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**Millington et al.**

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(54) **HANDLE ASSEMBLY FOR A VACUUM CLEANER**

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***A47L 9/24*** (2006.01)
***A47L 5/36*** (2006.01)

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CPC ..... ***A47L 9/327*** (2013.01); ***A47L 5/36*** (2013.01); ***A47L 9/24*** (2013.01)

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See application file for complete search history.

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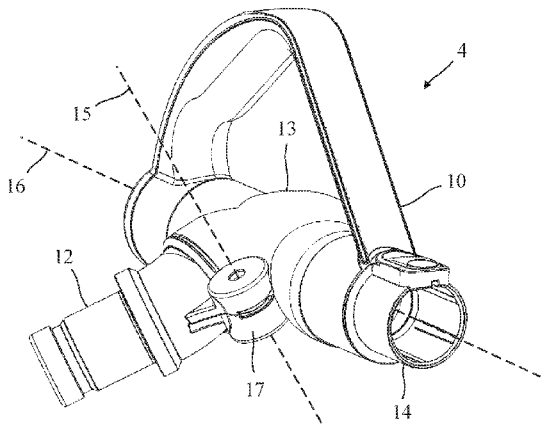
(57) **ABSTRACT**

A handle assembly for a vacuum cleaner that includes a handle attached to a duct assembly. The duct assembly includes a first duct and a second duct. The first duct pivots relative to the second duct about a pivot axis, and the first duct and the second duct rotate collectively relative to the handle about a rotation axis. The rotation axis is then orthogonal to the pivot axis.

**20 Claims, 6 Drawing Sheets**



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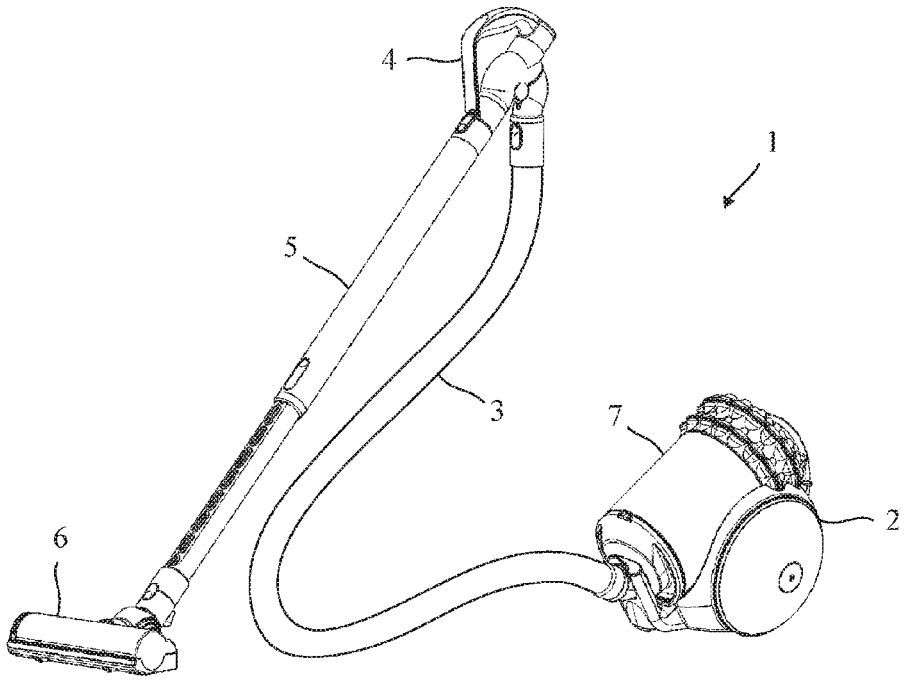


Fig. 1

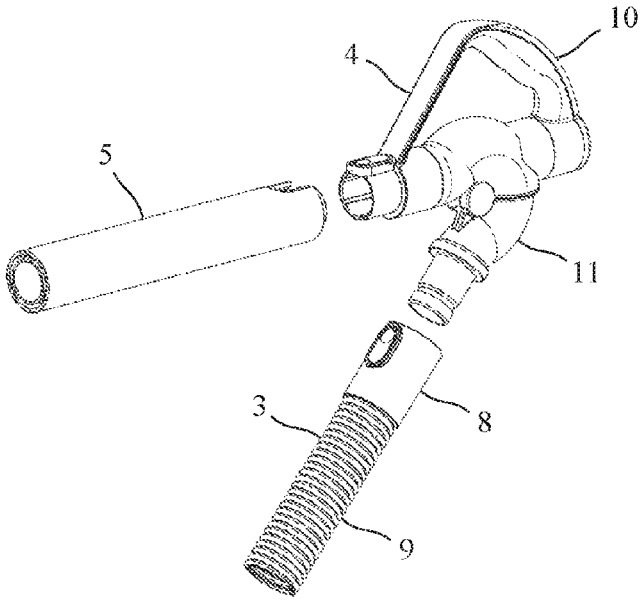


Fig. 2

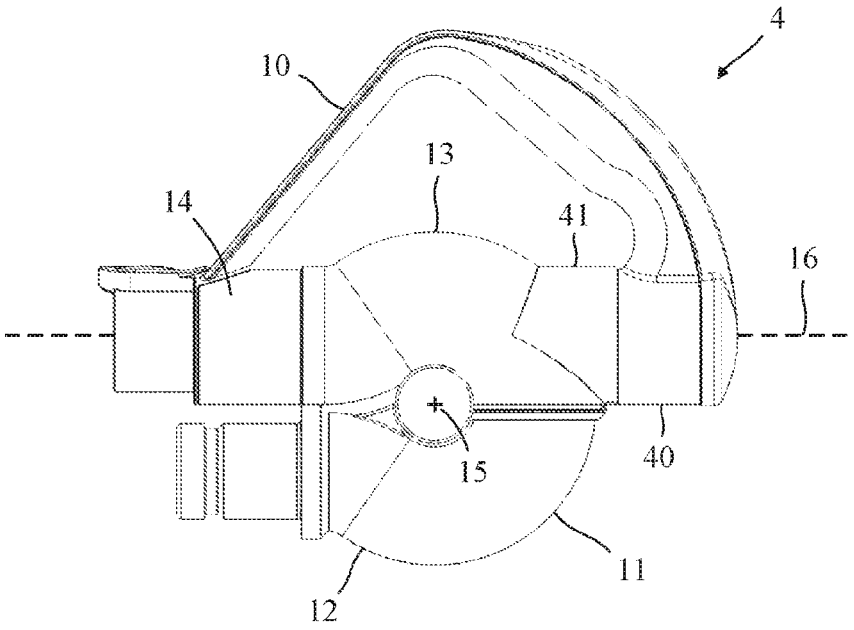
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Fig. 3

