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CORD SAVER RIB

Abstract

A vacuum cleaner including a surface cleaning head having a brushroll rotatable about an axis defining an axial direction, and a brushroll housing at least partially surrounding the brushroll. The brushroll housing includes an outlet port disposed at a first axial location, and a bottom housing. The bottom housing includes a front wall, a rear wall spaced from the front wall to define the suction inlet, and at least one rib disposed below the brushroll and extending across the suction inlet between the front and rear walls. Each rib includes a forward portion connected to the front wall, a rearward portion connected to the rear wall, and a central portion extending linearly orthogonal to the axial direction between the forward and rearward portions. The rearward portion is turned toward the first axial location of the outlet port to define a flow guide.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application claims priority to U.S. Provisional Patent Application No. 63/376,877, filed Sep. 23, 2022, the entire contents of which are hereby incorporated by reference herein.

TECHNOLOGICAL FIELD
[0002] The present disclosure relates to a cord saver rib of a brushroll housing on a surface cleaning head for a vacuum cleaner.
SUMMARY
[0003] In one embodiment, the disclosure provides a vacuum cleaner including a suction motor operable to move working air through a working air flow path from a suction inlet to a clean air outlet, a dirt separator located along the working air flow path to separate dirt from the working air, and a surface cleaning head. The surface cleaning head includes a brushroll rotatable about an axis defining an axial direction, and a brushroll housing at least partially surrounding the brushroll. The brushroll housing includes an outlet port disposed at a first axial location of the brushroll housing, and a bottom housing provided on the bottom of the brushroll housing. The bottom housing includes a front wall, a rear wall spaced from the front wall to define the suction inlet, and at least one rib disposed below the brushroll and extending across the suction inlet between the front and rear walls. Each rib includes a forward portion connected to the front wall, a rearward portion connected to the rear wall, and a central portion extending orthogonal to the axial direction between the forward and rearward portions. The rearward portion is turned toward the first axial location of the outlet port to define a flow guide.
[0004] Another embodiment of the disclosure provides a vacuum cleaner including a surface cleaning head with a brushroll and a brushroll housing. A bottom housing of the brushroll housing includes first and second ribs disposed below the brushroll and extending across the suction inlet between the front and rear walls. Each of the first and second ribs includes a forward portion connected to the front wall, a rearward portion connected to the rear wall, and a central portion extending orthogonal to the axial direction between the forward and rearward portions. The rearward portion is turned toward the first axial location of the outlet port to define a flow guide. The first rib is located on a first axial side of the first axial location and the second rib located on a second axial side of the first axial location.
[0005] In another embodiment, the disclosure provides a surface cleaning head with a brushroll and a brushroll housing. A bottom housing of the brushroll housing includes a plurality of ribs disposed below the brushroll. Each rib of the plurality of ribs includes a central portion extending orthogonal to the axis across a suction inlet between the front wall and the rear wall, and a flow guide to direct working air toward the first axial location of the outlet port.
[0006] Other aspects of the disclosure will become apparent by consideration of the detailed description and accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0007] FIG. **1** is a perspective view of a vacuum cleaner of an embodiment of the disclosure.
[0008] FIG. **2** is a cross-section view taken along line **2-2** of FIG. **1**.
[0009] FIG. **3** is a top view of a bottom housing of a brushroll housing of the vacuum cleaner of

FIG. **1**.
[0010] FIG. **4** is a perspective view of the bottom housing of FIG. **3**.
[0011] FIG. **5** is a section view taken along line **5-5** of FIG. **1**.
[0012] FIG. **6** is a cross-section view similar to FIG. **5**.
[0013] FIG. **7** is a cross-section view taken along line **7-7** of FIG. **1**.

