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## PORTABLE STEAM VACUUM CLEANER

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates to portable vacuum cleaners, and more particularly to a portable vacuum cleaner capable of generating steam for delivery to a surface to be cleaned.

#### 2. Description of Related Art

Portable vacuum cleaners for cleaning solid or liquid materials are well known in the art and are often referred to as "wet/dry" vacuum cleaners. Conventional wet/dry vacuum cleaners are disclosed for example, in U.S. Patent No. 4,821,366 to Levine, U.S. Patent No. 4,924,548 to Touya et al., and U.S. Patent No. 5,005,252 to Steiner et al. These devices typically include a motor driven fan enclosed within a housing for producing a vacuum to draw liquid and debris into a collection nozzle. However, conventional wet/dry vacuums are unsuited for cleaning stained fabrics, upholstery, or carpets.

Improvements have been made in wet/dry vacuum cleaners in an effort to increase their stain cleaning effectiveness. For example, U.S. Patent No. 4,788,738 to Monson et al. discloses a portable vacuum cleaner having an internal cleaning fluid supply system disposed in a removable discharge head which includes a chamber for retaining the cleaning fluid, a spray nozzle for discharging the cleaning fluid to the surface to be cleaned, and a vacuum intake head for drawing excess fluid and debris into the vacuum. A vacuum blower unit is provided in communication with the discharge head for creating suction to draw the excess cleaning fluid from the surface and for pumping cleaning fluid from the spray nozzle. A similar vacuum cleaner is described in U.S. Patent No. 4,930,178 to Monson et al. which incorporates a filter element for separating debris from the cleaning fluid which enables the cleaning fluid to be recycled for subsequent use.



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Often, however, it may be undesirable to apply cleaning fluids directly to fabric, upholstery, or carpets, because fading, deterioration or other damage may result.

It is desirable therefore, to provide a portable vacuum cleaner which is capable of generating steam for delivery to an area to be cleaned, which overcomes the disadvantages of the prior art by providing for both steam cleaning and normal vacuuming.

#### SUMMARY OF THE INVENTION

The present invention relates to a wet and dry hand held vacuum cleaner as disclosed in independent Claim 1. Preferred embodiments of the invention are disclosed in the dependent claims.

Further features of the invention, its nature, and various advantages will become more apparent to one skilled in the art from the following detailed description of the invention taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the subject invention will be described with reference to the drawings wherein:

Fig. 1 is a perspective view of a portable steam vacuum cleaner in accordance with a preferred embodiment of the subject invention;

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Fig. 2 is a side cross-sectional view taken along line 2-2 of Fig. 1;

Fig. 3 is a bottom plan view of the portable steam vacuum cleaner of Fig. 1;

Fig. 4 is a top plan view of the portable steam vacuum cleaner of Fig. 1;

Fig. 5 is a perspective view of the heating unit for generating steam within vacuum cleaner of Fig. 1;

Fig. 6 is a bottom plan view of the heating unit of Fig. 5;

Fig. 7 is a top plan view of the heating unit of Fig. 5;

Fig. 8 is a side elevational view of the heating unit of Fig. 5;

Fig. 9 is a front elevational view of the heating unit of Fig. 5;

Fig. 10 is a perspective view of another embodiment of the portable steam vacuum cleaner in accordance with the subject invention;

Fig. 11 is a side cross-sectional view taken along line 11-11 of Fig. 10;

Fig. 12 is a perspective view of yet another embodiment of the portable steam vacuum cleaner in accordance with the subject invention;

Fig. 13 is a side cross-sectional view taken along line 13-13 of Fig. 12; and

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Fig. 14 is a cross-sectional view of an alternate embodiment of the portable steam vacuum cleaner of Fig. 13.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

Referring now in detail to the drawings in which like reference numerals identify similar or identical elements, a preferred embodiment of the portable steam vacuum cleaner of the subject invention is illustrated in Fig. 1, and is designated generally by reference numeral 10. Vacuum cleaner 10 basically comprises a housing 12 which includes a handle portion 14 defining a handle grip 16, and a nozzle portion 18 preferably detachably mounted adjacent housing 12. Nozzle portion 18 may be released from housing 12 by movement of a clamp member 20 which may be manipulated by a user for gaining access to the interior of the vacuum cleaner 10.