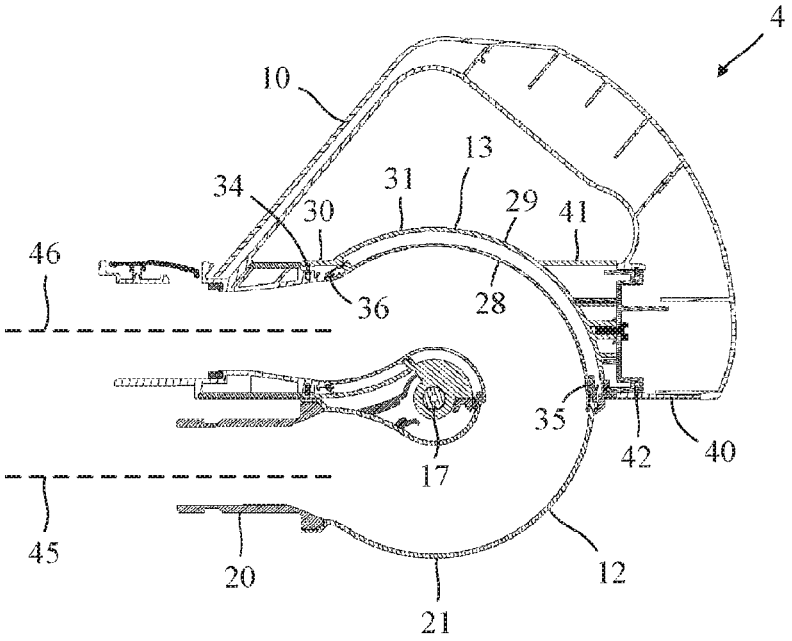
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Fig. 4

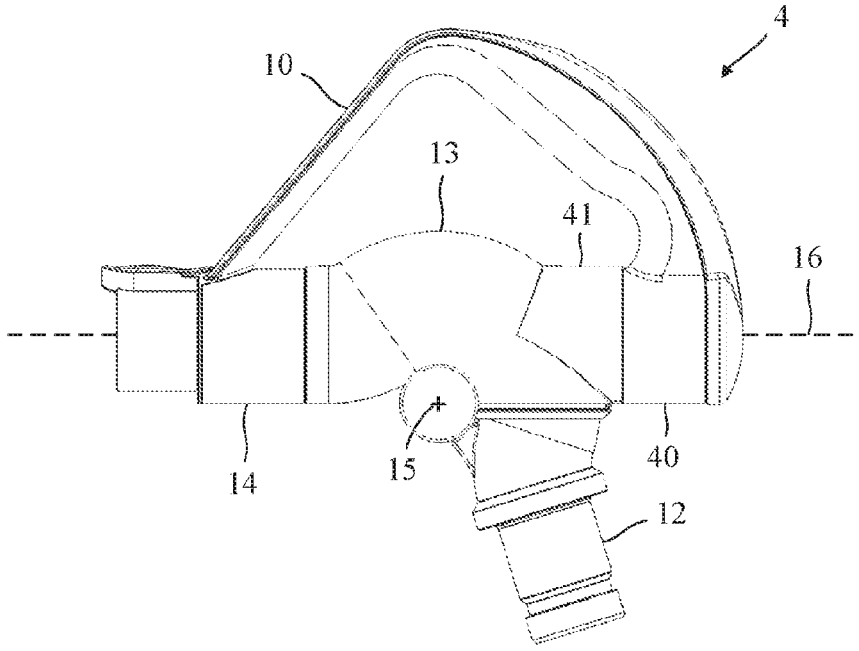
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Fig. 5

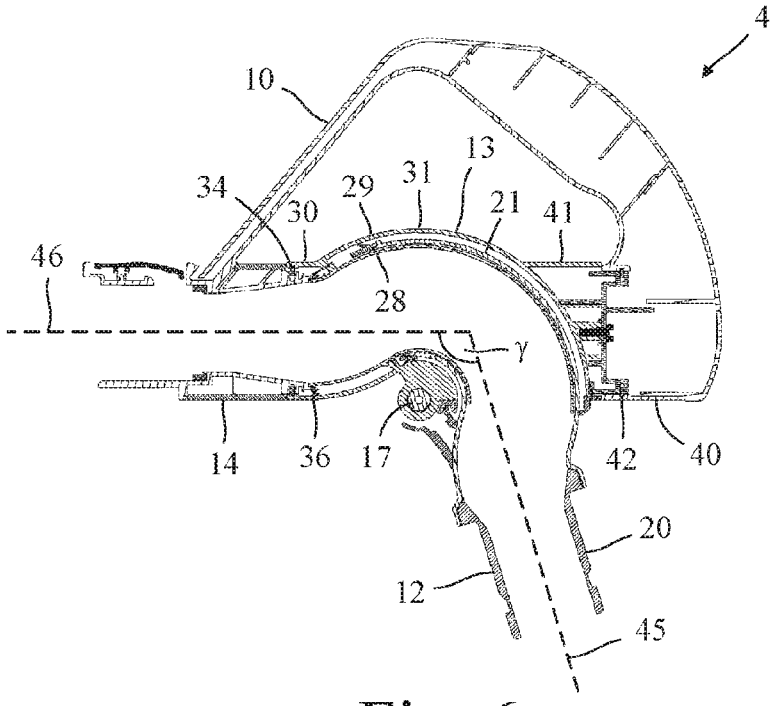
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Fig. 6

