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(54) **SURFACE CLEANING APPARATUS**

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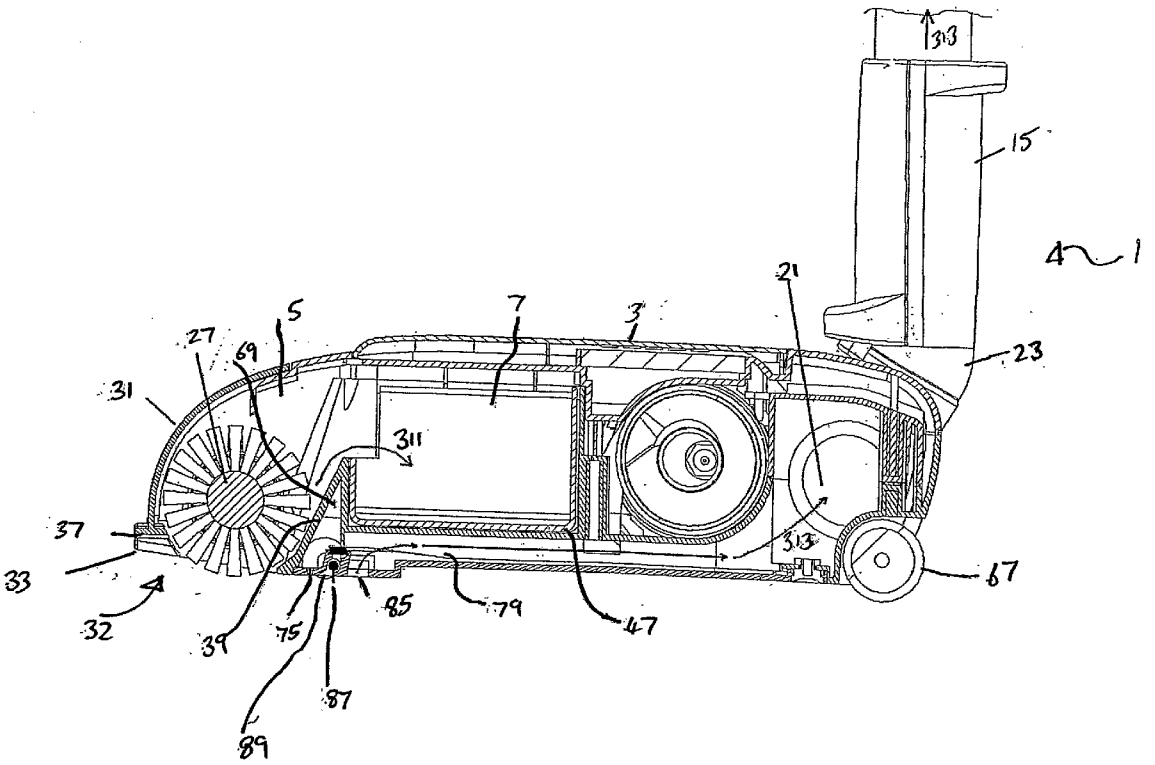
(57) **ABSTRACT**

A surface cleaning apparatus comprises a debris retrieval body (**3**), and a first collection means (**47**) and a second collection means (**13**) provided within the debris retrieval body for accumulating debris from a surface to be cleaned. A rotatable elongate brush arrangement (**27**) is provided within the debris retrieval body and is adapted to retrieve a first portion of debris from the surface to be cleaned and to direct the first portion of the debris along a first pathway (**311**) into the first collection means (**47**). A first inlet aperture (**75**) is provided in the debris retrieval body for the passage along a second pathway (**315**), independent of the first pathway, of a second portion of debris from the surface to be cleaned to the second collection means, the first inlet aperture communicating with a first means for creating suction (**17**). A second inlet aperture (**85**) is provided in the debris retrieval body for the passage along a third pathway (**313**), independent of the first and second pathways, of a third portion of debris from the surface to be cleaned to means for connection to a second means for creating suction.