Referring to Fig. 2, a motor 22 is enclosed within housing 12 for driving a fan 24 mounted for rotation relative to motor 22. Rotation of fan 24 creates suction for drawing debris and liquids into the nozzle portion 18 of vacuum cleaner 10. A sealing member 26 is disposed between fan 24 and motor 22 for preventing liquid from contacting the motor 22 during wet vacuuming. In addition, a liquid separator 28 is defined in nozzle portion 18 which includes structure for preventing liquid drawn into nozzle portion 18 during wet vacuuming from entering the cavity 30 in which the motor 22 and fan 24 are located, while prohibiting debris from contacting fan 24 during dry vacuuming. In particular, water drawn into an uptake port 32 of nozzle portion 18 will be directed towards a diverting wall 34 of arcuate configuration which diverts the liquid into a containing area 36 formed in nozzle portion 18, while permitting air to be directed into a filter chamber 38 in which a filter element 40 is disposed for removing debris from the air flow. Air, drawn through filter element 40, is subsequently exhausted through a plurality of vents 42 which are formed in the lateral walls of housing 12 (see Fig. 1).

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A reservoir chamber 44 is formed in the nozzle portion 18 of vacuum cleaner 10 for retaining water or a cleaning solution. Reservoir chamber 44 may be filled with the liquid in a conventional manner such as through an aperture 46 provided in clamp structure 20. A conduit 48 extends through a valve 52 from reservoir chamber 44 to a heating unit 50 which is provided for generating steam for delivery to an area to be cleaned. Conduit 48 permits gravitational flow of liquid from the reservoir 44 to the heating unit 50. Control valve 52 is associated with conduit 48 for selectively controlling the flow of liquid from the reservoir 44 to the heating unit 50.

Turning to Figs. 5-9, the heating unit 50 comprises a body portion 52 of substantially rectangular configuration having a cover panel 54 mountable to body portion 52 at a plurality of standoff locations 56 disposed in spaced relation about the periphery of body portion 52. Preferably, heating unit 50 is constructed of cast aluminum or a like material. An entrance port 58 extends through a side wall 60 of body portion 52 through which liquid from reservoir chamber 44 flows via conduit 48. Entrance port 58 communicates with a plurality of cascading steam generating chambers defined in body portion 52 including a primary steam generating chamber 62 of a generally inverted  $\Omega$ -shaped configuration. Opposed lateral dams 64 and 66 are formed at the head of primary steam generating chamber 62 for limiting the flow of heated liquid from the primary steam generating chamber 62 to a pair of secondary lateral steam generating chambers 68 and 70 of generally J-shaped configuration. Secondary dams 72 and 74 are formed at the trailing ends of lateral steam generating chambers 68 and 70 respectively, for limiting the flow of liquid into a tertiary steam generating chamber 76. A tertiary dam 78 separates the tertiary steam generating chamber 76 from a steam ejection chamber 80 which has a plurality of exit ports 82 defined therein through which steam generated by heating unit 50 is delivered to an area to be cleaned. A heating element such as cal-rod heating tube 84 is provided and is preferably cast integral with body portion 52 for transferring heat to the cascading steam generating chambers. Cal-rod heating tube 84 includes terminals 86 and

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88 which are in electrical connection with a power supply source of alternating current from power cord 90.

A bimetallic thermostat 92 is mountable within an annular cavity 94 provided in the bottom surface 96 of the body portion 52 of the heating unit 50 by a pair of opposed mounting flanges 98 and 100 (see Fig. 6). The thermostat automatically controls the operation of heating unit 50. Referring to Fig. 2, a scrubbing brush 102 is detachably mounted to the housing 12 of vacuum cleaner 10 adjacent exit ports 82 of heating unit 50 for assisting cleaning operations.