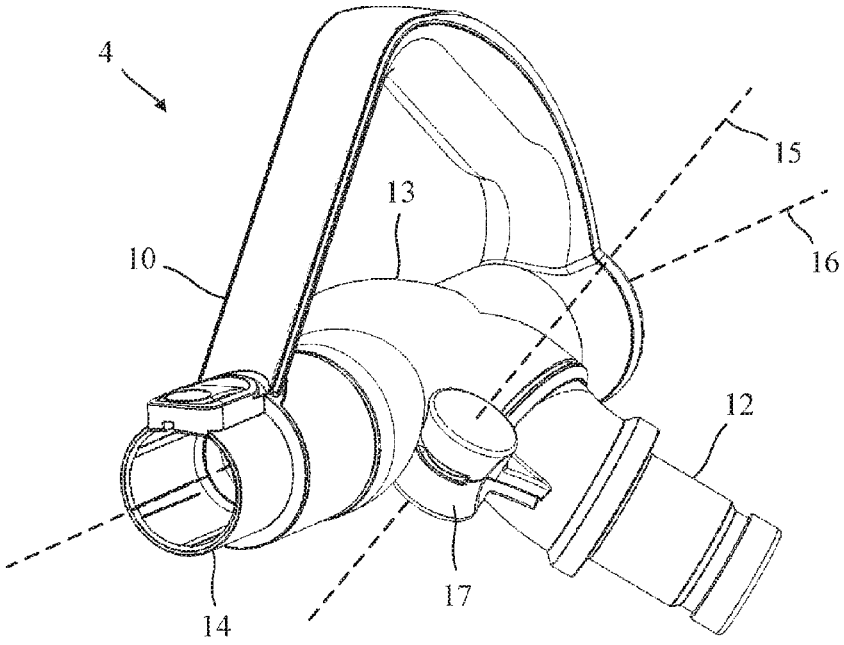


Fig. 7

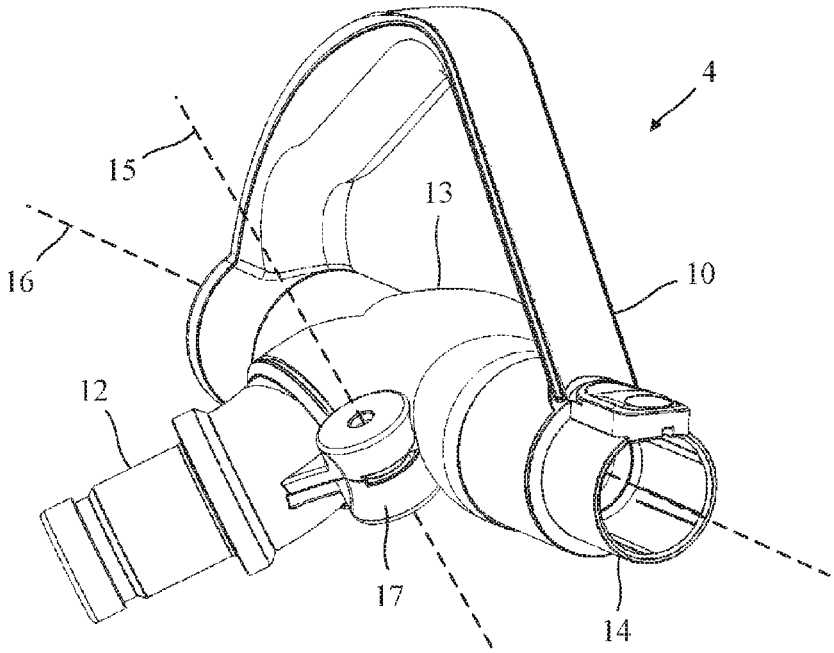


Fig. 8

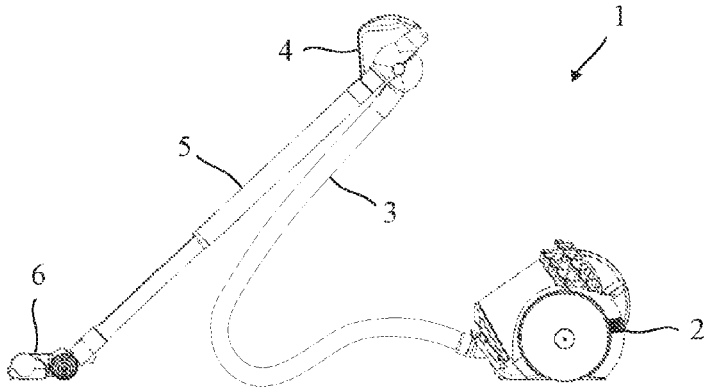


Fig. 9

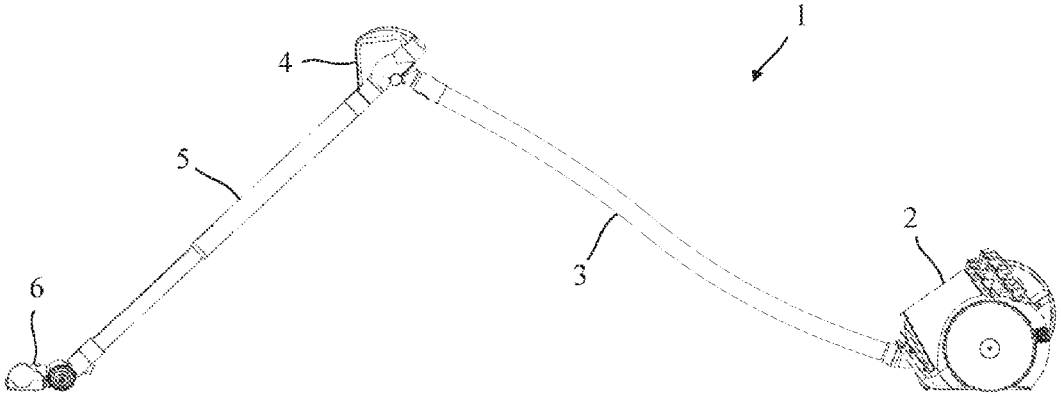


Fig. 10

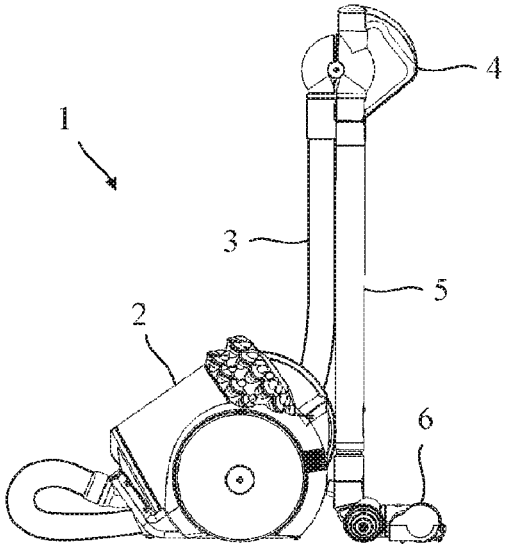


Fig. 11

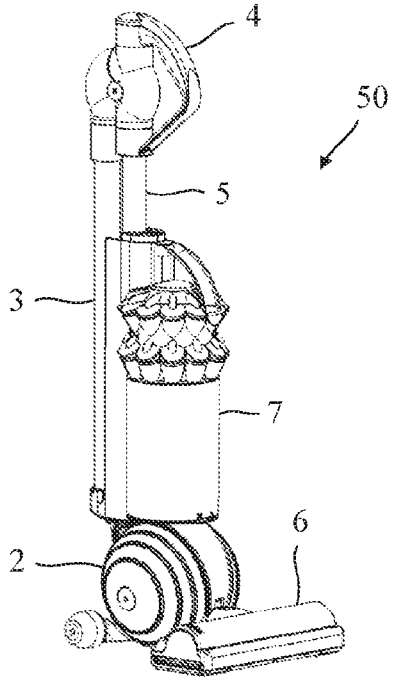


Fig. 12

# HANDLE ASSEMBLY FOR A VACUUM CLEANER

## REFERENCE TO RELATED APPLICATION

This application claims priority of United Kingdom Application No. 1516182.1, filed Sep. 14, 2015, the entire contents of which are incorporated herein by reference.