DETAILED DESCRIPTION

[0014] Before any embodiments are explained in detail, it is to be understood that the disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The disclosure is capable of other embodiments and of being practiced or of being carried out in various ways.
[0015] FIG. **1** illustrates a vacuum cleaner **10** according to one embodiment. The vacuum cleaner **10** includes a surface cleaning head **12** and an upper body **14** pivotally connected to the rear end of the surface cleaning head **12** for pivoting between an upright stowed position and a lowered in-use position. The upper body **14** includes a handle **16** to be gripped by an operator for moving the vacuum cleaner **10** across a surface to be cleaned. The illustrated vacuum cleaner **10** is an upright style vacuum cleaner. Other embodiments of the vacuum cleaner **10** could also include a canister style cleaner, a central vacuum system, a hard floor wet cleaner, a carpet extractor, a pole vacuum, a stick vacuum, or a handheld vacuum.
[0016] The upper body **14** also includes a suction motor (not shown) positioned within a motor housing **18** at the base of the upper body **18**. The suction motor is oriented such that an axis of rotation **20** of the motor shaft (not shown) is horizontal. The suction motor operates to move working air through a working air flow path from a suction inlet **34** to a clean air outlet **36**. The upper body also includes a dirt separator **22** located along the working air flow path to separate dirt and debris from the working air. The dirt separator **22** includes a dirt cup **24** removable from the upper body **14** for emptying. The dirt cup **24** includes a cylindrical wall **26**, a pivoting bottom door **28**, and an openable cover **30** having a carry handle **32**. The dirt cup **24** includes a cyclonic dirt separator (not shown) within the cylindrical wall **26**. The cyclonic dirt separator may include a single stage cyclone, a dual stage cyclone arrangement, or a multi-cyclone arrangement having a second stage with a plurality of cyclones in parallel. The dirt separator **22** may also include a filter bag or other non-cyclonic dirt separator.
[0017] With further reference to FIG. **2**, the surface cleaning head **12** includes a body **38**, a brushroll housing **40** at the front of the body **12**, and wheels **42** rotatably mounted at the rear of the body **38**. The surface cleaning head **12** also includes a brushroll **44** mounted for rotation about a brushroll axis **46** within the brushroll housing **40**, which substantially surrounds the brushroll **44**. The brushroll axis **46** defines an axial direction. The brushroll housing **40** includes a top housing **48** defining an upper portion of the brushroll housing **40** and a bottom housing **50** defining a lower portion of the brushroll housing **40**. The top housing **50** includes an outlet port **52** upstream along the working air flow path from the dirt separator **22** and suction motor. The outlet port **52** is located at a first axial location **54** along the brushroll axis **46**. The outlet port **52** is located offset from the axial center of the surface cleaning head **12**, however the outlet port **52** could be located at any axial position along the brushroll housing **40**. Although the illustrated surface cleaning head **12** is a main surface cleaning head of illustrated vacuum cleaner **10**, the surface cleaning head **12** could instead be an auxiliary surface cleaning head such as an accessory tool attachable to a vacuum cleaner hose for above floor cleaning.
[0018] The surface cleaning head **12** also includes a belt guard **56** extending between the back of the body **38** to the brushroll housing **40** and a belt **58** coupling the motor shaft and the brushroll **44** such that when the suction motor is turned on, the motor shaft will rotate to drive the belt **58** to in turn rotate the brushroll **44**. The belt **58** and belt guard **56** are located at a second axial position **70** spaced from the first axial position **54** of the outlet port **52**. The surface cleaning head **12** may also include a brushroll shutoff mechanism to alternately couple and decouple the belt connection via a

tensioner between the motor shaft and the brushroll to, for example, create slack in the belt **58** to stop the rotation of the brushroll **44** when the upper body **14** is in the upright position. The brushroll shutoff mechanism can be manually actuated or automatic based on the position of the upper body **14** relative to the surface cleaning head **12**.

[0019] With further reference to FIGS. **5-7**, the brushroll **44** includes a shaft **60**, a hub **62** connected to and rotatable with the shaft **60**, and bristles **64** extending radially outward from the hub **62** to agitate a surface to be cleaned during rotation of the brushroll **44**. The shaft **60** is mounted to the end walls **66** of the brushroll housing **40** for rotation. In some embodiments, end caps **68** are used to support bearings that rotatably support the shaft **60**. In some arrangements, the end caps **68** can be removably mounted to the end walls **66** such that the brushroll **44** can be removed from the brushroll housing **40**. The brushroll **44** may also include other configurations that include vanes or microfiber fabric material in addition to or instead of the bristles **64** for agitating a surface to be cleaned.

