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(54) **HAND HELD APPLIANCE**

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(57) **ABSTRACT**

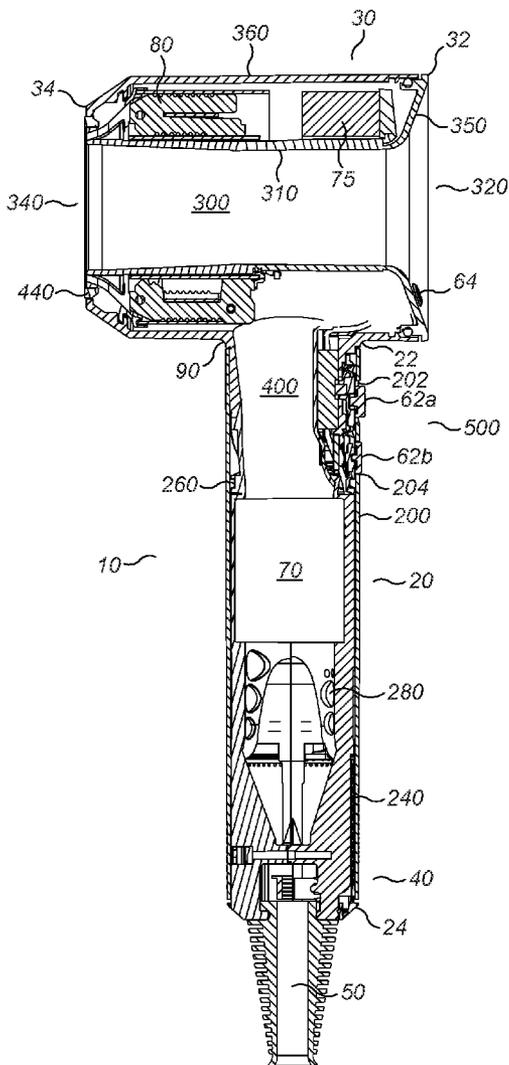
A hand held appliance comprising an outer wall, an inner wall, a fluid flow path extending within the inner wall from a fluid inlet into the appliance to a fluid outlet, a fan unit disposed within the inner wall for drawing fluid in through the fluid inlet and a seal disposed between the outer wall and the inner wall. Fluid in the fluid flow path may flow from the fluid inlet to an upstream end of the fan unit, through the fan unit to a downstream end of the fan unit and on to a fluid outlet. The seal may be downstream of the fluid inlet. The seal may be downstream of the fan unit. The outer wall may comprise a handle of the appliance. The seal may comprise an o-ring, a lip seal or any over moulded seal.

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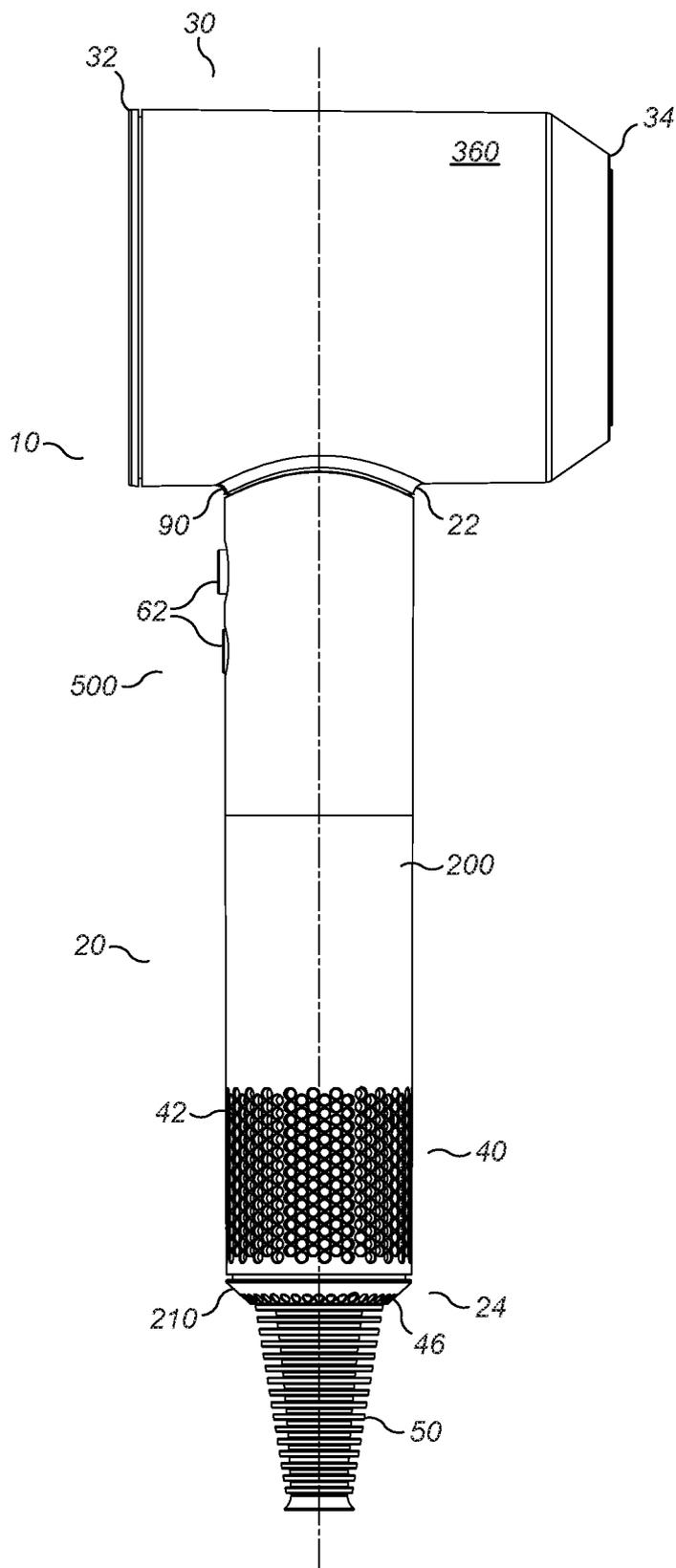