## FIELD OF THE INVENTION

The present invention relates to a handle assembly for a vacuum cleaner.

## BACKGROUND OF THE INVENTION

The handle assembly of a vacuum cleaner may comprise a duct through which dirt-laden air is carried. One end of the duct may be attached to a hose, which in turn is attached to a main body of the vacuum cleaner. The other end of the duct may be attached to an elongate tube, which in turn is attached to a cleaner head. During use, the handle assembly is used to maneuver the cleaner head over a surface to be cleaned. Unfortunately, the hose often restricts or impedes movement of the handle assembly, thus making it difficult to maneuver the cleaner head.

## SUMMARY OF THE INVENTION

The present invention provides a handle assembly for a vacuum cleaner, the handle assembly comprising a handle attached to a duct assembly, wherein the duct assembly comprises a first duct and a second duct, the first duct pivots relative to the second duct about a pivot axis, the first duct and the second duct rotate collectively relative to the handle about a rotation axis, and the rotation axis is orthogonal to the pivot axis.

One end of the duct assembly may be attached to a hose of the vacuum cleaner, and the other end may be attached to a cleaner head, accessory tool or other attachment, perhaps via an elongate tube. The handle assembly may then be used to maneuver the attachment over a cleaning surface. As the attachment is maneuvered, the handle assembly provides two degrees of freedom in the movement of the hose relative to the handle. In particular, the hose is free to pivot relative to the handle about the pivot axis, and the hose is free to rotate relative to the handle about the rotation axis. By providing two degrees of freedom, restriction in the movement of the handle by the hose is significantly reduced.

The duct assembly may comprise a third duct to which the handle is fixedly attached. The second duct may then be rotatably attached to the third duct. This then has the advantage that the handle may be used to better control the orientation of an attachment without undue interference from the hose. For example, by rotating the handle about the rotation axis, the orientation of an attachment attached to the third duct may be changed. As the handle rotates, the weight of a hose attached to the first duct will cause the first and second ducts to rotate relative to the handle about the rotation axis. The net result is that the first and second ducts remain stationary as the handle rotates, and thus the hose does not interfere with or impede the movement of the handle.

The handle may be rotatably attached to second duct for rotation about the rotation axis. Where the duct assembly comprises a third duct, the handle may be fixedly attached at one end to the third duct and rotatably attached at an opposite end to the second duct. This then has the advantage that the weight of a hose attached to the first duct is better supported by the handle assembly and thus the hose is able to rotate more freely relative to the handle.



The first duct may pivot relative to the second duct through an angle of at least 90 degrees. Additionally or alternatively, the first duct and the second duct may rotate relative to the handle through an angle of at least 90 degrees. A hose attached to the duct assembly is then free to pivot and/or rotate relative to the handle through an angle of at least 90 degrees. This represents a relatively large range of movement over which the handle may be used to maneuver an attachment without undue interference from the hose.

The first duct and the second duct may each comprise an arcuate section that arcs about the pivot axis, and pivoting the first duct relative to the second duct may cause the arcuate section of one of the ducts to move in and out of the arcuate section of the other of the ducts. By having two arcuate sections that arc about the pivot axis, each section is able to subtend a relatively large angle. Consequently, as the first duct pivots relative to the second duct and one of the arcuate sections moves in and out of the other arcuate section, a relatively large degree of pivot movement may be achieved. In arcing about the pivot axis, the two arcuate sections collectively define a segment of a torus that is centered on the pivot axis. As the first duct pivots relative to the second duct and one of the arcuate sections moves in and out of the other arcuate section, the size of the torus segment increases and decreases.

A first end of the duct assembly may extend along a first axis, and a second opposite end of the duct assembly may extend along a second axis. The first duct may then be free to pivot to a position in which the first axis is parallel to the second axis. Consequently, when a hose is attached to the first end and an elongate tube is attached to the second end of the duct assembly, the hose is free to pivot to a position in which the hose extends alongside the elongate tube. This then has the advantage of providing a relative compact arrangement when the handle assembly is not in use.

The pivot axis may be located below the handle, and the second duct may arc upwardly into the space between the handle and the pivot axis. By arcing upwardly into the space beneath the handle, a larger of range of pivot movement may be achieved between the first and second ducts without increasing excessively the height of the handle assembly.

The second duct may be a double-walled duct comprising an inner tube and an outer tube, and pivoting the first duct relative to the second duct may cause the first duct to move between the inner tube and the outer tube. Consequently, when the second duct is located upstream of the first duct, air flowing through the duct assembly moves from the smaller diameter inner tube to the larger diameter first duct. This then has the advantage that the end of the first duct does not present a shoulder to the oncoming flow of air, which would otherwise increase turbulence and thus flow losses and noise. By providing an outer tube in addition to an inner tube, the handle may be attached to the second duct without inhibiting or otherwise restricting the pivoting movement of the first duct.

The present invention also provides a vacuum cleaner comprising a hose and a handle assembly as described in any one of the preceding paragraphs, wherein the hose is attached to one end of the duct assembly and moves relative to the handle as the first duct pivots relative to the second duct and as the first duct and the second duct rotate collectively relative to the handle. The vacuum cleaner may additionally comprise an attachment, such as an elongate

tube, a cleaner head or an accessory tool, which is attached to the opposite end of the duct assembly.