[0020] As best shown in FIGS. **3-6**, the bottom housing **50** includes a front wall **72** across the front face of the bottom housing **50** and a rear wall **74** across the rear face of the bottom housing **50**. The front wall **72** is spaced apart from the rear wall **74** to define the suction inlet **34**. The front and rear walls **72**, **74** are arranged to slide over the surface to be cleaned. The front wall **72** (including the top surface and bottom surface) is sloped downwardly toward the suction inlet **34** and the rear wall **74** (including the top surface and bottom surface) is sloped upwardly away from the suction inlet **34**. The bottom housing **50** also includes a lower portion of the belt guard **56**. As shown in FIG. **6**, the back lower portion of the bottom housing **50** includes a bristle strip **92** extending across the brushroll housing **40** in the axial direction to inhibit dirt and debris from being flung from the rotating brushroll **44** rearwardly of the rear wall **74** such that such dirt and debris can be drawn into the suction inlet **34**. In some embodiments, the bottom housing **50** can include rollers (not shown) positioned on the front wall **72**, rear wall **74**, or both the front and rear walls **72**, **74**.

[0021] Referring to FIG. **3**, the bottom housing includes a plurality of ribs **76** located below the brushroll **44** and extending across the suction inlet between the front and rear walls **72**, **74**. The ribs **76** can also be referred to as “cord saver ribs” because if the surface cleaning head **12** is moved across a power cord lying on the surface to be cleaned, the spacing between the ribs **76** is sufficiently close to inhibit the cord from passing into the brushroll housing **40** far enough to wrap around the rotating brushroll **44**.

[0022] Each rib **76** includes a forward portion **78** connected to the front wall **72**, a rearward portion **80** connected to the rear wall **74**, and a central portion **82** extending linearly orthogonal to the axial direction between the forward and rearward portions **78**, **80**. The rearward portion **80** is turned toward the first axial location **54** of the outlet port **52** to define a flow guide. In the illustrated embodiment, the rearward portion **80** is angled at an angle **84** relative to the central portion **82** toward the first axial location **54** of the outlet port **52** to define a flow guide. In other words, the rearward portion **80** is angled relative to the central portion **82** such that the rearward portion **80** points toward the outlet port **52**. In some embodiments, the angle **84** is between 30 and 60 degrees, between 40 and 50 degrees, or about 45 degrees. The forward portion **78** is aligned with the central portion **82**. In other embodiments, the rearward portion includes an arc that is curved toward the first axial location **54** of the outlet port **52** to define the flow guide

[0023] Each rib **76** includes a thickness “t” measured in the axial direction and a height “h” measured in the vertical direction orthogonal to the axial direction. In some embodiments, the height h is greater than the thickness t. For example, the height h may be greater than 3 mm and the thickness may be less than 2 mm. In some embodiments, the bottom housing **50** is integrally molded as a single piece including the front wall, rear wall, ribs, and a portion of the belt guard. Each rib **76** includes a rear edge **86** that slopes downwardly from the top of the central portion **82** toward a top surface of the rear wall **74** and a front edge **88** that slopes downwardly from the top of the central portion **82** toward a top surface of the front wall **72**. The rear edge **86** slopes in an

opposite direction of the top surface of the rear wall **74**. The front edge slopes in an opposite direction of the top surface of the front wall **72**. The top surface of the central portion includes a downwardly curved portion **90** defining a recess to accommodate and prevent interference with the brushroll **44**. The lower surface of the central portion **82** likewise includes a rounded edge to maintain a generally constant height h across the length of the rib **76**.

[0024] With reference to FIGS. **3** and **5**, the rear wall **74** of the bottom housing **50** includes a top surface that spans a distance between the suction inlet **34** adjacent its forward end and the outlet port **52** adjacent its rearward end. The rearward portion of each rib **76**, which defines the flow guide, is positioned on the top surface of the rear wall **74** along this distance between the suction inlet **34** and the outlet port **52**.