FIG. 1

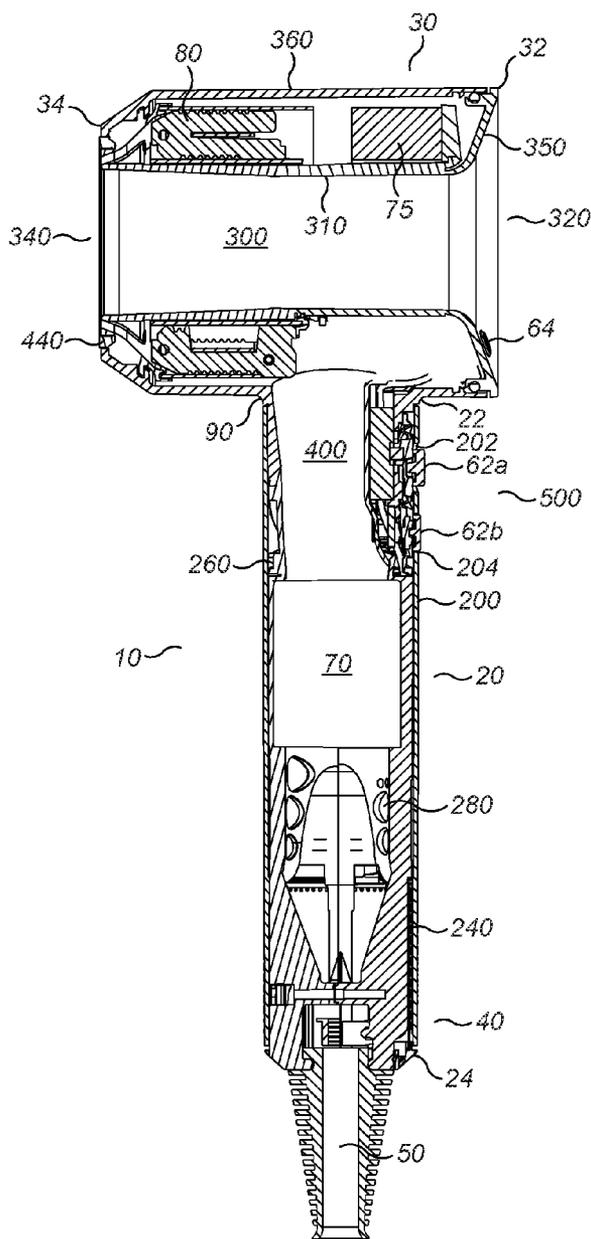


FIG. 2

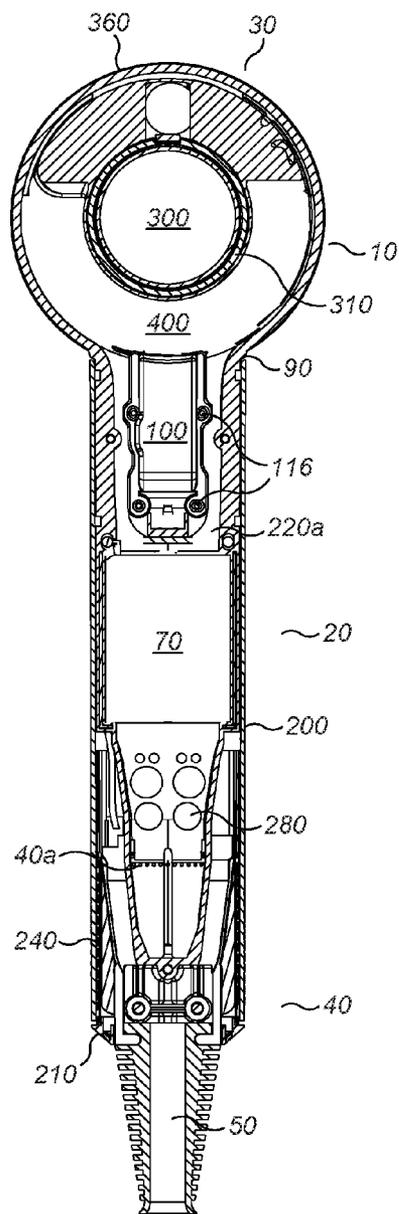


FIG. 3

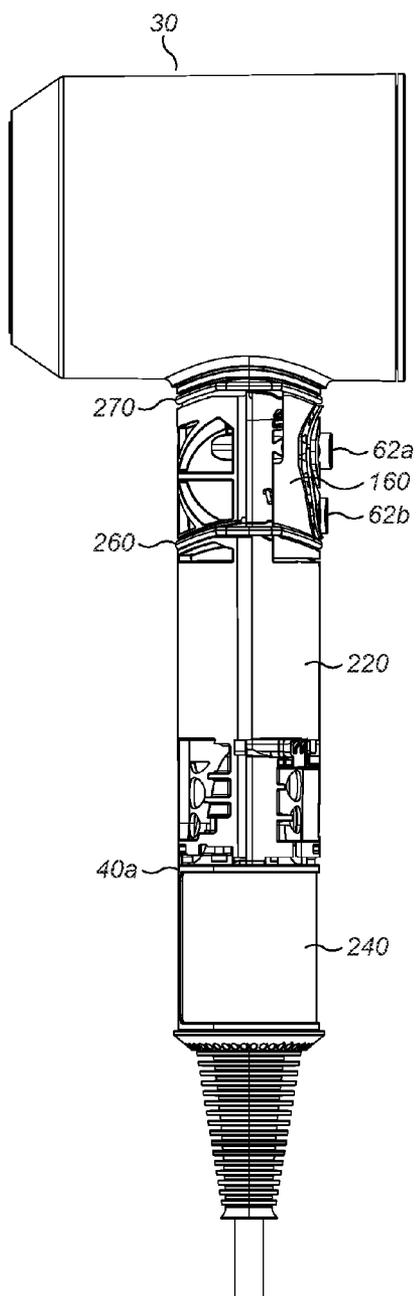


FIG. 4a

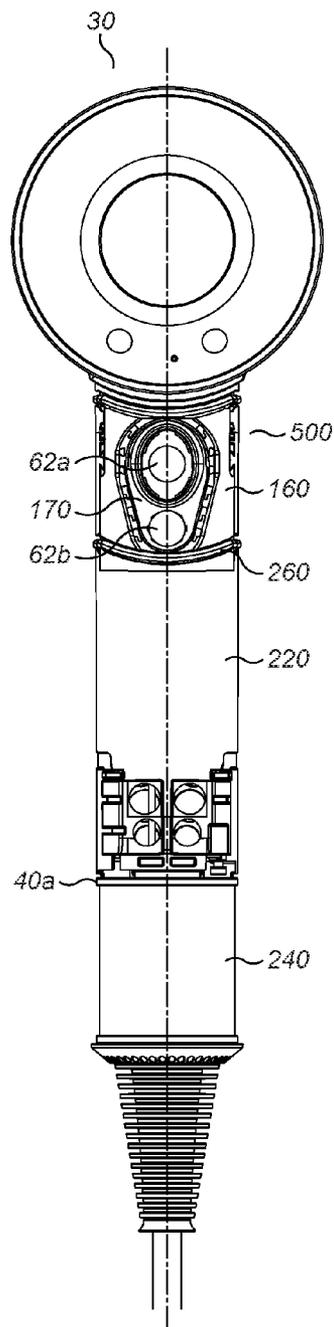


FIG. 4b

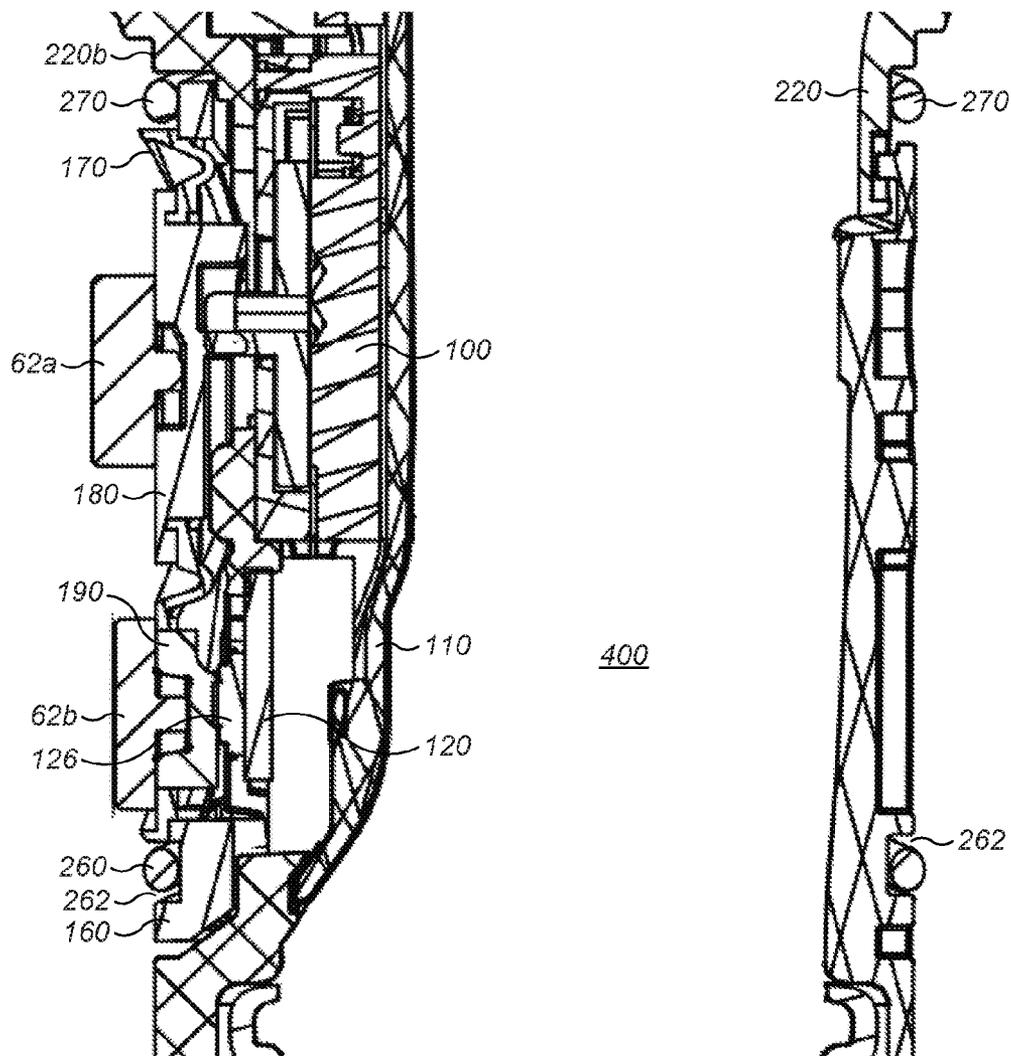