## BRIEF DESCRIPTION OF THE DRAWINGS

In order that the present invention may be more readily understood, embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. **1** shows a vacuum cleaner comprising a handle assembly in accordance with the present invention;

FIG. **2** is an exploded view of the handle assembly, hose and elongate tube of the vacuum cleaner;

FIG. **3** is side view of the handle assembly in which a duct forming part of the handle assembly is placed in an extended position;

FIG. **4** is a sectional slice through the handle assembly of FIG. **3**;

FIG. **5** is side view of the handle assembly in which the duct is placed in a retracted position;

FIG. **6** is a sectional slice through the handle assembly of FIG. **5**;

FIG. **7** is a perspective view of the handle assembly in which ducts forming part of the handle assembly are rotated in a first direction;

FIG. **8** is a perspective view of the handle assembly in which the ducts are rotated in a second direction;

FIG. **9** is a side view of the vacuum cleaner of FIG. **1** in a first use position;

FIG. **10** is a side view of the vacuum cleaner of FIG. **1** in a second use position;

FIG. **11** shows the vacuum cleaner of FIG. **1** in a storage position; and

FIG. **12** shows a further vacuum cleaner comprising the handle assembly in accordance with the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

The vacuum cleaner **1** of FIG. **1** comprises a main body **2**, a hose **3**, a handle assembly **4**, an elongate tube **5**, and a cleaner head **6**. The main body **2** comprises a dirt separator **7** and a vacuum motor (not shown). The hose **3** is attached at one end to the main body **2** and at an opposite end to the handle assembly **4**. The elongate tube **5** is attached at one end to the handle assembly **4** and at an opposite end to the cleaner head **6**. During use, the vacuum motor generates suction that causes dirt-laden air to be drawn in through an opening in the cleaner head **6**. From the cleaner head **6**, the dirt-laden air is carried to the dirt separator **7** via the elongate tube **5**, the handle assembly **4** and the hose **3**. The handle assembly **4** is then used to maneuver the cleaner head **6** over the cleaning surface.

Turning now to FIGS. **2** to **8**, the handle assembly **4** comprises a handle **10** attached to a duct assembly **11**. The hose **3** of the vacuum cleaner is then removably attached to a first end of the duct assembly **11**, and the elongate tube **5** is removably attached to a second opposite end of the duct assembly **11**.

The duct assembly **11** comprises a first duct **12**, a second duct **13**, and a third duct **14**. The first duct **12** is pivotally attached to the second duct **13**, and the second duct **13** is rotatably attached to the third duct **14**. The first duct **12** pivots relative to the second duct **13** about a pivot axis **15**, and the second duct **13** rotates relative to the third duct **14** about a rotational axis **16** that is orthogonal to the pivot axis **15**.

The first duct **12** is pivotally attached to the second duct **13** by means of a pin joint **17** and comprises a straight section **20** and an arcuate section **21**. The straight section **20** is configured for attachment to the hose **3**, and the arcuate section **21** bends or arcs around the pivot axis **15**. The arcuate section **21** describes a circular arc that is centered on the pivot axis **15** and subtends a central angle of around 125 degrees.

The second duct **13** is a double-walled duct comprising an inner tube **28** and an outer tube **29**. The two tubes **28**,**29** are attached such that the tubes **28**,**29** move together as one. Like that of the first duct **12**, the second duct **13** comprises a straight section **30** and an arcuate section **31**. The straight section **30** is relatively short and provides the means by which the second duct **13** is rotatably attached to the third duct **14**. In particular, the outer tube **29** is slightly longer than the inner tube **28** and comprises an annular groove formed around the inner surface of that part which extends beyond the inner tube **28**. An end of the third duct **14** is received within the outer tube **29** and comprises an annular groove formed around its outer surface. A snap ring **34** is then seated within the two grooves so as to permit relative rotation but prevent relative separation of the second duct **13** and the third duct **14**. The arcuate section **31** of the second duct **13**, like that of the first duct **12**, bends or arcs around the pivot axis **15**. The arcuate section **31** describes a circular arc that is centered on the pivot axis **15** and subtends a central angle of around 125 degrees. Pivoting the first duct **12** relative to the second duct **13** causes the arcuate section **21** of the first duct **12** to move in and out of the arcuate section **31** of the second duct **13**. The diameter of the first duct **12** is greater than that of the inner tube **28** but smaller than that of the outer tube **29**. Consequently, as the first duct **12** moves in and out of the second duct **13**, the first duct **12** moves between the inner tube **28** and the outer tube **29**.

The third duct **13** is generally straight and is configured for attachment to the elongate tube **5**.

In order to minimize leakages between ducts, a lip seal **35** is provided at an end of the first duct **12** and a further lip seal **36** is provided at the end of the third duct **14**. Both lip seals **35**,**36** contact and form a seal with the outer tube **29** of the second duct **13**.

The handle **10** is generally shaped as an inverted 'v'. One end of the handle **10** is fixedly attached to the third duct **14**, and the opposite end of the handle **10** is rotatably attached to the second duct **13**. Rotatable attachment is achieved in a similar manner to that between the second duct **13** and the third duct **14**. In particular, an end of the handle **10** is shaped as a collar **40** and comprises an annular groove formed around its inner surface. A further collar **41** having a slightly smaller diameter is secured to the outer tube **29** of the second duct **13** and comprises an annular groove formed around its outer surface. A snap ring **42** is then seated within the two grooves so as to permit relative rotation but prevent relative separation of the handle **10** and the second duct **13**. The second duct **13** rotates relative to the handle **10** about the same rotation axis **16**. Consequently, the second duct **13** swings beneath the handle **10** as if connected to the handle **10** by a hinge.

The first duct **12** pivots relative to the second duct **13** between an extended position and a retracted position. FIGS. **3** and **4** illustrate the handle assembly **4** with the first duct **12** in the extended position, and FIGS. **5** and **6** illustrate the handle assembly **4** with the first duct **12** in the retracted position. The first duct **12** pivots through an angle of about 105 degrees when moving between the extended position and the retracted position. Although the arcuate sections

21,31 of the first and second ducts 12,13 each subtend a central angle of 125 degrees, the attachment of the inner tube 28 to the outer tube 29 and the lip seal 35 provided at the end of the first duct 12 restrict the movement of the first duct 12 to about 105 degrees.

The first duct 12 and the second duct 13 rotate collectively relative to the handle 10. FIG. 7 illustrates the handle assembly 4 with the first and second ducts 12,13 rotated in a first direction, and FIG. 8 illustrates the handle assembly 4 with the first and second ducts 12,13 rotated in a second opposite direction. The degree of rotation of the ducts 12,13 is limited only by the handle 10, and in particular by the first duct 12 contacting the handle 10. Consequently, the first and second ducts 12,13 are free to rotate through about 280 degrees.