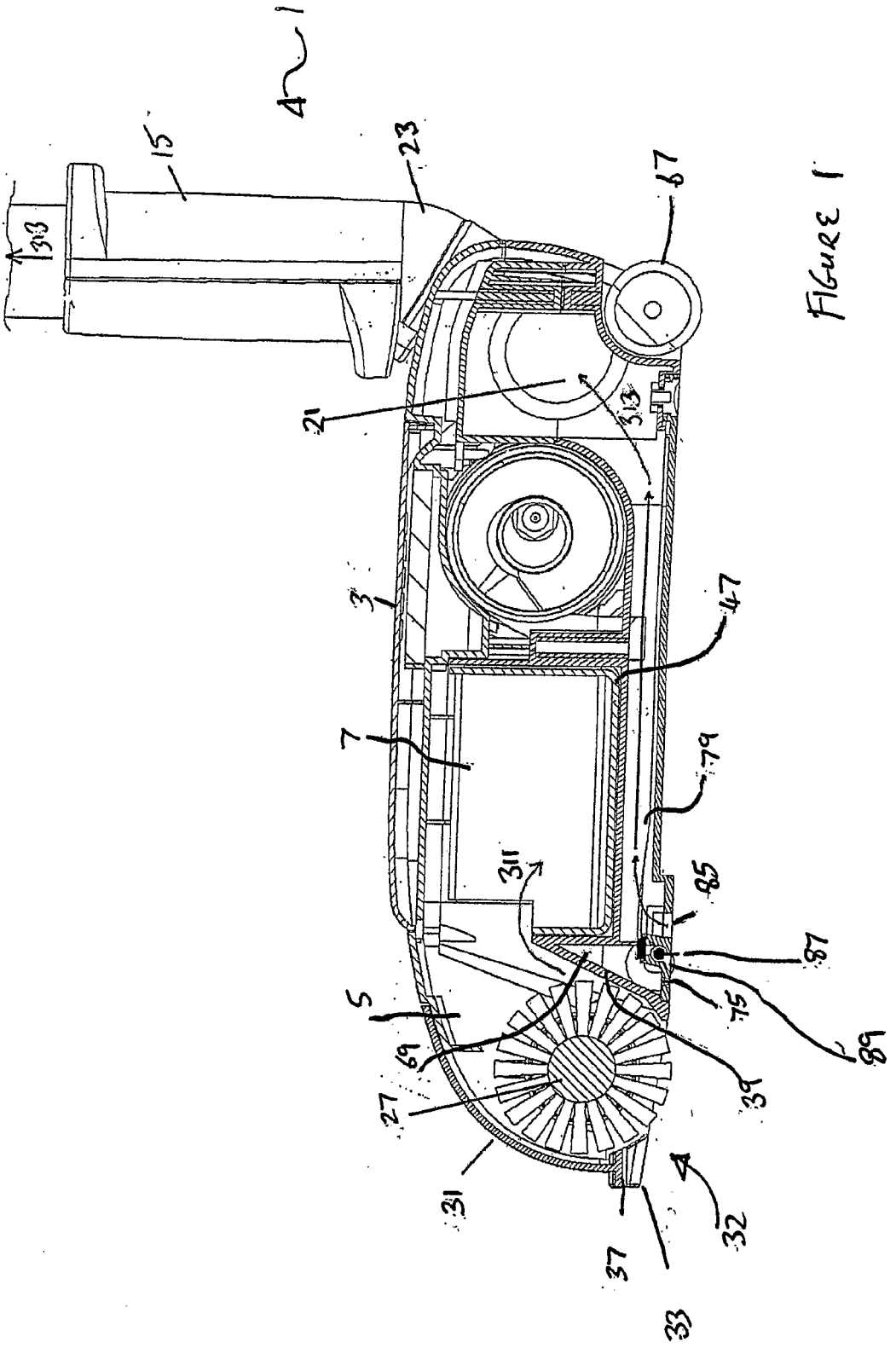


FIGURE 1

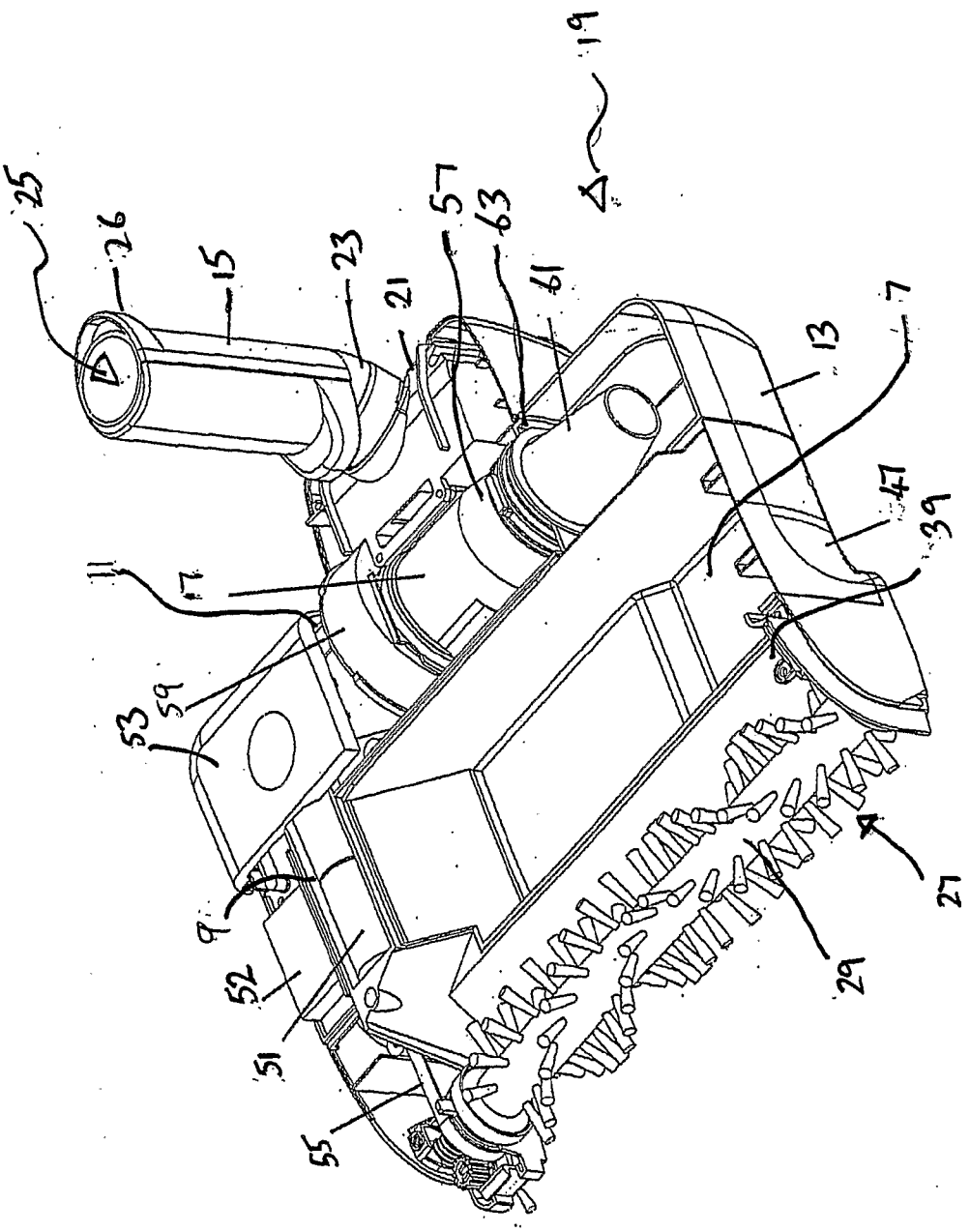


Figure 2

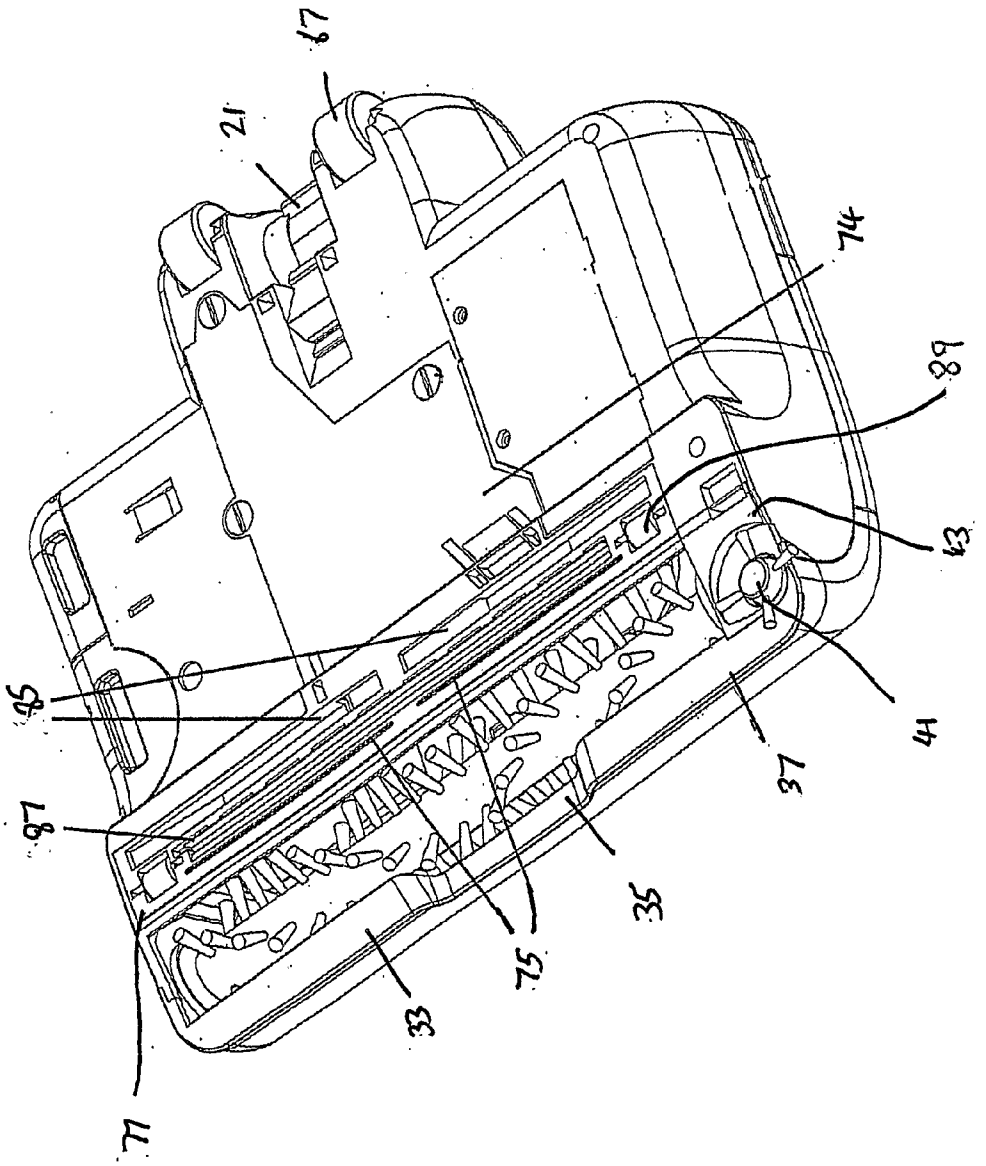


FIGURE 3

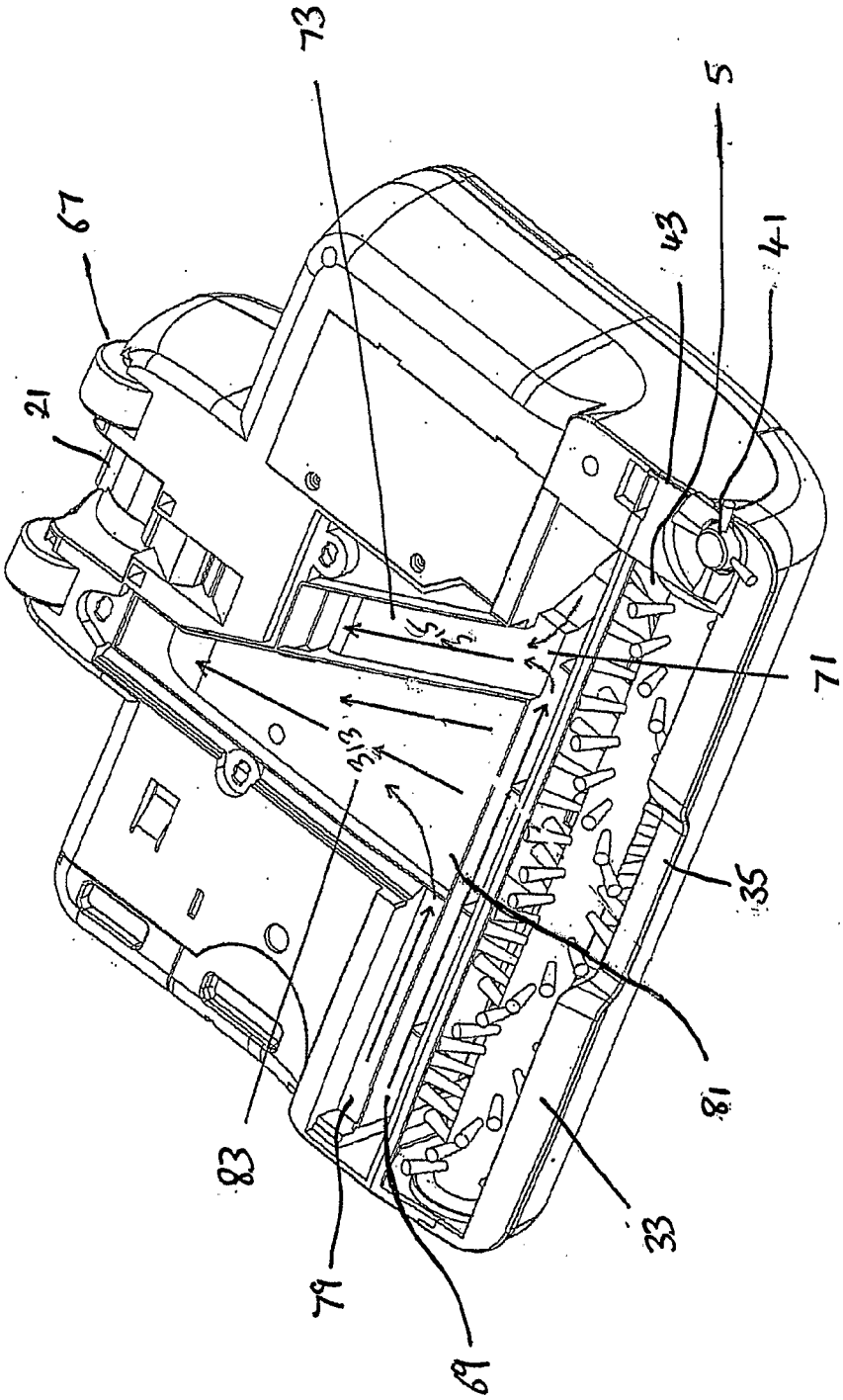


FIGURE 4

SURFACE CLEANING APPARATUS

[0001] This invention relates to a surface cleaning apparatus utilising both a rotatable brush assembly and a plurality of separate means for creating suction to retrieve debris from a surface.

[0002] In conventional vacuum cleaners, debris, for example dirt and dust, is retrieved from a surface by means of motor generated suction and the debris is collected in a suitable collection means, for example a filter bag or receptacle. The quantity of debris that can be picked up from the surface being cleaned depends on the efficiency of the motor generating the suction. Further, it is impractical simply to replace a mains-powered motor with a battery-powered motor due to the lower suction power that can be generated.

[0003] Vacuum cleaners are not suitable for the collection of large debris. The generated suction can cause the debris collecting aperture of the vacuum cleaner to become substantially sealed to a surface to be cleaned, preventing large debris from entering the aperture and being removed from the surface. Also, if large pieces of debris are sucked up it is known for them to cause a blockage of the pathways through which suction draws the debris.

[0004] Vacuum cleaners with a hose and a battery powered head are known, including cleaners in which the cleaning head can be detached and used independently of the vacuum cleaner in what is known as a sweeper mode. The independent battery powered head has a rotating brush and a debris collection means independent of the collection means of the vacuum cleaner. The debris collection means has a port to which a suction creating means of the vacuum cleaner can be connected when used in a vacuum cleaning mode.

