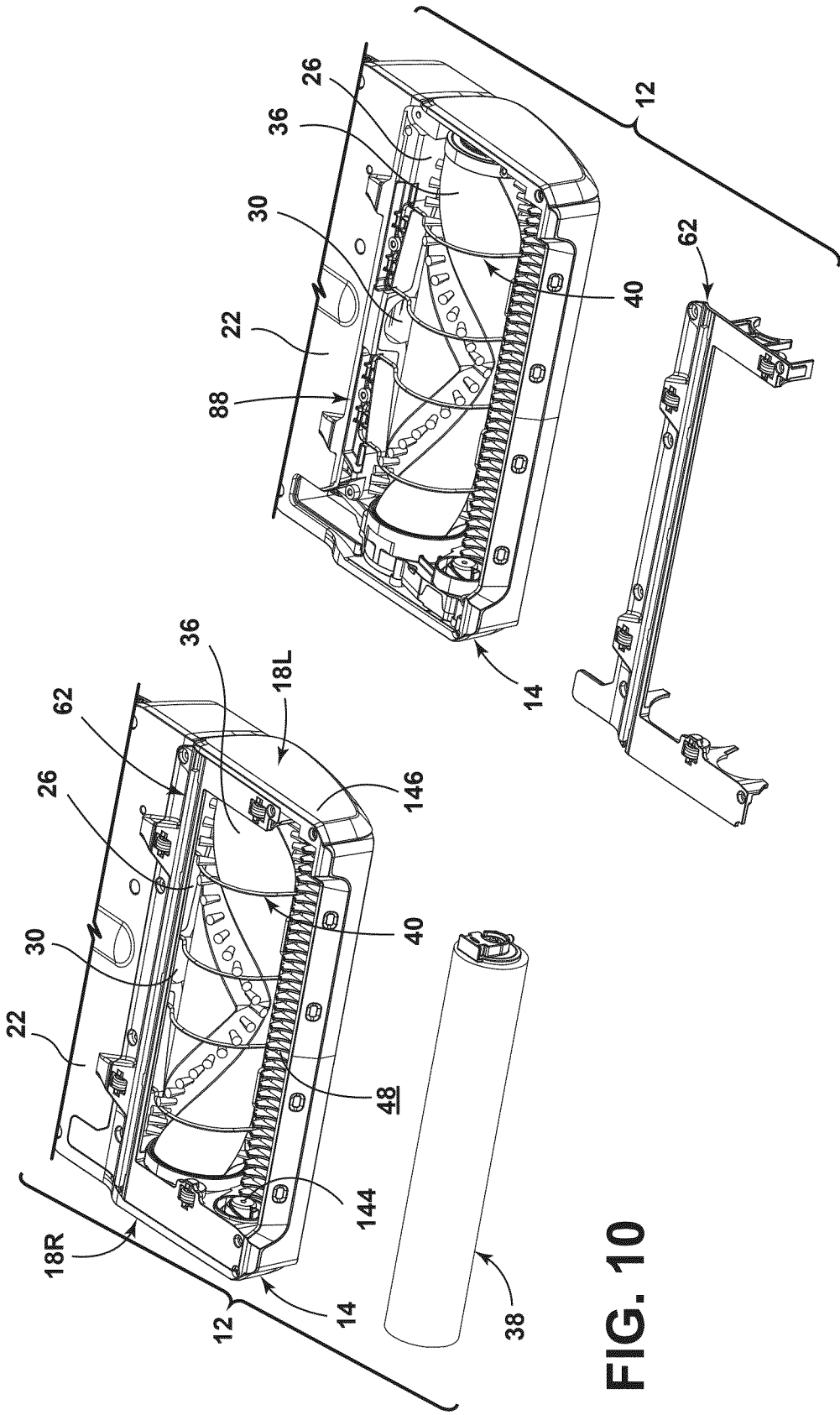


FIG. 10

FIG. 11

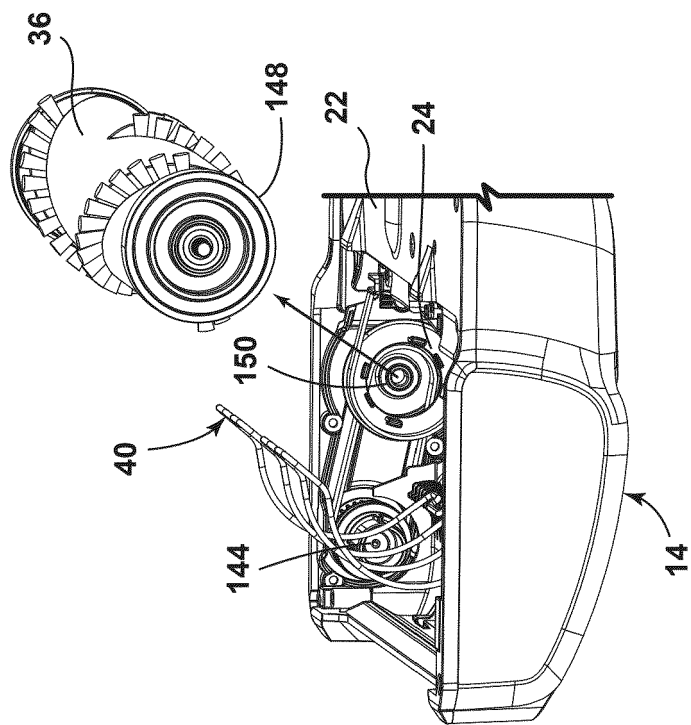


FIG. 13

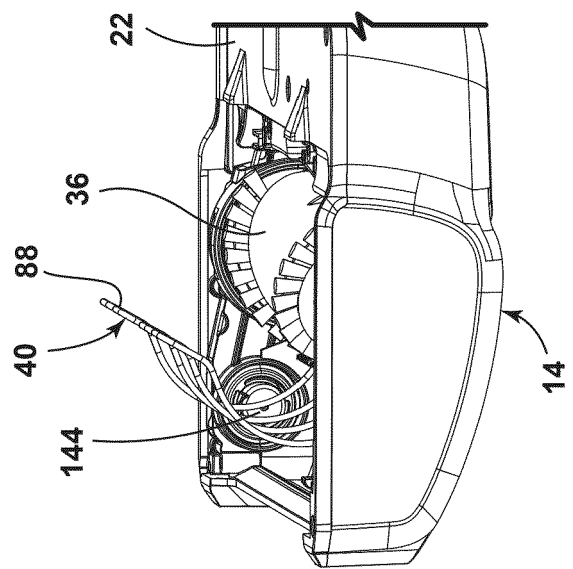


FIG. 12

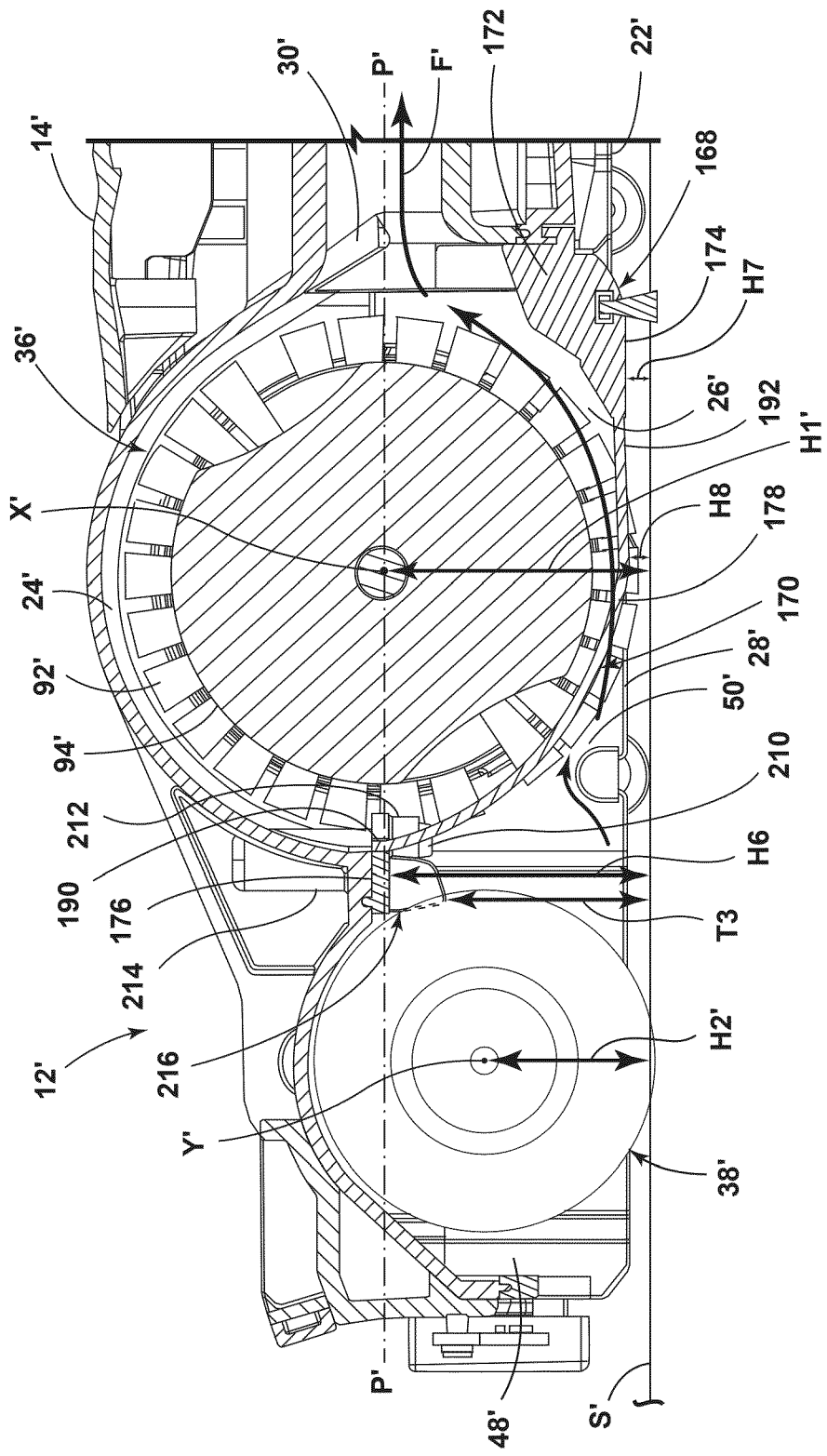


FIG. 14

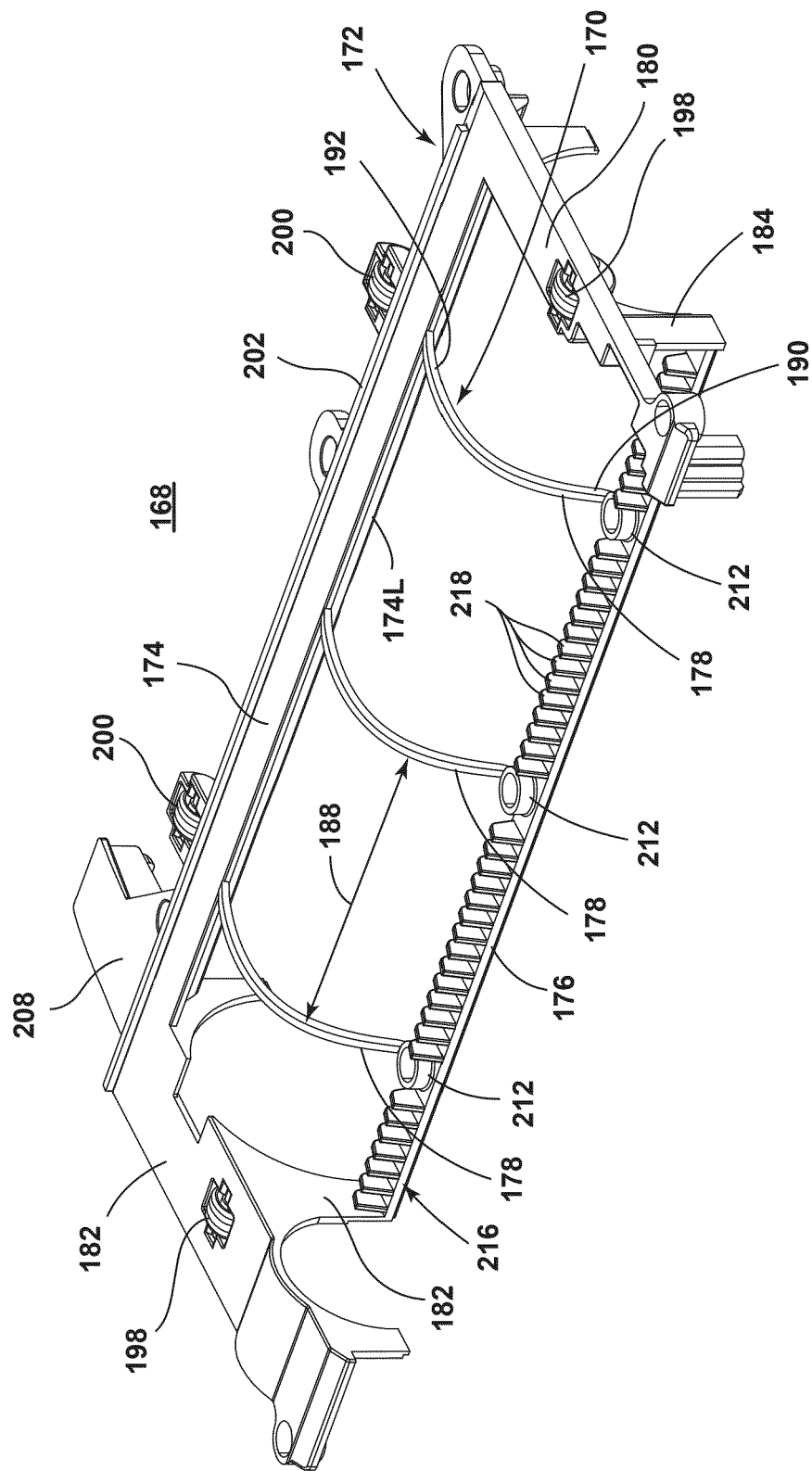


FIG. 15

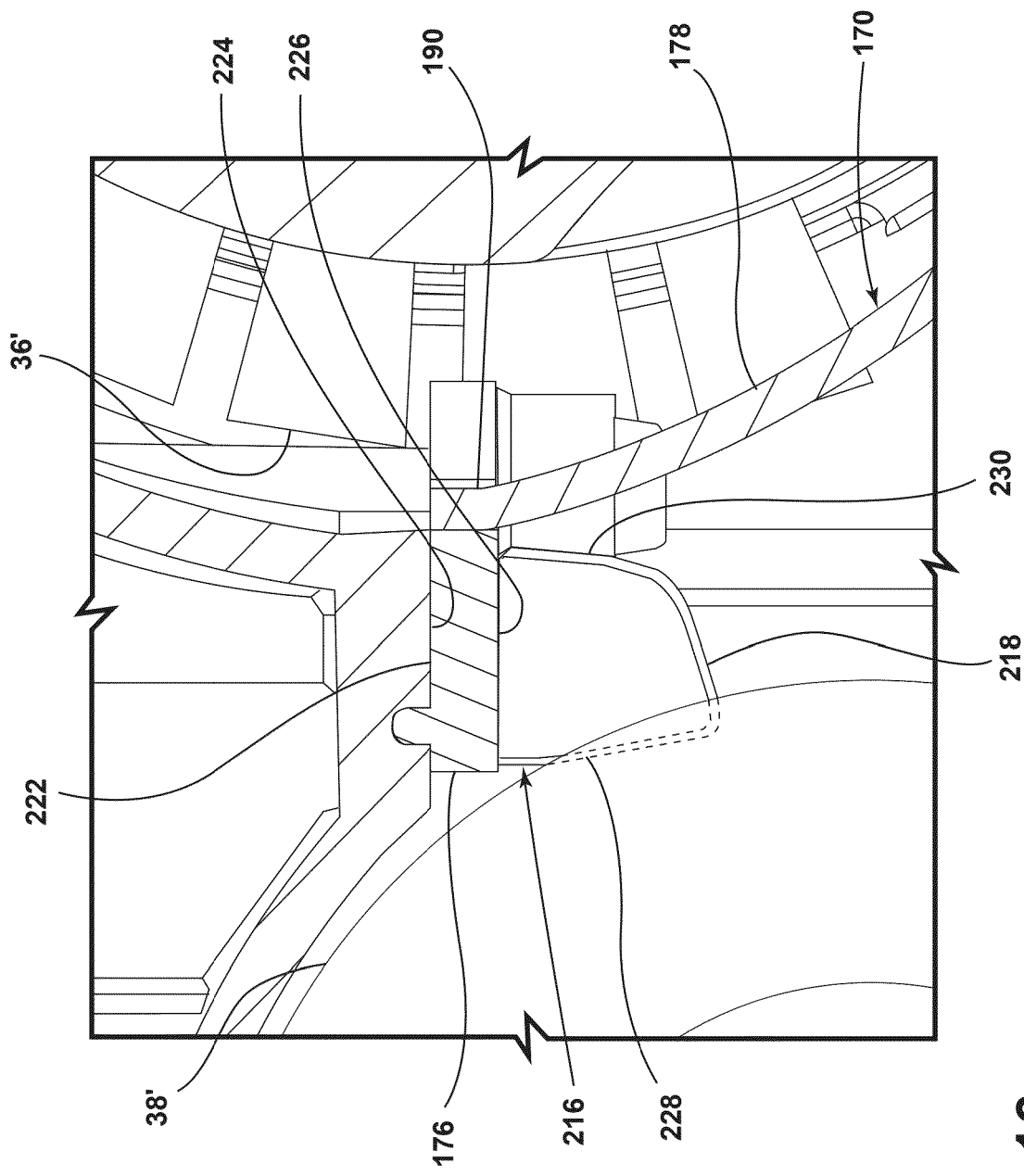


FIG. 16



## EUROPEAN SEARCH REPORT

Application Number

EP 25 21 3502

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category                                                                                                                                                                                                                                                                     | Citation of document with indication, where appropriate, of relevant passages                                                                                                            | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC)  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------|