The first end of the duct assembly 11 (i.e. that end which attaches to the hose 3) may be said to extend longitudinally along a first axis or a hose axis 45, and the second end of the duct assembly 11 (i.e. that end which attaches to the elongate tube 5) may be said to extend longitudinally along a second axis or a tube axis 46. For the purposes of the present discussion, the term 'hose angle' will be used when referring to the included angle γ between the hose axis 45 and the tube axis 46. When the first duct 12 is in the extended position, as shown in FIGS. 3 and 4, the hose axis 45 is parallel to the tube axis 46 and thus the hose angle γ is 0 degrees. When the first duct 12 is in the retracted position, as shown in FIGS. 5 and 6, the hose angle γ is about 105 degrees.

During use of the vacuum cleaner 1, the handle assembly 4 is typically held such that the elongate tube 5 forms an included angle of about 45 degrees with the cleaning surface. Owing to the weight of the hose 3, the hose 3 tends to hang vertically downwards from the handle assembly 4. As the cleaner head 6 is maneuvered forwards and backwards over the cleaning surface, the angle between the elongate tube 5 and the cleaning surface remains roughly the same. However, the separation distance between the handle assembly 4 and the main body 2 increases and decreases as the cleaner head 6 is maneuvered forwards and backwards respectively. Although the hose 3 provides a degree of bending flexibility, there is little flexibility in the overall length of the hose 3. Consequently, as the cleaner head 6 is maneuvered forwards and backwards, the shape of the hose 3 must change in order to accommodate the change in the separation distance between the handle assembly 4 and the main body 2. As can be seen in FIGS. 9 and 10, as the shape of the hose 3 changes, the hose angle .gamma. of the handle assembly 4 changes. In particular, as the cleaner head 7 is moved forwards and backwards over the cleaning surface, the hose angle .gamma. increases and decreases respectively.

With a conventional handle assembly having a fixed hose angle, the hose can often impede movement of the handle assembly. Additionally, the hose often buckles outwardly to one side of the handle assembly as the handle assembly is moved backwards and the separation distance between the handle assembly and the main body decreases. This buckle in the hose then places a twisting torque on the handle assembly, which a user must then oppose. All of this increases the strain on the wrist of the user.

With the handle assembly 4 described herein, the change in the shape of the hose 3 as the cleaner head 6 is maneuvered forwards and backwards is accommodated through changes in the hose angle .gamma.. As a result, the user experiences less resistance from the hose 3 as the cleaner head 6 is maneuvered forwards and backwards. The handle assembly 4 provides a relatively large degree of movement in the hose 3. In particular, the hose angle .gamma. is free to vary from 0 degrees to 105 degrees. As a result, the user experiences significantly less resistance from the hose 3 over a relatively large range of movement of the cleaner head 6. In particular, little resistance may be felt as the cleaner head 6 is maneuvered forwards and backwards over the range illustrated in FIGS. 9 and 10. The relatively large degree of movement in the hose 3 is made possible through the provision of the arcuate sections 21,31 in the first and second ducts 12,13. By having arcuate sections 21,31 that arc around the pivot axis 15, each of the arcuate sections 21,31 is free to subtend a relatively large angle, which in turn defines the permissible degree of pivot movement of the hose 3.

In addition to maneuvering the cleaner head 6 forwards and backwards, the handle assembly 4 may be used to steer the cleaner head 6 to the left and right. This is achieved by rotating the handle 10 about the tube axis 46. The handle 10 is fixedly attached to the third duct 13, which in turn is attached to the elongate tube 5. Rotating the handle 10 to the left or right therefore causes the elongate tube 5 to rotate about the tube axis 46, which in turn causes the cleaner head 6 to rotate to the left or right. As the handle 10 rotates about the tube axis 46, the weight of the hose 3 causes the first and second ducts 12,13 to rotate relative to the handle 10 about the rotation axis 16, which is coincident with the tube axis 46. The net result is that the first and second ducts 12,13 remain stationary as the handle 10 rotates to the left and right. This then has the benefit that the hose 3 does not interfere with or impede the handle assembly 4 when steering the cleaner head 6. In contrast, if there was no relative rotation between the handle 10 and the second duct 13, rotating the handle 10 to the left and right would cause the hose 3 to be lifted upwards. Owing to the weight of the hose 3, this would place a strain on the wrist of the user, thereby making steering difficult and tiresome.

The handle assembly 4 provides two degrees of freedom in the movement of the hose 3 relative to the handle 10. First, the hose 3 is free to pivot relative to the handle 10 about the pivot axis 15. Second, the hose 3 is free to rotate relative to the handle 10 about the rotation axis 16. By providing these two degrees of freedom, restriction in the movement of the handle 10 by the hose 3 is reduced and thus maneuvering the cleaner head 6 is made easier. As will now be explained, a further degree of freedom in the relative movement of the hose 3 may be provided. As illustrated in FIG. 2, the hose 3 comprises a cuff 8 attached to one end of a flexible hose 9. The cuff 8 is then used to attach the flexible hose 9 to the handle assembly 4. The cuff 8 may be attached to the flexible hose 9 in a manner that provides relative rotation about the hose axis 45. Alternatively, the cuff 8 may be fixedly attached to the flexible hose 9, and the straight section 20 of the first duct 12 may be configured so as to permit relative rotation of the cuff 8 about the hose axis 45. In both instances, the flexible hose 9 is free to rotate relative to the handle 10 about the hose axis 45. By providing this additional degree of freedom in the movement of the hose 3, restriction in the movement of the handle 10 by the hose 3 may be further reduced.

The arcuate section 31 of the second duct 13 arcs upwardly into the space below the handle 10. By using this otherwise unutilized space beneath the handle 10, the arcuate sections 21,31 of the duct assembly 11 are able to subtend relatively large angles, and thus provide a relatively large degree of movement between the extended and retracted positions, without increasing excessively the height of the handle assembly 4. Additionally, by first arcing

upwards, a similar degree of bending may be achieved at the transition of the straight section **20**,**30** and arcuate section **21**,**31** for both ducts **12**,**13**. By contrast, if the second duct **13** did not arc upwards then a sharper bend would be required at the transition between the straight and arcuate sections **20**,**21** of the first duct **12**. As a result, air flowing through the duct assembly **11** would experience greater turbulence at the transition in the first duct **12**, thereby leading to increased flow losses and noise.

A relatively large degree of movement in the hose **3** is made possible through the provision of the arcuate sections **21**,**31** in the first and second ducts **12**,**13**. Conceivably, a similar range of motion might be achieved by removing the arcuate sections **21**,**31** and having a stretch hose that extends between the straight sections **20**,**30** of the first and second ducts **12**,**13**. However, the use of a stretch hose has several disadvantages. A stretch hose has a corrugated inner surface. As a result, air flowing through the stretch hose experiences greater turbulence than that flowing through a duct having a smooth inner surface. There are therefore greater flow losses and increased noise associated with the stretch hose. Additionally, a stretch hose is more expensive than a rigid duct. The handle assembly **4** described herein provides a relatively large degree of movement of the hose **3** relative to the handle **10** in a way that reduces flow losses, noise and cost.