FIG. 5

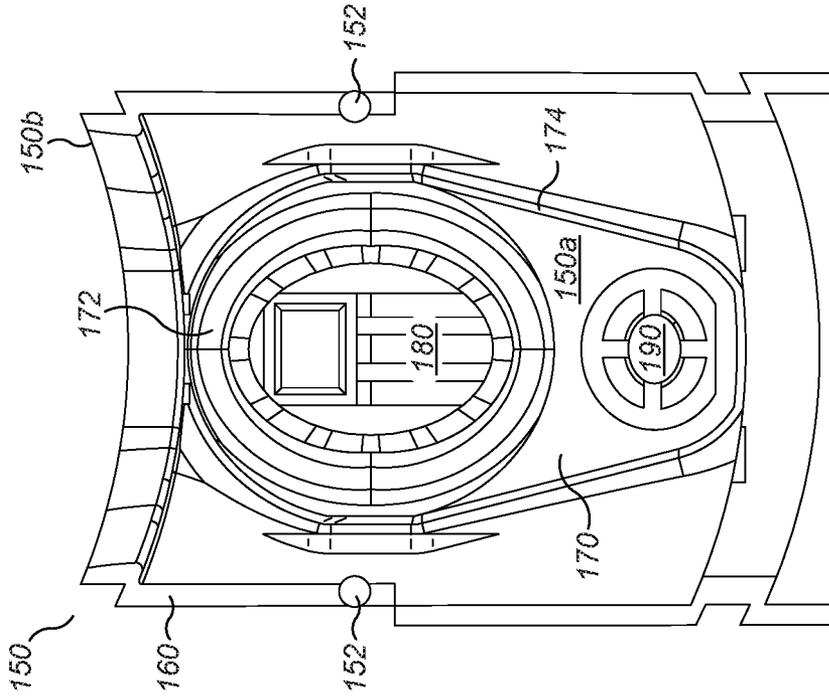


FIG. 7

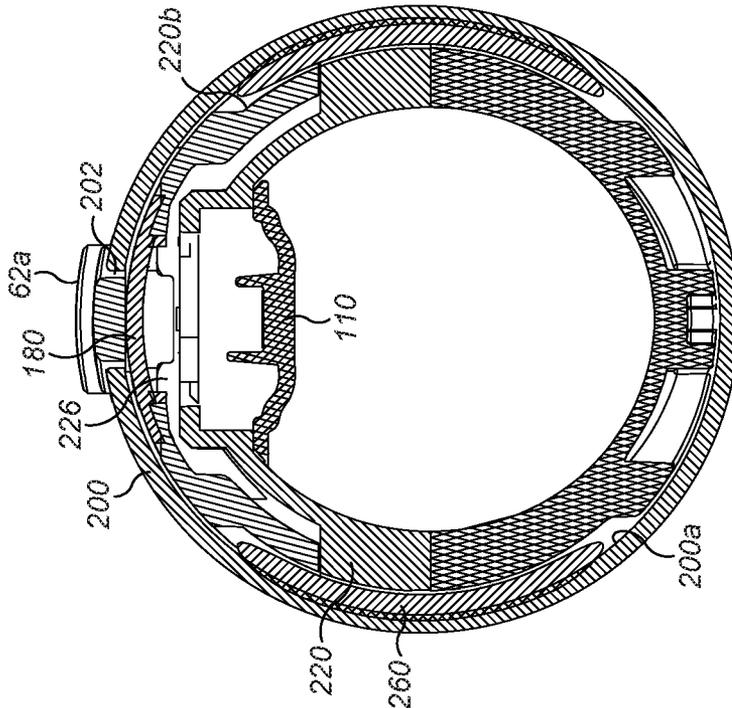


FIG. 6

## HAND HELD APPLIANCE

### REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority of United Kingdom Application No. 1508810.7, filed May 22, 2015, the entire contents of which are incorporated herein by reference.

### FIELD OF THE INVENTION

[0002] This invention relates to hand held appliance and in particular a hair care appliance.

