

# **FOAM DISPENSER WITH A POROUS FOAMING ELEMENT**

## **FIELD OF THE DISCLOSURE**

5 This disclosure relates to foam dispensers and in particular foam dispensers having a porous foaming element wherein the air and liquid mix within the porous foaming element.

## **BACKGROUND**

10 Foam dispensers are well known and widely used commercially. A wide variety of foam dispensers have been developed. In particular, a number of non-aerosol foam dispensers that use unpressurised liquid containers have been developed. The advantage of foam dispensers over soap dispensers is that for each wash less soap is used.

15 One way to reduce the costs for manufacturing is to reduce the number of components. Accordingly an embodiment that reduces the number of parts would be advantageous.

As well, an embodiment wherein the quality of foam is improved would also be advantageous.

## **SUMMARY**

20 According to a first aspect of the present invention, there is provided a

foaming assembly comprising; a porous foaming element having an air inlet, a liquid inlet and an outlet, the porous foaming element having at least two zones of different pore sizes; a liquid chamber in flow communication with the porous foaming element, the liquid chamber having a liquid volume that is movable  
5 between an at rest position to an activation position; an air chamber in flow communication with the porous foaming element, the air chamber having an air volume that is movable between an at rest position to an activation position; and whereby liquid and air are forced into the porous foaming element under pressure and air from the air inlet and liquid from the liquid inlet mix in the porous foaming  
10 element to form foam which exits through the outlet.

According to a second aspect of the present invention, there is provided a foam dispenser comprising: a liquid container; a porous foaming element having an air inlet, a liquid inlet and an outlet, the porous foaming element having at least two zones of different pore sizes, a liquid chamber in flow  
15 communication with the porous foaming element, the liquid chamber having a liquid volume that is movable between an at rest position to an activation position, an air chamber in flow communication with the porous foaming element, the air chamber having an air volume that is movable between an at rest position to an activation position; and whereby liquid and air are forced into the porous foaming element  
20 under pressure wherein they mix to form foam which exits through the outlet.

The porous foaming element may have a smaller pore size zone and a larger pore size zone. The smaller pore size zone may be downstream of the larger

pore size zone. Alternatively the smaller pore size zone may be upstream of the larger pore size zone. The porous foaming element may be generally bow tie shape in cross section.

5 The foaming assembly may include a foam cone, a piston and a bottle seal and wherein the piston and bottle seal define the liquid chamber, the foam cone, bottle seal and piston define the air chamber and movement inwardly of the foam cone into the bottle seal decreases the liquid volume of the liquid chamber and the air chamber thereby forcing under pressure air and liquid into the porous foaming element.

10 The porous foaming element may be positioned in the foam cone between the foam cone and the piston. The porous foaming element may be made of compressible material and a smaller pore size zone is where the compressible material is more compressed than in a larger pore size zone. The shape of the porous foaming element may be defined by the geometry of the piston and the foam  
15 cone.

The foaming assembly may include a piston dome, a liquid and air bore and a main pump body and the piston dome, liquid and air bore and main body define a liquid chamber, the piston dome and liquid and air bore define the air chamber and movement inwardly of the piston dome into the main body decreases  
20 the liquid volume of the liquid chamber and the air chamber thereby forcing under pressure air and liquid into the porous foaming element. The main pump body may include an exit nozzle and the porous foaming element is positioned in the exit nozzle between the liquid chamber and a venturi ring. The shape of the porous foaming element may be defined by the geometry of the exit nozzle and the venturi  
25 ring.

The foaming assembly may include a pump head, a bottle cap, an air piston, a piston and a main body and the main body and piston define the liquid chamber and the pump head, bottle cap, air piston, piston and main body define the air chamber movement inwardly of the pump head into the main body decreases the  
30 liquid volume of the liquid chamber and the air chamber thereby forcing, under pressure, air and liquid into the porous foaming element. The shape of the porous foaming element may be defined by the geometry of the air piston and the pump

head.

A foam dispenser includes a liquid container and a porous foaming element. The foam dispenser may further include a housing having an actuator wherein activating the actuator causes the air chamber and the liquid chamber to  
5 move between the at rest position to the activation position. The housing may further include at least one sensor and the actuator is activated responsive to the sensor sensing the presence of a user.