In the embodiment described above, the second duct **13** is a double-walled duct that comprises an inner tube **28** and an outer tube **29**. Since the first duct **12** and the third duct **14** each form a seal with the outer tube **29**, the inner tube **28** could conceivably be omitted. However, as will now be explained, there are advantages in having the inner tube **28**. The second duct **13** is located upstream of the first duct **12**, which is to say that air flowing through the duct assembly **11** first passes through the second duct **13** before passing through the first duct **12**. Consequently, if the inner tube **28** were removed, air would flow from the larger diameter second duct **13** to the smaller diameter first duct **12**. The end of the first duct **12** would then present a shoulder to the oncoming flow of air. As a result, the seal **35** at the end of the first duct **12** may become damaged by dirt and debris carried by the air flow, resulting in poorer suction at the cleaner head **6**. Additionally, dirt carried by the air flow may collect at the shoulder and become inadvertently trapped between the first duct **12** and the second duct **13** as the first duct **12** moves in and out of the second duct **13**. Finally, air flowing through the duct assembly **11** is likely to experience increased turbulence, resulting in increased flow losses and noise. In spite of these disadvantages, the inner tube **28** may nevertheless be omitted. Conversely, the inner tube **28** may be retained and the outer tube **29** may be omitted. In this instance, the first duct **12** and the third duct **14** would each form a seal with the inner tube **28**. The advantage of this arrangement is that air would flow from the smaller diameter second duct **13** to the larger diameter first duct **12**. The end of the first duct **12** would not therefore present a shoulder to the oncoming flow of air. However, a disadvantage with this arrangement is that the handle **10** cannot then be rotatably attached to the second duct **13**, otherwise pivoting of the first duct **12** relative to the second duct **13** will be inhibited. As explained below, whilst it is possible for the handle **10** to be attached to the third duct **14** only, there are advantages in additionally attaching the handle **10** to the second duct **13**. The second duct **13** may therefore be a single-walled duct or a double-walled duct. Where the second duct **13** is a single-walled duct, the first duct **12** may move in and out of the second duct **13** as the first duct **12** pivots about the pivot axis **15**. Alternatively, the second duct **13** may move in and out of the first duct **12** as the first duct **12** pivots about the pivot axis **15**. Where the second duct **13** is a double-walled duct, the first duct **12** moves in and out of the outer tube **29**, and the inner tube **28** moves in and out of the first duct **12**. Accordingly, in a more general sense, pivoting the first duct **12** relative to the second duct **13** may be said to cause the arcuate section **21**,**31** of one of the ducts **12**,**13** to move in and out of the arcuate section **21**,**31** of the other of the ducts **12**,**13**.

The second duct **13** is rotatably attached to both the third duct **14** and the handle **10**. This then has the advantage that the weight of the hose **3** is better supported by the handle assembly **4** and thus the hose **3** is able to rotate more freely relative to the handle **10**. Conceivably, the rotatable attachment with the handle **10** may be omitted. Rotation of the hose **3** relative to the handle **10** would then continue by virtue of the rotatable attachment of the second duct **13** with the third duct **14**, to which the handle **10** is fixedly attached. However, the disadvantage of this arrangement is that the weight of the hose **3** would then be supported solely by the rotation joint between the second and third ducts **13**,**14**. As a result, rotation of the hose **3** relative to the handle **10** may be less smooth.

Conceivably, rotation of the hose **3** relative to the handle **10** may be omitted altogether from the handle assembly **4**. That is to say that rotation of the second duct **13** relative to the third duct **14** and the handle **10** may be omitted. In this instance, there would be no need for a third duct **14** that is separate from and moves relative to the second duct **13**. The third duct **14** would then form part of the second duct **13**, the elongate tube **5** would attach to the second duct **13**, and the handle **10** would be fixedly attached at one or both ends to the second duct **13**. As noted above, rotation of the hose **3** relative to the handle **10** has particular advantages when steering the cleaner head **6**. In particular, the hose **3** is free to swing beneath the handle **10** as the handle **10** is rotated to the left and right. Nevertheless, the pivoting movement provided by the first and second ducts **12**,**13** has particular advantages, irrespective of any rotation of the hose **3** relative to the handle **10**. In particular, the provision of two arcuate sections**21**,**31** that arc about the pivot axis **15** provide a relatively large degree of pivoting movement of the hose **3** relative to the handle **10**. Consequently, when maneuvering the cleaner head **6** forwards and backwards over the cleaning surface, as illustrated in FIGS. **9** and **10**, a user experiences significantly less resistance from the hose **3**. Additionally, as explained below and illustrated in FIGS. **11** and **12**, the two arcuate sections **21**,**31** enable a relatively compact arrangement to be achieved when the vacuum cleaner **1**,**50** is not in use.

In the embodiment illustrated in the Figures, the handle **10** is attached at both ends to the duct assembly **11**. However, as noted in the preceding two paragraphs, the handle **10** may be attached at one end only to the duct assembly **11**. For example, the handle **10** may be attached solely to the third duct **14**, and rotation of the hose **3** relative to the handle **10** may be achieved by virtue of the rotatable attachment of the second duct **13** with the third duct **14**. Alternatively, where rotation of the hose **3** relative to the handle **10** is not required, the handle **10** may be fixedly attached at one end only to the second duct **13**. Moreover, whilst the handle **10** of the embodiment illustrated in the Figures is v-shaped, alternative shapes are possible, particular when the handle **10** is attached at one end only to the duct assembly **11**.

In addition to providing benefits when the vacuum cleaner **1** is in use, the handle assembly **4** also provides benefits when the vacuum cleaner **1** is not in use. As illustrated in

FIG. **11**, when storing the vacuum cleaner **1**, the elongate tube **5** or cleaner head **6** may be docked to the main body **2** in a manner that causes the elongate tube **5** to extend vertically upwards. With a conventional handle assembly, the hose would then extend upwardly and outwardly away from the handle assembly, before looping back to the main body. As a result, the vacuum cleaner would be relatively unstable and may easily be knocked by a user colliding with the hose. Additionally, the vacuum cleaner would require a relatively large storage space. With the handle assembly **4** described herein, the first duct **12** is free to pivot relative to the second duct **13** such that the hose extends vertically downwards from the handle assembly **4**. As a result, the center of gravity of the vacuum cleaner **1** is lower, thus making the vacuum cleaner **1** more stable. Additionally, the vacuum cleaner **1** is more compact and requires less storage space.