### BACKGROUND OF THE INVENTION

[0003] Generally, a motor and fan are provided which draw fluid into a body; the fluid may be heated prior to exiting the body. The motor is susceptible to damage from foreign objects such as dirt or hair so conventionally a filter is provided at the fluid inlet to the blower. The fan and heater require power in order to function and this is provided via internal wiring from either a mains power cable or batteries attached to the appliance.

### SUMMARY OF THE INVENTION

[0004] Embodiments of the invention provide a hand held appliance comprising an outer wall, an inner wall, a fluid flow path extending within the inner wall from a fluid inlet into the appliance to a fluid outlet, a fan unit disposed within the inner wall for drawing fluid in through the fluid inlet and a seal disposed between the outer wall and the inner wall.

[0005] Having an outer wall and an inner wall is convenient for a number of reasons. There is a reduction in the transmission of vibrations and noise from the fan unit. The internal components, such as the fan unit, are housed within the inner wall isolating them from the outer wall. It enables the outer wall to be formed as a tube without join lines which is aesthetically pleasing. For construction, the inner wall is conveniently formed in two parts so that internal components, such as the fan unit, can be assembled, prior to the two parts of the inner wall being connected then the outer wall is slid over the inner wall.

[0006] In the arrangement of having an outer wall and an inner wall, there is an issue with fluid passing in the space between the outer wall and the inner wall and recirculating within this space. Any recirculation causes pressure losses within the appliance and impacts the velocity and volume of fluid exiting the appliance. The recirculation is caused by a pressure differential in fluid within the appliance caused by the action of the fan unit.

[0007] Accordingly, a seal is provided to prevent such recirculation. Preferably, fluid in the fluid flow path flows from the fluid inlet to an upstream end of the fan unit, through the fan unit to a downstream end of the fan unit and on to a fluid outlet. It is preferred that the seal is downstream of the fluid inlet.

[0008] Preferably, the seal is downstream of the fan unit. The seal is provided in any convenient position such that fluid cannot recirculate around the fan unit, i.e. flow passed the fan unit in one direction within the inner wall and in the opposite direction between the inner wall and the outer wall.

[0009] In one embodiment, the outer wall comprises a handle of the appliance. Thus, the fluid inlet and the fan unit are provided in the handle of the appliance. The fan unit is the largest component that is housed within the handle and

thus determines the diameter of the handle. In order not to increase the diameter of the handle it is advantageous to locate the seal upstream or downstream of the fan unit.

[0010] Preferably, the seal comprises an o-ring, a lip seal or any over moulded seal that extends around either the radially outer circumference of the inner wall or the radially inner circumference of the outer wall.

[0011] Regardless of what type of seal is used, it is preferable to position the seal longitudinally spaced as far as possible from the fluid inlet. This reduces the frictional forces produced when assembling the handle by sliding the outer wall over the inner wall.

[0012] In one embodiment, the inner wall comprises at least one noise mitigating perforation which provides an easy path for fluid to pass into the space between the inner wall and the outer wall. In this embodiment, the seal is preferably located downstream of the at least one perforation.

[0013] Preferably, a second seal is provided. It is preferred that this second seal is provided downstream of the first seal.

[0014] In one embodiment, the outer wall comprises a user interface comprising at least one user operable button. Preferably, the first seal is positioned upstream of this user interface. It is preferred that the second seal is positioned downstream of the user interface.

[0015] The user interface provides a potential source of fluid leaking either into or out of the fluid flow path therefore it is advantageous to seal around the user interface so that any such leaking is mitigated.

[0016] Preferably, the user interface further comprises a switch located within the inner handle which cooperates with the user operable button. In a preferred embodiment the user operable button cooperates with an actuator which is mechanically connected to the switch. Preferably, the actuator forms part of a switch assembly which connects to the inner wall.

[0017] Preferably, the user interface further comprises an actuator which cooperates with the user operable button wherein the actuator is mechanically connected to a switch.

[0018] In a preferred embodiment, the seal and the second seal extend around the switch assembly and the inner wall. This holds the switch assembly in place with respect to the inner wall. In addition, when the outer wall is slid into position over the inner wall, and the first seal and second seal are squashed between the two walls, the first and second seals provide a seal above and below the switch assembly thus reducing fluid leaks into the fluid flow path via the user interface.

[0019] Preferably, the switch assembly comprises a flexible membrane which surrounds the actuator and comprises a protrusion that seals against the inner wall. Preferably, the protrusion extends along a longitudinal axis of the inner wall. In a preferred embodiment, the protrusion extends either side of the actuator along the longitudinal axis of the inner wall. In this embodiment, the user interface is sealed both radially and longitudinally to reduce stray fluid flow and also to mitigate ingress of and duct etc. into the fluid flow path at the user interface.

[0020] Preferably a further seal is provided. This further seal is preferably provided downstream of the fluid inlet and spaced from the seal. The seal is provided to prevent fluid from recirculating between the outer wall and the inner wall so, the seal is proud of either the radially outer surface of the inner wall or the radially inner surface of the outer wall. This

can cause the outer wall to rock or pivot about the seal with respect to the inner wall. For this reason a further seal is provided which centralises the outer wall with respect to the inner wall and mitigates any rocking or pivoting.

[0021] In one embodiment the functions of the second seal and the further seal are combined; thus the second seal both seals the user interface and mitigates rocking or pivoting of the outer wall with respect to the inner wall.