[0005] The problem with the known vacuum cleaners with an independent cleaning head is that blocking of the pathway from the independent collection means and the suction means can occur. A relatively large amount of debris can be collected in the collection means of the independent head during use in the sweeper mode. On reconnecting the head to the suction means, the relatively large amount of debris is drawn substantially as one single mass towards the suction means and can lead to blockages.

[0006] A known solution to the problem of blockages is the provision of a filter means which only allows particles below a certain size to enter a connection between the independent head and the suction means. However, the filter relatively quickly becomes blocked due to the relatively small surface area of the filter and the potentially large amount of debris that can be present in the collection means of the independent head. Therefore, the performance of such vacuum cleaners can be impaired and such vacuum cleaners have reduced suction power.

[0007] Conventional sweepers use a brush arrangement to retrieve debris from a surface. The brush arrangement is adapted to gather up and remove relatively large pieces of debris from a surface, but fine particles of dust, for example, are not efficiently removed from the surface being cleaned, especially from crevices and deep inside soft furnishings. Further, conventional sweepers do not efficiently remove light debris, for example fine particles of dust, from hard floors

[0008] It is therefore an object of the present invention to provide a surface cleaning apparatus utilising both a rotatable brush assembly and a plurality of separate means for creating suction to retrieve debris from a surface and to overcome, or at least ameliorate, the problems of known apparatus.

[0009] According to the present invention there is provided a surface cleaning apparatus comprising:

a debris retrieval body;

a first collection means and a second collection means provided within the debris retrieval body for accumulating debris from a surface to be cleaned;

a rotatable elongate brush arrangement provided within the debris retrieval body and adapted to retrieve a first portion of debris from the surface to be cleaned and to direct the first portion of the debris along a first pathway into the first collection means;

a first inlet aperture provided in the debris retrieval body for the passage along a second pathway, independent of the first pathway, of a second portion of debris from the surface to be cleaned to the second collection means, the first inlet aperture communicating with a first means for creating suction; and

a second inlet aperture provided in the debris retrieval body for the passage along a third pathway, independent of the first and second pathways, of a third portion of debris from the surface to be cleaned to means for connection to a second means for creating suction.

[0010] The first means for creating suction may be provided within the debris retrieval body.

[0011] The second means for creating suction may be provided remotely from the debris retrieval body.

[0012] The remotely provided means for creating suction may be incorporated into a cleaner body adapted for attachment to the debris retrieval body.

[0013] The first means for creating suction and/or the second means for creating suction may be a cyclonic suction generating system.

[0014] The first inlet aperture and/or the second inlet aperture may be elongate.

[0015] The first inlet aperture and/or the second inlet aperture may be spaced from the elongate brush arrangement.

[0016] A plurality of perforations may be provided in a removable plate covering the first inlet aperture and/or the second inlet aperture.

[0017] The debris retrieval body may be provided with an opening through which bristles of the elongate brush arrangement extend for retrieving the first portion of debris.

[0018] The opening for the bristles may be separate from the first and/or the second inlet aperture.

[0019] The first inlet aperture and/or the second inlet aperture may extend substantially parallel and adjacent to the opening for the bristles of the elongate brush arrangement.

[0020] The second inlet aperture may have a greater area than the first inlet aperture.

[0021] The apparatus may be adapted to convey the first portion of debris directly to the first collection means.

[0022] The first collection means and/or the second collection means may be in the form of a removable tray.

[0023] A lower edge of a front wall of the debris retrieval body may be maintained at a distance from the surface to be cleaned. The lower edge of the front wall of the debris retrieval body may be provided with a recess.

[0024] A battery may be provided to provide power to rotate the elongate brush arrangement and to power the first means for creating suction.

[0025] A mains power supply may be provided to power the second means for creating suction.

[0026] For a better understanding of the present invention and to show more clearly how it may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:

[0027] FIG. **1** is a cross-sectional view of an embodiment of a surface cleaning apparatus according to the present invention;

[0028] FIG. **2** is a perspective cut-away view, from above, of the surface cleaning apparatus shown in FIG. **1**;

[0029] FIG. **3** is a perspective view, from below, of the surface cleaning apparatus shown in FIG. **1**; and

[0030] FIG. **4** is the perspective view of the surface cleaning apparatus shown in FIG. **3** with a portion of the lower surface removed.

[0031] Referring to FIGS. **1** and **2**, a surface cleaning apparatus **1** has a debris retrieval body **3** comprising five compartments **5**, **7**, **9**, **11** and **13** and a handle **15** which acts as a means for connection to a first suction creating means (not shown), for example a mains powered vacuum cleaner, preferably a cyclonic suction generating vacuum cleaner, provided external to the debris retrieval body.

[0032] As will be described hereinafter, the cleaning apparatus **1** can be used in an external vacuum mode to remove debris from a surface to be cleaned by means of the first suction creating means. The cleaning apparatus **1** can also be used in an internal vacuum mode to remove debris from a surface to be cleaned by means of a second suction creating means **17** provided within a first rear compartment **11** of the debris retrieval body suction. Consequently, the apparatus can be used independently of any external suction creating means.

[0033] The handle **15** is in the form of an elongate tubular member provided at the rear **19** of the debris retrieval body **3**. The handle **15** is pivotably attached to the rear **19** of the debris retrieval body **3** by means of a pivot member **21**. Swivel means **23** is provided between the pivot member **21** and the handle **15**, as shown in FIGS. **1** and **2**. The swivel means **23** allows the handle **15** to rotate about the axis thereof relative to the debris retrieval body **3** and the pivot member **21** allows the handle **15** to pivot about an axis transverse to the axial direction of the handle **15**.

[0034] The pivot member **21** and the swivel means **23** enable the sweeping apparatus **1** to be steered by the user.

[0035] The tube of the handle **15** forms the means for connection to the first suction creating means by providing a portion of a channel **25** (see FIG. **1**) which passes down the length of the elongate handle, through the swivel means **23** and the pivot member **21**, and through which suction created by the external suction means, for example a vacuum cleaner apparatus, can be transmitted to within the debris retrieval body **3**.

[0036] An upper end **26** of the connection means **15**, furthest from the debris retrieval body **3**, is shaped to be complementary with connecting portions of, for example, a hose member of the suction creating means, such that the connecting portions of the suction creating means can be, for example, push fitted onto the upper end **26** when the apparatus is used in external vacuum mode.

[0037] The shape of the upper end **26** also enables extension members to be added to the handle when the apparatus is used in the internal vacuum mode.