The handle assembly **4** has thus far been described as forming part of a canister vacuum cleaner **1**. Equally, however, the handle assembly **4** may form part of an alternative type of vacuum cleaner. By way of example only, FIG. **12** illustrates an upright vacuum cleaner **50** comprising the handle assembly **4**. As with the canister vacuum cleaner **1** of FIG. **1**, the upright vacuum cleaner **50** comprises a main body **2**, a hose **3**, a handle assembly **4**, an elongate tube **5**, and a cleaner head **6**. However, unlike the canister vacuum cleaner **1**, the elongate tube **5** and the cleaner head **6** of the upright vacuum cleaner **50** are each directly attached to the main body **2**. The vacuum cleaner **50** has two modes of cleaning: floor and above-floor. In floor cleaning mode, the elongate tube **5** is locked to the main body **2** and is prevented from rotating relative to the main body **2**. The handle assembly **4** is then used to maneuver the vacuum cleaner **50** as a whole over the cleaning surface. In above-floor cleaning mode, the elongate tube **5** is unlocked and detached from the main body **2**. A valve or other means within the main body **2** redirects the suction generated by the vacuum motor (not shown) from the cleaner head **6** to the elongate tube **5**. The handle assembly **4** and elongate tube **5** may then be used to clean surfaces above the floor, perhaps with the aid of an accessory tool attached to the elongate tube **5**. When the vacuum cleaner **1** is returned to floor cleaning mode and the elongate tube **5** is attached to the main body **2**, the first duct **12** pivots under the weight of the hose **3** such that the hose **3** hangs vertically downwards. As a result, the handle assembly **4** and the hose **3** adopt a relatively compact arrangement. Additionally, the hose **3** is not subject to any bending stresses at the attachment with the handle assembly **4**.

The invention claimed is:

**1**. A handle assembly for a vacuum cleaner, the handle assembly comprising:

a handle attached to a duct assembly, wherein the duct assembly comprises a first duct and a second duct, the first duct pivots relative to the second duct about a pivot axis, the first duct and the second duct rotate collectively relative to the handle about a rotation axis, and the rotation axis is orthogonal to the pivot axis.

**2**. The handle assembly of claim **1**, wherein the duct assembly comprises a third duct, the handle is fixedly attached to the third duct, and the second duct is rotatably attached to the third duct.

**3**. The handle assembly of claim **1**, wherein the handle is rotatably attached to the second duct for rotation about the rotation axis.

**4**. The handle assembly of claim **1**, wherein the first duct pivots relative to the second duct though an angle of at least 90 degrees.

**5**. The handle assembly of claim **1**, wherein the first duct and the second duct rotate relative to the handle through an angle of at least 90 degrees.

**6**. The handle assembly of claim **1**, wherein the first duct and the second duct each comprise an arcuate section that arcs about the pivot axis, and pivoting the first duct relative to the second duct causes the arcuate section of one of the ducts to move in and out of the arcuate section of the other of the ducts.

**7**. The handle assembly of claim **1**, wherein the duct assembly has a first end that extends along a first axis and a second opposite end that extends along a second axis, and the first duct is free to pivot to a position in which the first axis is parallel to the second axis.

**8**. The handle assembly of claim **1**, wherein the pivot axis is located below the handle, and the second duct arcs upwardly into the space between the handle and the pivot axis.

**9**. The handle assembly of claim **1**, wherein the second duct is a double-walled duct comprising an inner tube and an outer tube, and pivoting the first duct relative to the second duct causes the first duct to move between the inner tube and the outer tube.

**10**. The handle assembly of claim **1**, wherein one end of the duct assembly is attachable to a hose, and the other end of the duct assembly is attachable to an attachment comprising one of an elongate tube, a cleaner head and an accessory tool.

**11**. A vacuum cleaner comprising;

a hose and

a handle assembly, the handle assembly comprising:

a handle attached to a duct assembly, wherein the duct assembly comprises a first duct and a second duct, the first duct pivots relative to the second duct about a pivot axis, the first duct and the second duct rotate collectively relative to the handle about a rotation axis, and the rotation axis is orthogonal to the pivot axis

wherein the hose is attached to one end of the duct assembly and moves relative to the handle as the first duct pivots relative to the second duct and as the first duct and the second duct rotate collectively relative to the handle.

**12**. The vacuum cleaner of claim **11**, wherein the vacuum cleaner comprises an attachment attached to the opposite end of the duct assembly, the attachment comprising one of an elongate tube, a cleaner head and an accessory tool.

**13**. A handle assembly for a vacuum cleaner, the handle assembly comprising:

a handle attached to a duct assembly, wherein the duct assembly comprises a first duct and a second duct, the first duct pivots relative to the second duct though an angle of at least 90 degrees, and the first duct and the second duct rotate collectively relative to the handle through an angle of at least 90 degrees.

**14**. The handle assembly of claim **13**, wherein the first duct pivots relative to the second duct about a pivot axis, the first duct and the second duct each comprise an arcuate section that arcs about the pivot axis, and pivoting the first duct relative to the second duct causes the arcuate section of one of the ducts to move in and out of the arcuate section of the other of the ducts.

**15**. The handle assembly of claim **13**, wherein the first duct pivots relative to the second duct about a pivot axis, the

first duct and the second duct rotate collectively relative to the handle about a rotation axis, and the rotation axis is orthogonal to the pivot axis.

**16**. The handle assembly of claim **13**, wherein the duct assembly comprises a third duct, the handle is fixedly attached to the third duct, and the second duct is rotatably attached to the third duct.

**17**. A handle assembly for a vacuum cleaner, the handle assembly comprising:

a handle attached to a duct assembly, wherein the duct assembly comprises a first duct and a second duct, the first duct pivots relative to the second duct about a pivot axis, the first duct and the second duct rotate collectively relative to the handle about a rotation axis, the first duct and the second duct each comprise an arcuate section that arcs about the pivot axis, and pivoting the first duct relative to the second duct causes the arcuate section of one of the ducts to move in and out of the arcuate section of the other of the ducts.

**18**. The handle assembly of claim **17**, wherein the rotation axis is orthogonal to the pivot axis.

**19**. The handle assembly of claim **17**, wherein the duct assembly comprises a third duct, the handle is fixedly attached to the third duct, and the second duct is rotatably attached to the third duct.

**20**. The handle assembly of claim **19**, wherein the handle is fixedly attached at one end to the third duct and is rotatably attached at an opposite end to the second duct.

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