In operation, the portable steam vacuum cleaner 10 of the subject invention may be prepared for use by connecting the unit to an electrical outlet through power cord 90. After approximately one minute, the cal-rod heating tube 84 will have transferred sufficient heat to the body portion 52 of heating unit 50 so as to generate steam once liquid is introduced. Thus, at a desired time, the user may depress control valve 52 to cause cleaning solution or water to gravitate from the reservoir 44 into the primary steam generating chamber 62 of heating unit 50 via conduit 48. Upon entering the primary steam generating chamber 62, the liquid will begin to increase in temperature and pressure whereby heated liquid will transfer into the secondary lateral steam generating chambers 68 and 70 by traversing lateral dams 64 and 66. The temperature and pressure of the liquid is further increased in steam generating chambers 68 and 70 until such time as it flows into the tertiary steam generating chamber 76 by passing over secondary dams 72 and 74. Once introduced into the tertiary chamber 76 of heating unit 50, the temperature of the liquid is sufficiently increased to generate steam which traverses tertiary dam 78 and enters into the ejection chamber 80 where it is ejected under pressure through the ejection ports 82 to the area to be cleaned. As steam is ejected from the heating unit 50, the user may manipulate the device to employ scrub brush 102 which will assist in the cleaning task.

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Once the stain has been removed and the area cleaned, the user may depress a toggle switch 104 located adjacent handle 16 which activates the motor driven fan 24, thereby creating a vacuum for drawing debris and the excess liquid created by the condensed steam into the uptake port 32 of nozzle portion 18. Liquid drawn into uptake portion 32 is advantageously directed toward the diverting wall 34 of separator structure 28 and into the liquid containing area 36, while air flow is directed through filter chamber 38, against filter element 40, and subsequently through the exhaust vents 42 formed in the wall of housing 12.

Turning to Figs. 10 and 11, another embodiment of the portable steam vacuum cleaner in accordance with the subject invention is illustrated and designated generally by reference numeral 200. Vacuum cleaner 200 comprises a housing 212 having a handle portion 214 defining a handle grip 216, and a nozzle portion 218. A motor 222 and fan 224 are enclosed within housing 212 for creating a vacuum to draw debris and liquid into the nozzle portion 218 through an uptake port 232. A reservoir 244 is defined in the handle portion 214 of vacuum cleaner 200 which may be filled with water or cleaning solution through an aperture 215 extending through the wall thereof.

A pump 260 is provided in vacuum cleaner 200 operable by a toggle switch 262 for pumping liquid from reservoir 244 to a heating unit 250. A delivery tube 264 extends from the reservoir 244 to pump 260, and an outlet tube 266 extends from pump 260 through housing 212 to an entrance port 258. A relief valve 268 may be provided for returning liquid to reservoir 244 from heating unit 250 via a tubular conduit 270 in the event of overpressurization. Valve 268 is provided in the cover panel 254 of heating unit 250. An external relief valve 272 is associated with tubular conduit 270 for releasing pressure outside the vacuum 200.

In operation, vacuum cleaner 200 is prepared for use by heating the unit 250 for a sufficient period of time, and thereupon depressing the toggle switch 262 so that pump 260 delivers liquid to heating unit 250 where it is sufficiently heated to generate

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pressurized steam for delivery to an area to be cleaned. Thereafter, the motor driven fan 224 is activated by depressing switch 290 to draw excess liquid and debris into the nozzle portion 218 of vacuum cleaner 200.

Referring to Figs. 12 and 13, yet another embodiment of the portable steam vacuum cleaner of the subject invention is illustrated and is designated generally by reference numeral 300. Vacuum cleaner 300 is substantially similar to vacuum cleaner 200 in that it comprises a pump 360 operable by a toggle switch 364 for transferring liquid from a reservoir 344 defined in a handle portion 314 to a heating unit 350 via a tubular conduit 370 extending through the housing portion 312 thereof. Vacuum cleaner 300 differs however, in that the heating unit 350 is enclosed within a chamber 380 which is pivotably mounted with respect to the housing 312 thereof by a pivot pin 382. By mounting the heating unit 350 in this manner, the range of operability of vacuum cleaner 300 is substantially increased.