[0038] A front compartment **5** houses an elongate rotatable brush arrangement **27** comprising rows of tufts of bristles attached to a cylindrical member **29**. For convenience, a front wall **31** of the front compartment **5** (see FIG. **1**) is arcuate and extends around the periphery of the brush arrangement **27**. The front wall **31** may be removable. The bottom of the front compartment **5** is provided with an opening **32** to allow the bristles of the brush arrangement **27** to contact a floor, carpet or like surface over which the surface cleaning apparatus **1** is to be moved.

[0039] The front wall **31** of the front compartment **5** forms the front wall of the surface cleaning apparatus **1**. In use, a lower edge **33** of the front wall is maintained a distance from the surface to be cleaned. The distance between the lowest portion of the lower edge **33** of the front wall **31** and the surface to be cleaned is in a range from 5 mm to 8 mm. The lower edge **33** of the front wall **31** is non-planar (see FIGS. **3** and **4**). The lower edge **33** incorporates a recess **35**, as shown in FIGS. **3** and **4**, with a width, for example, in a range from about 20 mm to about 150 mm, preferably about 60 mm. The depth of the recess **35**, that is the distance between the top of the recess **35** and the lowest portion of the lower edge **33**, is nominally about 10 mm but may, for example, be in the range from about 4 mm to about 20 mm. The recess **35** allows debris, such as dust, dirt and the like, too large to pass under the lowest portion of the lower edge **33** to pass into the front compartment **5** and be picked up by means of the brush arrangement **27**.

[0040] As shown in FIG. **1**, a narrow elongate flange **37**, substantially parallel to the surface to be cleaned, is provided along the lower edge **33** of the front wall **31** extending both outward and inward of the front compartment. The flange is adapted to substantially prevent air turbulence, generated by the rotation of the brush arrangement **27**, forcing debris away from the front of the apparatus **1**. The inward extending edge of the flange extends from the front wall **31** towards the elongate brush arrangement **27**. The end of the flange **37** nearest to the brush arrangement **27** is positioned such that there is no contact between the flange and the bristles of the elongate brush arrangement.

[0041] At the rear of the front compartment **5** is a rearwardly inclined wall **39** which allows debris, such as dust, dirt and the like, to be propelled up the wall **39** due to rotation of the brush arrangement **27** (shown by arrow **311** in FIG. **1**) and to pass over the wall **39** into a first intermediate compartment **7** which will be described in more detail hereinafter. The wall **39** extends upwardly to about the same height as the top of the brush arrangement **27** and is angled rearwardly (i.e. away from the front compartment **5**) at an angle of about 18 degrees. The precise angle is not important, but the inclination facilitates the passage of the debris up and over the wall **39** and at the same time facilitates retention of the debris within the rear compartment.

[0042] The brush arrangement **27** in the front compartment **5** extends substantially the entire width of the front compartment **5** and is provided with two helically arranged rows of bristles. The length of the bristles, for example, is in a range from 8 mm to 25 mm, preferably a range from 14 mm to 17 mm. The thickness of individual bristles is in a range from 0.04 mm to 0.3 mm, preferably in a range from 0.06 mm to 0.25 mm. The bristles are arranged in tufts and the tufts have a diameter in a range from 1.5 mm to 5 mm, preferably a range from 2 mm to 3 mm.

[0043] The elongate brush arrangement **27** is arranged such that it can be detached from retaining portions (not shown) of the debris retrieval body **3**, for example for cleaning or for replacement.

[0044] An auxiliary rotary brush **41** (shown in FIGS. **3** and **4**) is provided at one side of the brush arrangement **27**. Such an auxiliary brush **41** is described, for example, in GB-A-1 547 286 or GB-A-2 393 900. Such an auxiliary brush **41** is able to sweep debris into the path of the brush arrangement **27**. The auxiliary brush **41** is driven by gearing from the brush arrangement **27**. Alternative means of driving the auxiliary brush **41**, for example by friction with the surface to be swept, may also be used. The auxiliary brush **41** is provided in a support member **43** and extends outwardly beyond the debris retrieval body **3**. The auxiliary brush **41** comprises a cylindrical body rotatable about an axis which is inclined to the vertical by about 10 degrees so as to extend outwardly beyond the debris retrieval body **3**. Bristles protrude radially outwardly from the periphery of the cylindrical body, preferably at an angle of about 80 degrees to the axis of rotation, so as to form a cone which increases in cross-section with increasing distance from the debris retrieval body **3**.

[0045] The support member **43** of the auxiliary brush **41** is detachable from the debris retrieval body **3**, for example for the cleaning or replacement of the auxiliary brush **41**. The support member **43** is held in position, for example, by two protruding members which fit within complementary apertures in the debris retrieval body **3**. The support member **43** is secured to the debris retrieval body **3**, for example, by means of a releasable catch on the side of the support member **43** furthest from the front wall **31** of the debris retrieval body **3**.

[0046] The first intermediate compartment **7**, shown in FIGS. **1** to **4**, is provided in the form of a removable tray **47** positioned in a recess provided in the debris retrieval body **3** between the rear wall **39** of the front compartment **5**, front walls of the first rear compartment **11** and a second rear compartment **13**, and an upper wall of the debris retrieval body. The first intermediate compartment **7** is open on an upper face and on its front side in a position corresponding to the region between the top of the rearwardly inclined wall **39** of the front compartment and the upper side of the debris retrieval body **3**. Debris propelled over the rear wall **39** of the front compartment can enter the tray **47** through the opening in the front side.

[0047] The first intermediate compartment **7** in the form of the tray **47** is removable from the debris retrieval body **3**, for example for emptying, by sliding the tray **47** in a lateral direction out of the recess in the debris retrieval body. A transparent window may be provided in the first intermediate compartment to enable a user to determine if the first intermediate compartment requires emptying.

[0048] The second intermediate compartment **9** (shown in FIG. **2**) is provided to one side of the recess **49** of the debris retrieval body. The second intermediate compartment **9** houses a rechargeable battery pack **51**. The battery pack **51** may be connected to a mains power supply (not shown) for recharging the battery pack **51**. The battery pack **51** may be connected either to the mains supply whenever the apparatus **1** is not in use or at suitable times when the battery pack **51** has become depleted. As an alternative to a rechargeable battery pack **51**, the apparatus **1** could employ disposable batteries or be mains powered.

[0049] The rear **19** of the debris retrieval body comprises a first rear compartment **11** and a second rear compartment **13** arranged side by side behind the rear walls of the first and second intermediate compartments **7**, **9** as shown in FIG. **2**. The first rear compartment **11** and the second rear compartment **13** are separated from each other by an internal wall **63**.

[0050] The first rear compartment **11** houses an electric motor (not shown). The motor is used to rotate the brush arrangement **27** by way of toothed rollers attached to each of the motor and the brush arrangement **27** and a toothed belt **55**, for example of elastomeric material, extending around the rollers (see FIG. **2** where the upper wall of the debris retrieval body and the brush arrangement have been omitted to show a portion of the belt arrangement). The motor is powered by the rechargeable battery pack in the second intermediate compartment **9**.