[0022] Preferably, the appliance is a hair care appliance.

[0023] Preferably, the hair care appliance is a hairdryer. Alternatively, the hair care appliance is a hot styling appliance.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

[0025] FIG. 1 shows a hairdryer according to the invention;

[0026] FIG. 2 shows a cross section through the hairdryer of FIG. 1;

[0027] FIG. 3 shows a further cross section through the hairdryer of FIG. 1;

[0028] FIGS. 4a and 4b show a side view and a rear view of a the hairdryer of FIG. 1 without the outer wall of the handle;

[0029] FIG. 5 is a further cross section through the handle of hairdryer shown in FIG. 1;

[0030] FIG. 6 shows a different cross section through the handle of the hairdryer of FIG. 1; and

[0031] FIG. 7 shows the radially inner surface of the switch assembly of FIG. 4a.

#### DETAILED DESCRIPTION OF THE INVENTION

[0032] FIGS. 1, 2 and 3 show a hairdryer 10 with a handle 20 and a body 30. The handle has a first end 22 which is connected to the body 30 and a second end 24 distal from the body 30 and which includes a primary fluid inlet 40. Power is supplied to the hairdryer 10 via a cable 50. At a distal end of the cable 50 from the hairdryer 10 a plug (not shown) is provided, the plug may provide electrical connection to mains power or to a battery pack for example.

[0033] The handle 20 has an outer wall 200 which extends from the body 30 to a distal end 24 of the handle. At the distal end 24 of the handle an end wall 210 extends across the outer wall 200. The cable 50 enters the hairdryer through this end wall 210. The primary fluid inlet 40 in the handle 20 includes first apertures that extend around and along 42 the outer wall 200 of the handle and second apertures that extend across 46 and through the end wall 210 of the handle 20. The cable 50 is located approximately in the middle of the end wall 210 so extends from the centre of the handle 20. The handle 20 has a longitudinal axis X-X along which the outer wall 200 extends from the body 30 towards the distal end 24.

[0034] An inner wall 220 is provided that extends within the outer wall 200 from a downstream end 40a of the fluid inlet 40 to the body 30. The inner wall 220 includes a number of perforations 280 located between the downstream end 40a of the fluid inlet 40 and the fan unit 70. These

perforations stop some noise that is generated within the handle 20 from being transmitted to the outside of the handle 20.

[0035] The fluid inlet 40 is a primary filtration for the fluid that enters the fluid flow path 400. A second filter 240 is provided within the outer wall 200 extending from the end wall 210 to the downstream end 40a of the fluid inlet. This second filter is a secondary filtration for fluid that enters the fluid flow path 400.

[0036] Downstream of the primary fluid inlet 40, a fan unit 70 is provided. The fan unit 70 includes a fan and a motor. The fan unit 70 draws fluid through the primary fluid inlet 40 towards the body 30 through a primary fluid flow path 400 that extends from the primary fluid inlet 40 and into the body 30 where the handle 20 and the body 30 are joined 90. The body 30 has a first end 32 and a second end 34, the primary fluid flow path 400 continues through the body 30 towards the second end 34 of the body, around a heater 80 and to a primary fluid outlet 440 where fluid that is drawn in by the fan unit exits the primary fluid flow path 400. The primary fluid flow path 400 is non linear and flows through the handle 20 in a first direction and through the body 30 in a second direction which is orthogonal to the first direction.

[0037] The body 30 includes an outer wall 360 and an inner duct 310. The primary fluid flow path 400 extends along the body from the junction 90 of the handle 20 and the body 30 between the outer wall 360 and the inner duct 310 towards the primary fluid outlet 440 at the second end 34 of the body 30.

[0038] Another fluid flow path 300 is provided within the body 30; this flow is not directly processed by the fan unit 70 or the heater 80 but is drawn into the hairdryer 10 by the action of the fan unit producing the primary flow through the hairdryer. This fluid flow is entrained into the hairdryer by the fluid flowing through the primary fluid flow path 400.

[0039] The first end 32 of the body includes a fluid inlet 320 and the second end 34 of the body includes a fluid outlet 340. Both the fluid inlet 320 and the fluid outlet 340 are at least partially defined by the inner duct 310 which is an inner wall of the body 30 and extends within and along the body. A fluid flow path 300 extends within the inner duct 310 from the fluid inlet 320 to the fluid outlet 340. At the first end 32 of the body 30, a side wall 350 extends between the outer wall 360 and the inner duct 310. This side wall 350 at least partially defines the fluid inlet 320. The primary fluid outlet 440 is annular and surrounds the fluid flow path 300.

[0040] A printed circuit board (PCB) 75 including the control electronics for the hairdryer is located in the body 30 near the side wall 350 and fluid inlet 320. The PCB 75 is ring shaped and extends round the inner duct 310 between the inner duct 310 and the outer wall 360. The PCB 75 extends about the fluid flow path 300 and is isolated from the fluid flow path 300 by the inner duct 310.

[0041] The PCB 75 controls parameters such as the temperature of the heater 80 and the speed of rotation of the fan unit 70. Internal wiring (not shown) electrically connects the PCB 75 to the heater 80 and the fan unit 70 and the cable 50. The internal wiring consists of a live wire 112 and a neutral wire 122 that extend from the cable to the switch mechanism. Control buttons 62, 64 are provided and connected to the PCB 75 to enable a user to select from a range of temperature settings and flow rates for example. Control button 62 comprises a pair of buttons. A first button 62a

switches the product on and off and a second button **62b** provides a second function, in this case a cold shot function.