Referring to Fig. 14, an alternate embodiment of vacuum cleaner 300 is illustrated wherein the reservoir 344 is positioned adjacent heating unit 350 enclosed within chamber 380 and adapted to be filled through an aperture 345 associated therewith. Arranged in this manner, a pump is not required for transferring the liquid from the reservoir to the heating unit. Instead, a conduit 348 extends from the reservoir 344 to heating unit 350 and includes a manually operated control valve 352 for selectively controlling the flow of liquid to heating unit 350.

In use, cleaning solution or water is delivered from reservoir 344 to the heating unit 350 by depressing the control valve 352 to allow liquid to gravitate into heating unit 350 where it is generated into pressurized steam for delivery to an area to be cleaned.

## Claims

1. A wet and dry hand held vacuum cleaner comprising:

- a) a housing (12,212,312) having a handle portion (14,214,314) and a nozzle portion (18,218);
- b) a motor (22,222) driven fan (24,224) assembly disposed in the said housing (12,212,312) and communicating with said nozzle portion (18,218) for drawing liquid and debris into said nozzle portion (18,218);
- c) means for containing (36) the debris and liquid drawn into said nozzle portion (18,218);
- d) means for deflecting liquid drawn into said nozzle portion (18,218) away from said fan assembly (24,224) for collection in said containing means (36);
- e) a reservoir (44,244,344) associated with said housing (12,212,312) for retaining liquid;

characterised in that it further comprises means for heating (50,250,350) the liquid so as to generate steam and means for delivering said steam to a surface to be cleaned.

2. A wet and dry hand held vacuum cleaner as claimed in claim 1 characterised in that it comprises means for pumping liquid (260,360) from said reservoir (44, 244,344) to said heating means (50,250,350).

3. A wet and dry hand held vacuum cleaner as claimed in claim 1 or claim 2 characterised in that it comprises conduit means (48,370,348) for communicating said reservoir (44,244,344) with said heating means (50,250,350).

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4. A wet and dry hand held vacuum cleaner as claimed in claim 3 characterised in that it comprises valve means (52,352) for selectively allowing or preventing transferral of liquid from said reservoir (44,244,344) through said conduit means (48,370,348) to said heating means (50,250,350).

5. A wet and dry hand held vacuum cleaner as claimed in any preceding claim characterised in that said heating means (50,250,350) is disposed in a pivoting head member (380) mounted for movement relative to said housing (12,212,312).

6. A wet and dry hand held vacuum cleaner as claimed in any preceding claim characterised in that said heating means (50,250,350) includes means for controlling operation of said heating means (50,250,350).

7. A wet and dry hand held vacuum cleaner as claimed in any preceding claim characterised in that said heating means (50,250,350) comprises an enclosure defining an entry port (58) for receiving liquid, a plurality of cascading steam generating chambers (62,68,76) in communication with said entry port (58) for sequentially heating the liquid, and a plurality of exit ports (82) in communication with one of said steam generating chambers (62,68,76) for ejecting steam from said heating means (50,250,350).

8. A wet and dry hand held vacuum cleaner as claimed in claim 7 characterised in that a brush (102) is detachably mounted to said housing (12,212,312) adjacent said exit ports (82) of said heating means (50,250,350).

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9. A wet and dry hand held vacuum cleaner as claimed in any preceding claim characterised in that a brush (102) is detachably mounted to said housing (12,212,312) adjacent said nozzle portion (18,218).

10. A wet and dry hand held vacuum cleaner as claimed in any preceding claim characterised in that said containing means (36) is configured for preventing the liquid and debris drawn into said nozzle portion (18,218) from interfering with said motor (22,222) driven fan (24,224) assembly.

11. A wet and dry hand held vacuum cleaner as claimed in any preceding claim characterised in that it comprises a baffle (34) for substantially isolating said fan means (24,224) from contact with the liquid drawn into said housing (12,212,312).