[0051] Electrical connections including a printed circuit board **52** are provided between the rechargeable battery pack **51** and the motor. Switch means **53** (shown in FIG. **2**) is provided on an upper region of the first rear compartment **11** to permit a user to energise and de-energise the motor as desired.

[0052] The first rear compartment **11** also houses the second suction creating means **17** which is in the form of a cyclonic suction creating assembly as known to a person skilled in the art. As shown in FIG. **3**, the second suction creating means **17** includes a cyclone body, a cyclonic separator **57** and an impeller **59** to create suction in the debris retrieval body **3**. A truncated conical-shaped end **61** of the cyclone body, furthest from the impeller **59**, protrudes into the second rear compartment **13** through an aperture in the internal wall **63** between the first rear compartment **11** and the second rear compartment **13**.

[0053] The second suction creating means **17** may be powered by the same motor as that used to rotate the elongate brush arrangement or may be powered by a separated motor (not shown), for example energised/de-energised by an additional switch means (not shown).

[0054] The exhaust from the cyclonic separator **57** exits the apparatus **1** through an apertured region in the form of a removable section (not shown) of an upper surface of the first rear compartment **11**. The apertured region is provided with a replaceable filter member to minimise the possibility of any debris particles exiting the body.

[0055] The second rear compartment **13**, in the form of a removable compartment, is provided in a recess provided in the debris retrieval body **3** between a rear wall **39** of the debris retrieval body and a rear wall of the first intermediate compartment **7**. The second rear compartment **13** is only open in a central region of a face nearest to the internal wall **63**. The open central region corresponds to the position of the aperture in the internal wall **63** through which the truncated conical end **61** of the cyclone body protrudes. Debris propelled out of the truncated conical end **61** of the cyclone body is deposited in the second rear compartment **13**.

[0056] The second rear compartment **13** is removable from the debris retrieval body **3**, for example for emptying, by sliding the second rear compartment **13** in a horizontal direction away from the first rear compartment **11** of the debris retrieval body. A transparent window may be provided in the second rear compartment **13** to enable a user to determine if the second rear compartment requires emptying.

[0057] Ground-engaging wheels **67** to assist mobility of the surface cleaning apparatus **1** are provided on the rear of the debris retrieval body.

[0058] As shown in FIGS. **1** and **4**, a first elongate chamber **69**, enclosed at its upper surface, is provided rearward of the inclined wall **39** of the front compartment **5**. The first elongate

chamber **69** is provided with an outlet **71** from the chamber **69** which is positioned in the region of one end of the chamber **69**.

[0059] A duct **73** (shown in FIG. **4**) connects the outlet **71** provided in the rear wall of the first elongate chamber **69** with the second suction creating means **17** in the first rear compartment **11**. The duct **73** is substantially the width of the outlet **71** and is positioned beneath the first intermediate compartment **7**. An upper wall of the duct **73** is positioned adjacent to a portion of the lower wall of the first intermediate compartment **7**. The lower wall of the duct **73** is formed by a section **74** of the lower wall of the surface cleaning apparatus **1** (see FIG. **3**). The section **74** of the lower wall is removable to enable the duct to be cleaned.

[0060] FIGS. **1** and **3** show a nozzle in the form of an elongate inlet aperture **75** in a lower face of the first chamber **69**. The inlet aperture **75** is separate from the opening **32** for the brush bristles of the front compartment **5**. During the use of the apparatus **1**, the inlet aperture **75** enables suction created by the internal second suction means within the first chamber **69** to be applied in close proximity to a surface to be cleaned. The application of suction via the inlet aperture **75** in close proximity to the surface to be cleaned enables debris to be removed from the surface as will be described hereinafter.

[0061] The area of the inlet aperture **75** is less than the cross-sectional area of the first chamber **69**.

[0062] For a given power usage of a motor associated with suction creating means of a vacuum cleaner, a relatively constant volume of air will be drawn through the suction creating means. To enable debris to be retrieved from a surface, the debris must be entrained in the air that enters the apparatus through an aperture forming a nozzle. To achieve this, a relatively high air speed must be generated through the nozzle. In conventional vacuum cleaners the width of the aperture is relatively large to enable relatively large amounts of debris on a surface to be removed by a single pass of the aperture over the surface. Therefore, a relatively large volume of air must be drawn though the nozzle of a conventional vacuum cleaner in order to achieve sufficient air speed to entrain debris. As such, a motor using relatively high amounts of power is required in order to draw such relatively large volumes of air through the wide apertured nozzle.

[0063] For a given volume of air drawn into an apparatus in accordance with the present invention for a given power usage of a motor, the presence of the narrow inlet aperture **75** and the associated lower area compared to the cross-sectional area of the first chamber **69** and/or the cross-sectional area of a passage through which the air is drawn causes the speed of the air on passing through the inlet aperture **75** and/or the passage to be increased compared to the speed of the air which passes through the first chamber **69** to the second suction creating means **17**. As the use of the suction means is directed to retrieving fine dust, which has not been removed along with larger pieces of debris by the rotating brush arrangement, there is no need for a wide aperture for retrieving larger pieces of debris. Therefore, it is possible to generate sufficiently high air speed through the inlet aperture forming the nozzle, to entrain fine dust, by means of the narrow width of the inlet aperture **75** constricting the volume of air as it passes through the inlet aperture. As such, the flow of air through the inlet aperture can have a high air speed generated in this way for a relatively low power usage by the motor of the second suction means. The narrow, elongate inlet aperture enables effective cleaning of the surface over which the inlet aperture is positioned in use.

[0064] The increased cross-sectional area of the chamber **69** compared to the area of the inlet aperture **75** and the resultant lower speed of air flow in the chamber **69** is also beneficial in that losses resulting from friction between the air flow and walls of the chamber are reduced by the slowing of the air flow on entering the chamber. The power usage by the motor of the second suction means can be minimised by the reduction of the frictional losses in the chamber by means of the difference between the area of the inlet aperture and the cross-sectional area of the chamber.

[0065] The provision of a chamber with a relatively large cross-sectional area also helps to minimise the potential of a blockage being formed in the chamber by the dust entrained in the air flow entering the chamber from the inlet aperture.

[0066] As shown in FIG. **3**, the inlet aperture **75** of the first chamber **69** extends along substantially the entire length of the longitudinal extent of the opening **32** in the front compartment **5**.

[0067] A cover **77** (see FIG. **3**) is provided over the entire length of the inlet aperture **75** of the first chamber **69**, releasably secured to the debris retrieval body **3** by fastening means, for example screw fasteners. The cover **77** has a series of elongate apertures to further reduce the width of the inlet aperture **75** between the surface to be cleaned and the first chamber **69**.

[0068] Provided rearward of the first chamber **69** is a second elongate chamber **79** enclosed at its upper surface, as shown in FIG. **1**. The second chamber **79** is provided with an outlet **81** from the chamber **79** which is positioned substantially equidistant from the side walls of the debris retrieval body (as shown in FIG. **4**).