| A                                                                                                                                                                                                                                                                            | AU 2019 246 800 B2 (SHARKNINJA OPERATING LLC [US]) 24 June 2021 (2021-06-24)<br>* no cord guard covering the first agitator (claim 1) or the suction inlet (claim 15);<br>figures 1-10 * | 1-15                             | INV.<br>A47L5/30<br>A47L9/00<br>A47L9/04 |
| A                                                                                                                                                                                                                                                                            | US 10 702 108 B2 (SHARKNINJA OPERATING LLC [US]) 7 July 2020 (2020-07-07)<br>* dual agitator cleaner;<br>figure 10 *                                                                     | 1-15                             |                                          |
|                                                                                                                                                                                                                                                                              |                                                                                                                                                                                          |                                  | TECHNICAL FIELDS SEARCHED (IPC)          |
|                                                                                                                                                                                                                                                                              |                                                                                                                                                                                          |                                  | A47L                                     |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                   |                                                                                                                                                                                          |                                  |                                          |
| Place of search                                                                                                                                                                                                                                                              |                                                                                                                                                                                          | Date of completion of the search | Examiner                                 |
| Munich                                                                                                                                                                                                                                                                       |                                                                                                                                                                                          | 4 March 2026                     | Trimarchi, Roberto                       |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                  |                                                                                                                                                                                          |                                  |                                          |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document                                                      |                                                                                                                                                                                          |                                  |                                          |
| T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                                                          |                                  |                                          |

EPO FORM 1503 03.82 (P34C01)



# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 25 21 3502

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-03-2026

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| <b>AU 2019246800 B2</b>                   | <b>24-06-2021</b>   | <b>AU 2016341998 A1</b>    | <b>10-05-2018</b>   |
|                                           |                     | <b>AU 2016342001 A1</b>    | <b>10-05-2018</b>   |
|                                           |                     | <b>AU 2019246800 A1</b>    | <b>31-10-2019</b>   |
|                                           |                     | <b>AU 2019253786 A1</b>    | <b>14-11-2019</b>   |
|                                           |                     | <b>AU 2021201726 A1</b>    | <b>15-04-2021</b>   |
|                                           |                     | <b>AU 2022202981 A1</b>    | <b>26-05-2022</b>   |
|                                           |                     | <b>CA 3002859 A1</b>       | <b>27-04-2017</b>   |
|                                           |                     | <b>CA 3002867 A1</b>       | <b>27-04-2017</b>   |
|                                           |                     | <b>CA 3223536 A1</b>       | <b>27-04-2017</b>   |
|                                           |                     | <b>CN 106963290 A</b>      | <b>21-07-2017</b>   |
|                                           |                     | <b>CN 108135409 A</b>      | <b>08-06-2018</b>   |
|                                           |                     | <b>CN 108175334 A</b>      | <b>19-06-2018</b>   |
|                                           |                     | <b>CN 112450800 A</b>      | <b>09-03-2021</b>   |
|                                           |                     | <b>CN 113197512 A</b>      | <b>03-08-2021</b>   |
|                                           |                     | <b>CN 114504268 A</b>      | <b>17-05-2022</b>   |
|                                           |                     | <b>CN 206687670 U</b>      | <b>01-12-2017</b>   |
|                                           |                     | <b>CN 208693165 U</b>      | <b>05-04-2019</b>   |
|                                           |                     | <b>EP 3364843 A1</b>       | <b>29-08-2018</b>   |
|                                           |                     | <b>EP 3364844 A1</b>       | <b>29-08-2018</b>   |
|                                           |                     | <b>JP 6737883 B2</b>       | <b>12-08-2020</b>   |
|                                           |                     | <b>JP 6935335 B2</b>       | <b>15-09-2021</b>   |
|                                           |                     | <b>JP 7046465 B2</b>       | <b>04-04-2022</b>   |
|                                           |                     | <b>JP 2018521707 A</b>     | <b>09-08-2018</b>   |
|                                           |                     | <b>JP 2018531108 A</b>     | <b>25-10-2018</b>   |
|                                           |                     | <b>JP 2020114540 A</b>     | <b>30-07-2020</b>   |
|                                           |                     | <b>KR 20180072763 A</b>    | <b>29-06-2018</b>   |
|                                           |                     | <b>KR 20180084055 A</b>    | <b>24-07-2018</b>   |
|                                           |                     | <b>KR 20200080330 A</b>    | <b>06-07-2020</b>   |
|                                           |                     | <b>US 2017127896 A1</b>    | <b>11-05-2017</b>   |
|                                           |                     | <b>US 2018296046 A1</b>    | <b>18-10-2018</b>   |
|                                           |                     | <b>US 2021169289 A1</b>    | <b>10-06-2021</b>   |
|                                           |                     | <b>US 2023090575 A1</b>    | <b>23-03-2023</b>   |
|                                           |                     | <b>US 2024341549 A1</b>    | <b>17-10-2024</b>   |
|                                           |                     | <b>US 20260041292 A1</b>   | <b>12-02-2026</b>   |
|                                           |                     | <b>WO 2017070489 A1</b>    | <b>27-04-2017</b>   |
|                                           |                     | <b>WO 2017070492 A1</b>    | <b>27-04-2017</b>   |
| -----                                     |                     |                            |                     |
| <b>US 10702108 B2</b>                     | <b>07-07-2020</b>   | <b>US 2017347848 A1</b>    | <b>07-12-2017</b>   |
|                                           |                     | <b>US 2020329930 A1</b>    | <b>22-10-2020</b>   |
|                                           |                     | <b>US 2024415345 A1</b>    | <b>19-12-2024</b>   |
| -----                                     |                     |                            |                     |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82