According to a third aspect, there is provided a method of making foam including the steps of forcing air and liquid under pressure into a porous  
10 foaming element having at least two zones of different pore sizes wherein they mix to form foam which exits through the outlet.

Further features will be described or will become apparent in the course of the following detailed description.

## 15 **BRIEF DESCRIPTION OF THE DRAWINGS**

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

Fig. 1 is a perspective view of a foam dispenser including a foaming assembly with a porous foaming element;

20 Fig. 2 is a blown apart perspective view of the foaming assembly of the foam dispenser of figure 1;

Fig. 3 is a sectional view of the foaming assembly of figure 2;

Fig. 4 is a sectional view of an alternate embodiment of the foaming assembly of figure 2;

25 Fig. 5 is a sectional view of a further alternate embodiment of the foaming assembly of figure 2;

Fig. 6 is a blown apart perspective view of a prior art foaming assembly;

30 Fig. 7 is a blown apart perspective view of an alternate embodiment of a foaming assembly;

Fig. 8 is a sectional view of a foam dispenser including the foaming assembly of figure 7;

Fig. 9 is an enlarged sectional view of the nozzle portion of the foaming assembly shown in figures 7 and 8;

Fig. 10 is a sectional view of a partially assembled dispenser shown in figure 8 but showing the porous foaming element and venturi ring disassembled;

5 Fig. 11 is a blown apart perspective view of a further alternate embodiment of a foaming assembly;

Fig. 12 is a sectional view of the foaming assembly of figure 11;

Fig. 13 is a perspective view of the soap dispenser of figure 1 and showing an outer housing broken away; and

10 Fig. 14 is a side view of figure 13.

### DETAILED DESCRIPTION

Referring to figures 1 to 3, an unpressurized, non-aerosol foam dispenser is shown generally at 10. Dispenser 10 includes a foaming assembly 12 connected to a liquid container 13. The liquid container 13 is an unpressurized liquid container.

The foaming assembly 12 includes foam cone 14, a piston 16 and a bottle seal 18. The piston 16 and bottle seal 18 define a liquid chamber 20. The foam cone 14, bottle seal 18 and piston 16 define an air chamber 22. The liquid chamber 20 is a central liquid chamber and the air chamber 22 is an annular air chamber. The foam cone 16 moves relative to the bottle seal 18. The piston 16 is operably connected to the foam cone 14 with a press fit. An O-ring 24 slides between the piston 16 and the bottle seal 18 and provides a liquid seal therebetween.

25 The liquid container 13 is in flow communication with the liquid chamber 20. A bottle seal valve 28 controls the inlet 30 of the liquid chamber 20. A top hat valve 32 controls the outlet 34 of the liquid chamber 20.

A mixing chamber 37 is located between the piston 16 and the foam cone 14. The mixing chamber 37 defines an interior volume which is filled with a porous foaming element 36. The mixing chamber extends from an upstream end to a downstream end and the upstream end is spaced apart from the downstream end. The porous material extends from the upstream end to the downstream end of the

porous foaming element. The mixing chamber 37 has an air inlet 38, a liquid inlet 40 and an outlet 41. The air inlet 38, the liquid inlet 40 and the outlet 41 are in flow communication with the porous foaming element 36 such that air and liquid mix in the mixing chamber 37 and mix within the porous foaming element. The air inlet 38 and liquid inlet 40 are spaced apart. The porous foaming element 36 has zones of different porosity. By way of example only the porous foaming element 36 has a smaller pore size zone 44 and a larger pore size zone 46. The porous foaming element 36 may be compressible material or it may be manufactured such that the pore size varies as prescribed. By way of example only the compressible material may be sponge material. Generally as pore size decreases the foam quality changes. It has been observed that as pore size decreases the resultant foam appears smoother or richer and thus would be considered better quality foam. As air and liquid are forced under pressure through the porous foaming element 36 the foam quality improves.