[0025] As best illustrated in FIG. **3**, the first rib **76** (starting from left-to-right) is located to one side of the first axial location and includes a rearward portion **80** angling in a first axial direction toward the outlet port **52**. The second rib **76** is located to the opposite side of the first axial location and includes a rearward portion **80** angling in an opposite axial direction toward the outlet port **52**. The first and second ribs **76** are mirror images of each other. The third and fourth ribs **76** are configured similarly to the second rib. The fifth rib **76**, also configured similarly to the second rib **76**, is located on the far-right axial side of the belt guard **56** opposite to the first through fourth ribs **76**. Although five ribs **76** are illustrated, four or less ribs could be used or six or more ribs could be used. In addition, although the angle **84**, the thickness t, and the height h are all the same for each of the ribs **76** of the plurality, these feature dimension can vary across the ribs **76**. For example, the magnitude of the angle **84** can increase or decrease in relation to the distance of the individual rib **76** from the first axial location **54**.

[0026] The ribs **76** help deflect the debris into the airstream for transferring dust and debris to the working air path passing through the brushroll housing **40** to the outlet port **52**. More importantly the rearward portion **80** of each rib **76** eliminates a dead air pocket that forms with straight ribs and would otherwise collect debris and prevent debris going into the working air flow path. Tables 1 and 2, provided below, illustrate the benefits of cord saver ribs **76** having turned flow guides formed by the rearward portions **80**. Table 1 is test data from a configuration with straight ribs without flow guides formed by turned rearward portions, and Table 2 is test data gathered from two similar units (Unit #1 and Unit #2) configured with flow guides formed by turned rearward portions.

TABLE-US-00001 TABLE 1 Nozzle Setting Bare Floor Debris Width 12.2 in Nozzle Width 13.0 in Mass of Each Debris 5.6 g Debris Area 336.72 in.sup.2 Total Mass of Debris 22.4 g Results - Unit # 1 Run # 1 Run # 2 Run # 3 Initial Weight 1363.0 g Initial Weight 1383.1 g Initial Weight 1403.4 g Final Weight 1383.1 g Final Weight 1403.4 g Final Weight 1423.8 g Grams Picked Up 20.1 g Grams Picked Up 20.3 g Grams Picked Up 20.4 g Average Grams Picked Up 20.3 g Average Percent Debris 90.48% Collected

TABLE-US-00002 TABLE 2 Nozzle Setting Bare Floor (I) Debris Width 12.2 in Nozzle Width 13.0 in Mass of Each Debris 5.6 g Debris Area 336.72 in.sup.2 Total Mass of Debris 22.4 g Results - Unit 2 Run # 1 Run # 2 Run # 3 Initial Weight 1177.8 g Initial Weight 1199.4 g Initial Weight 1220.6 g Final Weight 1199.4 g Final Weight 1220.6 g Final Weight 1242.0 g Grams Picked Up 21.6 g Grams Picked Up 21.2 g Grams Picked Up 21.4 g Average Grams Picked Up 21.4 g Average Percent Debris 95.54% Collected Results - Unit 3 Run # 1 Run # 2 Initial Weight 1177.5 g Initial Weight 1198.9 g Final Weight 1198.9 g Final Weight 1220.5 g Grams Picked Up 21.4 g Grams Picked Up 21.6 g Average Grams Picked Up 21.5 g Average Percent Debris 95.98% Collected