[0042] In use, fluid is drawn into the primary fluid flow path **400** by the action of the fan unit **70**, is optionally heated by the heater **80** and exits from the primary fluid outlet **440**. This processed flow causes fluid to be entrained into the fluid flow path **300** at the fluid inlet **320**. The fluid combines with the processed flow at the second end **34** of the body. In the example shown in FIG. 3, the processed flow exits the primary fluid outlet **440** and the hairdryer as an annular flow which surrounds the entrained flow that exits from the hairdryer via the fluid outlet **340**. Thus fluid that is processed by the fan unit and heater is augmented by the entrained flow.

[0043] Referring to FIGS. 4 to 7 in particular, the invention will now be described.

[0044] The handle **20** has an outer wall **200** and an inner wall **220** extending from the fluid inlet **40** to the body **30**. The fluid flow path **400** extends within the inner wall **220** however, as there is clearance between the outer wall **200** and the inner wall **220** to enable assembly of the outer wall **200** over the inner wall **220**, some fluid drawn in by the action of the fan unit can flow between the outer wall **200** and the inner wall **220**. To stop this, an o-ring **260** is provided between the outer wall **200** and the inner wall **220**. The inner wall **220** includes a recess **262** that extends around the inner wall **220** which partially accommodates the o-ring **260**, leaving enough thickness of the o-ring **260** proud of the outer surface **220b** of the inner wall **200** for the o-ring to engage with and seal against an inner surface **200a** of the outer wall **200**.

[0045] Conveniently, the o-ring **260** has a second function. This is possible as the seal can be made anywhere along the length of the inner wall **220** where a recirculation path for the fluid flowing within the handle **20** is prevented. Thus, for the example where perforations **280** are provided within the inner wall **220**, the seal must be made downstream of the perforations **280**. In this embodiment, the seal can be made anywhere along the inner wall **220** downstream of the perforations **280** to the body **30**, in theory. However, in one embodiment, having a user interface **500** having control buttons **62a,62b** provided on the handle **20**, the o-ring **260** is used to additionally provide a seal with respect to that user interface **500**. Thus, the o-ring **260** is downstream of the fan unit **70** and upstream of the user interface **500**.

[0046] The outer wall **200** includes a pair of apertures **202,204** through which the user operable buttons **62a,62b** activate a respective switch **100,126**. These apertures provide a potential leak path into fluid flow path **400**. A number of features are provided to mitigate that potential including having a switch assembly **150** disposed between the inner wall **220** and the outer wall **200**, a sealing lip **174** extending from the switch assembly **150** and the o-ring **260** which extends around the inner wall **220** and the switch assembly **150** thus biasing the switch assembly **150** towards the inner wall **220**.

[0047] The switch assembly **150** includes a frame **160**, a flexible membrane **170** and an actuator **180**. The frame **160** provides a support for the switch assembly **150**. The actuator **180** provides a support for the user operable button **62a**. The flexible membrane **170** connects the actuator **180** to the frame **160** and allows the actuator **180** to be moved by a user operating the button **62a** whilst providing a seal between the actuator **180** and the frame **160**.

[0048] The switch assembly **150** is located within the handle **20** of the hairdryer **10**. For convenience, the switch assembly **150** is connected to an inner wall **220** of the handle **20** via a pair of locating pins **152**. The inner wall **220** includes an aperture **226** through which the switch assembly **150** can engage with the switch mechanism **100** when the switch assembly **150** is connected to the inner wall **220**.

[0049] The different parts can be retained by mechanically fixing them together for example using glue, however in this embodiment, a switch cover **110** is used to house and retain the switch mechanism **150** with respect to the inner wall **220**.

[0050] For the switch assembly **150**, the locating pins **152** retain it with respect to the inner wall **200**, then the o-ring **260** is positioned within recess **262** and the outer wall **200** is positioned over the inner wall **220** by sliding the outer wall **200** along the inner wall **220**. The outer wall **200** is provided with an aperture **202** through which button **62a** cooperates with its' switch **100**. Once the outer wall **200** is correctly located, the user operable button **62a** is attached to the actuator **180** through aperture **202**.

[0051] In this embodiment the switch mechanism **100** is a sliding switch with an activation knob **102**. In order to accommodate the sliding action of the activation knob **102** and the actuator **180**, the flexible membrane is provided with a bellows **172** which extends around the actuator.

[0052] The switch assembly **150** additionally contains a second actuator **190** which is surrounded by the flexible membrane **170**. The second actuator **190** is connected to a second button, in this case a cold shot button **62b** which restricts or cuts power to the heater when activated to provide a cool flow from the hairdryer. The outer wall **200** is provided with a second aperture **204** through which the cold shot button **62b** engages with the second actuator **190**. When the cold shot button **62b** is activated the actuator **190** engages with an electronic switch **126** which is housed on a PCB extension **120**. This PCB extension **120** is electrically connected to the PCB **75** to provide signals to controlling software relating to activation and deactivation of the electronic switch **126**. This cold shot button **62b** is also attached to the second actuator **190** through the second aperture **204** after the outer wall **200** has been assembled over the inner wall **220**.