[0069] A duct **83** (shown in FIG. **4**) connects the outlet **81** provided in the rear wall of the second elongate chamber **79** with the first suction creating means. The duct **83** has a fluted shape such that in a region of the duct adjacent to the outlet **81**, the duct **83** widens to extend substantially across the entire width of the outlet **81**. The duct **83** between the outlet **81** of the second chamber **79** and the first suction creating means is separate from the duct **73** between the outlet **71** of the first chamber **69** and the second suction creating means **17**.

[0070] An upper wall of the duct **83** is positioned adjacent to a portion of the lower wall of the first intermediate compartment **7**. The lower wall of the duct **83** is formed by the section **74** of the lower wall of the surface cleaning apparatus **1**. The section **74** of the lower wall, as described hereinbefore, is removable to enable the duct **83** to be cleaned.

[0071] FIG. **3** shows a nozzle in the form of an elongate inlet aperture **85** in a lower face of the second chamber **79**. The inlet aperture **85** of the second chamber **69** is separate from the opening **32** for the brush bristles of the front compartment **5** and from the inlet **75** of the first chamber **69**. During the use of the apparatus **1**, the inlet aperture **85** enables suction created by the external first suction means within the second chamber **79** to be applied in close proximity to a surface to be cleaned. The application of suction via the inlet aperture **85** in close proximity to the surface to be cleaned enables debris to be removed from the surface as will be described hereinafter.

[0072] As with the inlet aperture **75** of the first chamber **69**, the area of the inlet aperture **85** of the second chamber **79** is less than the cross-sectional area of the chamber **79**. The

difference in area results in an increase in the speed of air flow through the inlet aperture **75**, as described hereinbefore. Therefore, it is possible to generate sufficiently high air speed through the inlet aperture forming the nozzle, to entrain dust and small debris, by means of the width of the inlet aperture constricting the volume of air as it passes through the inlet aperture. As such, the flow of air through the inlet aperture can have a high air speed generated in this way for a relatively low power usage by the motor of the first suction means. The narrow, elongate inlet aperture enables effective cleaning of the surface over which the aperture is positioned in use.

[0073] As discussed hereinbefore, the increased cross-sectional area of the chamber **79** compared to the area of the inlet aperture **85** and the resultant lower speed of air flow in the chamber **79** is also beneficial in that losses resulting from friction between the air flow and walls of the chamber are reduced by the slowing of the air flow on entering the chamber. The power usage by the motor of the first suction means can be minimised by the reduction of the frictional losses in the chamber by means of the difference between the area of the inlet aperture and the cross-sectional area of the chamber.

[0074] The provision of a chamber with a relatively large cross-sectional area also helps to minimise the potential of a blockage being formed in the chamber by the dust entrained in the air flow entering the chamber from the inlet aperture.

[0075] As shown in FIG. **3**, the inlet aperture **85** of the second chamber **79** extends along substantially the entire length of the longitudinal extent of the opening **32** in the front compartment **5**.

[0076] The width of the inlet apertures **75**, **85** are relatively narrow, for example in a range from 1 to 20 mm, or in a range from 1 to 10 mm. If desired, the width of the inlet aperture may be in a range from 2 to 4 mm.

[0077] The width, and thus the area, of the inlet aperture **85** of the second chamber **79** is greater than the width, and thus the area, of the inlet aperture **75** of the first chamber **69**.

[0078] The inlet aperture **85** of the second chamber **79** can, and generally does, have a greater area than the inlet aperture **75** of the first chamber **69** as there can be more power available to the external first means to create suction compared to the power available from the battery pack **51** for the internal second means to create suction **17**.

[0079] The cover **77**, described hereinbefore, is provided over the entire length of the inlet aperture **85**. The cover **77** has a series of elongate apertures to further reduce the width of the inlet aperture **85** between the surface to be cleaned and the chamber **79**.

[0080] As shown in FIGS. **1** and **3**, provided between the inlet aperture **75** of the first chamber **69** and the inlet aperture **85** of the second chamber **79** is a cleaning strip assembly **87**, for example for cleaning hard floor surfaces, as known to a person skilled in the art.

[0081] Ground-engaging wheels **89** to assist mobility of the surface cleaning apparatus **1** are provided in a region adjacent to the inlets **75**, **85** of the debris retrieval body **3** (see FIGS. **1** and **3**).

[0082] In use in the external vacuum mode, a surface cleaning apparatus **1** in accordance with the present invention is placed upon a surface to be cleaned, such as a carpet, and the switch **53** is operated to energise the brush assembly motor. The brush arrangement **27** is rotated to sweep debris from the surface to be cleaned and then propel the debris up and over the inclined wall **39** and into the removable tray **47** where it is temporarily stored. That is, the debris passes along path **311** as shown in FIG. **1**.

[0083] As the surface cleaning apparatus **1** is moved over the surface to be cleaned, with the brush arrangement **27** rotating, further debris is similarly swept from the surface and propelled up and over the wall **39** into the first intermediate compartment **7**.

[0084] As shown in FIG. **4**, due to the external first suction creating means creating a vacuum in the debris retrieval body of the apparatus **1**, debris passes through the inlet aperture **85** of the second elongate chamber **79** into the duct **83** via the outlet **81** provided in the rear wall of the elongate chamber **79**. The duct **83** transfers the debris, in the direction of arrow **313**, from the inlet aperture **85** beneath the first intermediate compartment **7** and on to a collection means provided in the first suction creating means via the handle **15**.

[0085] In use in the internal vacuum mode, a surface cleaning apparatus **1** in accordance with the present invention is placed upon a surface to be cleaned, such as a carpet, the motor is energised to rotate the brush assembly and the internal second suction creating means **17** is also energised. The brush arrangement **27** is rotated to sweep debris from the surface to be cleaned as described for the external vacuum mode.

[0086] As shown in FIG. **4**, vacuum created within the debris retrieval body by the internal second suction creating means **17** causes debris to pass through the inlet aperture **75** of the first elongate chamber **69** into the duct **73** via the outlet **71** provided in the rear wall of the elongate chamber **69**. The duct **73** transfers the debris, in the direction of arrow **315**, from the inlet aperture **75** beneath the first intermediate compartment **7** to the cyclonic separator **57**. In the cyclonic separator **57** the fine particles of dust are separated from the air stream and deposited, via the truncated conical end **61** of the cyclone body into the second rear compartment **13**.