Claims

1. A vacuum cleaner comprising: a suction motor operable to move working air through a working air flow path from a suction inlet to a clean air outlet; a dirt separator located along the working air flow path to separate dirt from the working air; and a surface cleaning head including a brushroll rotatable about an axis defining an axial direction, a brushroll housing at least partially surrounding the brushroll and having an outlet port disposed at a first axial location of the brushroll housing, and a bottom housing provided on the bottom of the brushroll housing, the bottom housing including a front wall, a rear wall spaced from the front wall to define the suction inlet, and at least one rib disposed below the brushroll and extending across the suction inlet between the front and rear walls, wherein the at least one rib includes a forward portion connected to the front wall, a rearward portion connected to the rear wall and turned toward the first axial location of the outlet port to define a flow guide, and a central portion extending orthogonal to the axial direction between the forward and rearward portions.
2. The vacuum cleaner of claim 1, wherein the at least one rib includes a thickness and a height that is greater than the thickness.
3. The vacuum cleaner of claim 2, wherein the height is greater than 3 mm.
4. The vacuum cleaner according to claim 1, wherein the rearward portion is angled between 30 and 60 degrees relative to the central portion.
5. The vacuum cleaner of claim 4, wherein the rearward portion is angled between 40 and 50 degrees.
6. The vacuum cleaner according to claim 1, wherein the first axial location is not centered on the brushroll housing along the axial direction.
7. The vacuum cleaner according to claim 1, wherein the rearward portion includes a rear end that slopes downwardly toward the rear wall.
8. The vacuum cleaner of claim 7, wherein the forward portion includes a front end that slopes downwardly toward the front wall.
9. The vacuum cleaner according to claim 1, wherein a top surface of the rear wall is sloped upwardly away from the suction inlet.
10. The vacuum cleaner according to claim 1, wherein a portion of a top surface of the front wall is sloped downwardly toward the suction inlet.
11. The vacuum cleaner according to claim 1, wherein the at least one rib includes a first rib located on a first axial side of the first axial location and a second rib located on a second axial side of the first axial location.
12. The vacuum cleaner of claim 11, wherein the first and second ribs are mirror images of each other.
13. The vacuum cleaner according to claim 11, wherein the rearward portion of the first rib and the rearward portion of second rib are angled toward each other.
14. The vacuum cleaner according to claim 11, wherein the at least one rib includes a third rib located on the second axial side of the first axial location.
15. The vacuum cleaner of claim 14, wherein the rearward portions of the second and third ribs are parallel.
16. The vacuum cleaner according to claim 14, wherein the surface cleaning head includes a brushroll belt positioned at a second axial location, and wherein the second and third ribs are located on opposite sides of the second axial location.
17. The vacuum cleaner according to claim 1, wherein each rib of the at least one rib includes a downwardly curved portion for accommodating the brushroll.
18. The vacuum cleaner according to claim 1, wherein the brushroll housing includes a top housing coupled to the bottom housing to at least partially surround the brushroll, wherein the outlet port is positioned along a rearward wall of the top housing.
19. The vacuum cleaner according to claim 1, wherein the bottom housing is integrally molded as a

single piece including the front wall, rear wall, and the at least one rib.

20. A vacuum cleaner comprising: a suction motor operable to move working air through a working air flow path from a suction inlet to a clean air outlet; a dirt separator located along the working air flow path to separate dirt from the working air; and a surface cleaning head including a brushroll rotatable about an axis defining an axial direction, and a brushroll housing at least partially surrounding the brushroll and having an outlet port disposed at a first axial location of the brushroll housing, and a bottom housing provided on the bottom of the brushroll housing, the bottom housing including a front wall, a rear wall spaced from the front wall to define the suction inlet, and first and second ribs disposed below the brushroll and extending across the suction inlet between the front and rear walls, wherein each of the first and second ribs includes a forward portion connected to the front wall, a rearward portion connected to the rear wall and turned toward the first axial location of the outlet port to define a flow guide, and a central portion extending orthogonal to the axial direction between the forward and rearward portions, wherein the first rib is located on a first axial side of the first axial location and the second rib located on a second axial side of the first axial location.

22. The vacuum cleaner of claim **21**, wherein the first and second ribs are mirror images of each other.

23. The vacuum cleaner according to claim **21**, wherein the rearward portion of the first rib and the rearward portion of second rib are angled toward each other.

24. A surface cleaning head comprising: a brushroll rotatable about an axis defining an axial direction; and a brushroll housing at least partially surrounding the brushroll and having an outlet port disposed at a first axial location of the brushroll housing, and a bottom housing provided on the bottom of the brushroll housing, the bottom housing including a front wall, a rear wall spaced from the front wall to define the suction inlet, and a plurality of ribs disposed below the brushroll, wherein each rib of the plurality of ribs includes a central portion extending orthogonal to the axis across a suction inlet between the front wall and the rear wall, and a flow guide turned to direct working air toward the first axial location of the outlet port.