[0053] The flexible membrane **170** is provided with a sealing lip **174** (FIG. 7). This sealing lip **174** extends radially inwards from the radially inner surface **150a** of the switch assembly. The sealing lip **174** extends along the longitudinal axis X-X of the handle **20** to seal around both the actuator **180** and the second actuator **190**. The sealing lip **174** may also extend completely about the actuator **180** and the second actuator **190** to encapsulate them. Thus any fluid or dirt that passes between a user operable button **62a,62b** and its' respective actuator **180,190** has a convoluted path between the inner wall **220** and the switch assembly **150**, through the lip seal **174** and then between the inner wall **220** and the switch cover **110** in order to enter the fluid flow path **400**.

[0054] A second o-ring **270** is provided and this second o-ring **270** can be positioned anywhere along the inner wall **220** between the inner wall **220** and the outer wall **200**. It is advantageous that this second o-ring **270** is spaced from the o-ring **260** as one of the functions of this second o-ring **270** is to stop a pivoting action between the outer wall **200** and

the inner wall 220 by providing two spaced apart points of contact between the outer wall 200 and the inner wall 220.

[0055] In this embodiment, the second o-ring 270 is provided near a downstream end 150b of the switch assembly 150 and the o-ring 260. This seal has dual functionality in that it seals between the outer wall 200 and the inner wall 220 and in addition is used to bias the downstream end 150b of the switch assembly 150 towards the inner wall 220 to help prevent ingress of fluid or dirt from the user interface or specifically the apertures 202, 204 in the outer wall 200 through which user operable buttons 62a,62b engage with respective switches 100,120.

[0056] The outer wall 220 is tubular and moulded as a single unit. This limits the number of places where either fluid can escape from the fluid flow path or foreign mater and fluid can be introduced.

[0057] Alternatively, the two functions of the second o-ring provided in this embodiment are provided by a second o-ring and a further o-ring. The further o-ring (not shown) is preferably spaced from both the o-ring 260 and the second o-ring 270.

[0058] The invention has been described in detail with respect to a hairdryer however, it is applicable to any appliance that draws in a fluid and directs the outflow of that fluid from the appliance.

[0059] The appliance can be used with or without a heater; the action of the outflow of fluid at high velocity has a drying effect.

[0060] The fluid that flows through the appliance is generally air, but may be a different combination of gases or gas and can include additives to improve performance of the appliance or the impact the appliance has on an object the output is directed at for example, hair and the styling of that hair.

[0061] The invention is not limited to the detailed description given above. Variations will be apparent to the person skilled in the art.

- 1. A hand held appliance comprising:
  - an outer wall;
  - an inner wall;
  - a fluid flow path extending within the inner wall from a fluid inlet into the appliance to a fluid outlet; and
  - a fan unit disposed within the inner wall for drawing fluid in through the fluid inlet and a seal disposed between the outer wall and the inner wall.
- 2. The appliance of claim 1, wherein fluid in the fluid flow path flows from the fluid inlet to an upstream end of the fan unit, through the fan unit to a downstream end of the fan unit and on to a fluid outlet.
- 3. The appliance of claim 1, wherein the seal is downstream of the fluid inlet.

4. The appliance of claim 1, wherein the seal is downstream of the fan unit.

5. The appliance of claim 1, wherein the outer wall comprises a handle of the appliance.

6. The appliance of claim 5, wherein the seal comprises an o-ring, a lip seal or any over moulded seal.

7. The appliance of claim 6, wherein the seal extends around the radially outer circumference of the inner wall.

8. The appliance of claim 6, wherein the seal extends around the radially inner circumference of the outer wall.

9. The appliance of claim 1, wherein the inner wall comprises at least one noise mitigating perforation wherein the seal is located downstream of the at least one perforation.

10. The appliance of claim 1, wherein a second seal is provided.

11. The appliance of claim 10, wherein the second seal is provided downstream of the first seal.

12. The appliance of claim 10, wherein the outer wall comprises a user interface comprising at least one user operable button.

13. The appliance of claim 12, wherein the first seal is positioned upstream of the user interface and the second seal is positioned downstream of the user interface.

14. The appliance of claim 12, wherein the user interface further comprises an actuator which cooperates with the user operable button wherein the actuator is mechanically connected to a switch.

15. The appliance of claim 14, wherein the actuator forms part of a switch assembly which connects to the inner wall.

16. The appliance of claim 15, wherein the seal extends around the switch assembly and the inner wall.

17. The appliance of claim 15, wherein the second seal extends around the switch assembly and the inner wall.

18. The appliance of claim 15, wherein the switch assembly comprises a flexible membrane which surrounds the actuator and comprises a protrusion that seals against the inner wall.

19. The appliance of claim 18, wherein the protrusion extends along a longitudinal axis of the inner wall.

20. The appliance of claim 18, wherein the protrusion extends on either side of the actuator along a longitudinal axis of the inner wall.

21. The appliance of claim 1, wherein a further seal is provided.

22. The appliance of claim 21, wherein the further seal is positioned downstream of the fluid inlet and spaced from the seal.

23. The appliance of claim 1, wherein the appliance is a hair care appliance.

24. The appliance of claim 23, wherein the hair care appliance is a hairdryer.

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