[0087] It should be appreciated that the apparatus **1** can be used in both the internal vacuum mode and the external vacuum mode simultaneously. As the brush arrangement **27** is rotated to sweep debris from the surface, the debris is propelled up and over the inclined wall **39** and conveyed directly into the first intermediate compartment **7** where it is temporarily stored. Simultaneously, debris that is not swept up and propelled into the first intermediate compartment **7** by the brush arrangement **27** is drawn through the inlet aperture **75** into the first elongate chamber **69** by the suction created by the internal second suction creating means **17** and is drawn through the inlet aperture **85** into the second elongate chamber **79** by the suction created by the external first suction creating means. The two portions of debris removed by suction means follow separate and distinct pathways **313** and **315** through the apparatus **1** (as shown in FIG. **4**). The two portions of debris removed by suction means also follow separate and distinct pathways from the pathway **311** of the debris removed from the surface by the rotatable brush arrangement.

[0088] There is no connection pathway between the first intermediate compartment **7**, the duct **73** between the first chamber **69** and the second suction creating means **17**, and the duct **83** between the second chamber **79** and the first suction creating means that would enable debris in the first intermediate compartment **7** to be conveyed towards either of the suction creating means. As such, there is no possibility that the debris collected during use of the apparatus in the sweeper

mode can be drawn towards either the first or the second suction creating means and cause a blockage.

[0089] Although the nozzles in the form of inlet apertures **75**, **85** have been described as being provided rearward of the brush assembly, it should be appreciated that at least one of the inlet apertures could be provided forward of the elongate brush assembly with associated ducting passing over or to the side of the front compartment.

[0090] It should also be appreciated that, although a single removable plate covering the inlet apertures **75**, **85** has been described, either of the inlet apertures **75**, **85** could be uncovered. It should also be appreciated that the inlet **75** of the first chamber **69** and the inlet aperture **85** of the second chamber **79** may be covered by separate removable plates.

[0091] It should be appreciated that debris can be collected directly in a non-removable form of the first intermediate compartment and/or the second rear compartment wherein a closure is provided which can be opened for the emptying of debris therein.

[0092] It should also be appreciated that debris picked up by the brush arrangement and debris picked up by the internal suction generating means can be collected into two separate collecting means of a single collection body, where the two collecting means are sealed relative to each other to maintain suction within the apparatus.

[0093] Although an auxiliary brush **41** is described, it should be appreciated that a surface cleaning apparatus in accordance with the present invention need not have the auxiliary brush.

[0094] Although the means of creating suction within a surface cleaning apparatus in accordance with the present invention has been described hereinbefore as a cyclonic system, it should be appreciated that other methods of creating suction within a surface cleaning apparatus, known to a person skilled in the art, could be used, for example a suction creating assembly using a porous bag for the accumulation of debris.

1. A surface cleaning apparatus comprising:
a debris retrieval body (**3**);
a first collection means (**47**) and a second collection means (**13**) provided within the debris retrieval body for accumulating debris from a surface to be cleaned;
a rotatable elongate brush arrangement (**27**) provided within the debris retrieval body and adapted to retrieve a first portion of debris from the surface to be cleaned and to direct the first portion of the debris along a first pathway (**311**) into the first collection means (**47**);
a first inlet aperture (**75**) provided in the debris retrieval body for the passage along a second pathway (**315**), independent of the first pathway, of a second portion of debris from the surface to be cleaned to the second collection means, the first inlet aperture communicating with a first means for creating suction (**17**); and
a second inlet aperture (**85**) provided in the debris retrieval body for the passage along a third pathway (**313**), independent of the first and second pathways, of a third portion of debris from the surface to be cleaned to means for connection to a second means for creating suction.

2. A surface cleaning apparatus as claimed in claim **1**, wherein the first means for creating suction (**17**) is provided within the debris retrieval body (**3**).

3. A surface cleaning apparatus as claimed in claim **1**, wherein the second means for creating suction is provided remotely from the debris retrieval body (**3**).

4. A surface cleaning apparatus as claimed in claim **3**, wherein the remotely provided means for creating suction is incorporated into a cleaner body adapted for attachment to the debris retrieval body.

5. A surface cleaning apparatus as claimed in claim **1**, wherein the first means for creating suction (**17**) is a cyclonic suction generating system.

6. A surface cleaning apparatus as claimed in claim **1**, wherein the second means for creating suction is a cyclonic suction generating system.

7. A surface cleaning apparatus as claimed in claim **1**, wherein the first inlet aperture (**75**) is elongate.

8. A surface cleaning apparatus as claimed in claim **1**, wherein the first inlet aperture (**75**) is spaced from the elongate brush arrangement (**27**).

9. A surface cleaning apparatus as claimed in claim **1**, wherein a plurality of perforations is provided in a removable plate (**77**) covering the first inlet aperture (**75**).

10. A surface cleaning apparatus as claimed in claim **1** wherein the second inlet aperture (**85**) is elongate.

11. A surface cleaning apparatus as claimed in claim **1**, wherein the second inlet aperture (**85**) is spaced from the elongate brush arrangement (**27**).

12. A surface cleaning apparatus as claimed in claim **1**, wherein a plurality of perforations is provided in a removable plate (**77**) covering the second inlet aperture (**85**).

13. A surface cleaning apparatus as claimed in claim **1**, wherein the debris retrieval body is provided with an opening (**32**) through which bristles of the elongate brush arrangement extend for retrieving the first portion of debris.

14. A surface cleaning apparatus as claimed in claim **13**, wherein the opening (**32**) for the bristles is separate from the first inlet aperture (**75**).

15. A surface cleaning apparatus as claimed in claim **14**, wherein the first inlet aperture (**75**) extends substantially parallel and adjacent to the opening for the bristles of the elongate brush arrangement.

16. A surface cleaning apparatus as claimed in claim **1**, wherein the opening (**32**) for the bristles is separate from the second inlet aperture (**85**).

17. A surface cleaning apparatus as claimed in claim **16**, wherein the second inlet aperture (**85**) extends substantially parallel and adjacent to the opening for the bristles of the elongate brush arrangement.

18. A surface cleaning apparatus as claimed in claim **1**, wherein the second inlet aperture has a greater area than the first inlet aperture.

19. A surface cleaning apparatus as claimed in claim **1**, wherein the apparatus is adapted to convey the first portion of debris directly to the first collection means (**47**).

20. A surface cleaning apparatus as claimed in claim **1**, wherein the first collection means (**47**) is in the form of a removable tray.

21. A surface cleaning apparatus as claimed in claim **1**, wherein the second collection means is in the form of a removable tray.

22. A surface cleaning apparatus as claimed in claim **1**, wherein a lower edge (**33**) of a front wall (**31**) of the debris

retrieval body is maintained at a distance from the surface to be cleaned.

23. A surface cleaning apparatus as claimed in claim **22**, wherein the lower edge (**33**) of the front wall (**31**) of the debris retrieval body is provided with a recess (**35**).

24. A surface cleaning apparatus as claimed in claim **1**, wherein a battery (**51**) is provided to pro-vide power to rotate the elongate brush arrangement (**27**) and to power the first means for creating suction (**17**).

25. A surface cleaning apparatus as claimed in claim **1**, wherein a mains power supply is provided to power the second means for creating suction.

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