It will be appreciated by those skilled in the art that with a compressible porous foaming element the zones of different porosity are defined by the geometry of the piston 16 and the foam cone 14. Compression of the porous foaming element 36 is achieved during assembly. As shown in figures 3 to 5, a variety of different configurations may be constructed such that the porous foaming element 36 has a compressed zone 44 having smaller pores and an expanded zone 46 with larger pores. The mixing chamber 37 filled with the porous foaming element 36 may have a generally bow tie shape as shown in figure 3 wherein the larger pore size zone 46 is around the outside and the smaller pore size zone 44 is in the center. The mixing chamber 37 filled with the porous foaming element 36 may be shaped into a half bow tie at the bottom as shown in figure 4 wherein the small pore size zone 44 is downstream of the larger pore size zone 46. The mixing chamber 37 filled with the porous foaming element 36 may be shaped into a half bow tie at the top as shown in figure 5, wherein the small pore size zone 44 is upstream of the larger pore size zone 46. Note that where the porous foaming element is made from compressible material there may be a gradual transition of pore size between the large pore size zone 46 to the small pore size zone 44.

In use when the dispenser 10 is activated the foam cone 14 moves

inwardly relative to the bottle seal 18 thus moving between an at rest position to an activation position decreasing the liquid volume of the liquid chamber 20 and the air chamber 22 thus pressurizing the liquid and air therein and forcing the liquid and air under pressure into the mixing chamber 37 filled with the porous foaming element 36. This embodiment is similar to that shown in US patent 8,104,650 issued to Lang et al. on January 31, 2012.

One advantage of the mixing chamber 37 filled with the porous foaming element 36 is that it acts as both a foaming element and an anti-drip element. Thus in the embodiment described above a number of elements may be reduced. Comparing a prior art foaming component 49 shown in figure 6 to the embodiment described above, most of the components are the same except that it does not include the porous foaming element 36. Rather it includes the upstream gauze tube 50 having large gauze pores, downstream gauze tube 52 having smaller gauze pores and venturi ring 54, all of which are not needed in the embodiments of the present disclosure. The foam cone 14, valve 32, piston 16, O-ring 24, bottle seal valve 28 and bottle seal 18 are similar to those described above with regard to foaming assembly 12.

It will be appreciated by those skilled in the art that the porous foaming element described above may also be used in other type of pumps, for example dispenser 60 shown in figure 10 and described in detail in US application 13/458,318 filed April 27 2012 to Banks et al. Referring to figures 7 to 10, dispenser 60 includes a pump or foaming assembly 62 and a liquid container 64. Pump 62 includes a piston dome 66, a liquid and air bore 68 and a main pump body 70. The main pump body 70 includes an exit nozzle 72. A mixing chamber 73 is defined by the exit nozzle and a venturi ring 76. A porous foaming element 74 is positioned in the mixing chamber 73 of the exit nozzle 72. A venturi ring 76 is downstream of the porous foaming element 74. A valve 78 is positioned in exit nozzle 72 to selectively open and close the liquid outlet 82 of liquid chamber 80. The liquid and air bore 68 and main body 70 define a liquid chamber 80. The piston dome 66 and liquid and air bore 68 define the air chamber 84. Movement inwardly of the piston dome 66 into the main body 70 decreases the liquid volume of the liquid chamber 80 and the air chamber 84 thereby forcing under pressure air and liquid through the liquid outlet

82 and the air outlet 83 into the porous foaming element 74. Air and liquid mix together and then foam within the porous element 74.

The porous foaming element 74 is positioned in the exit nozzle between the liquid chamber 80 and the venturi ring 76 and fills the area  
5 therebetween. In one embodiment, the porous foaming element 74 is made of compressible material and a smaller pore size zone 86 is where the compressible material is more compressed than in a larger pore size zone 88. The geometry of the porous foaming element 74 is defined by the geometry of the exit nozzle 72 and the venturi ring 76. In the assembly process the porous foaming element 74 is  
10 positioned in the nozzle 72 and then the venturi ring 76 is inserted into the nozzle 72. The geometry of the venturi ring 76 is configured to create a compressed area such that there is a smaller pore size zone 86 and a larger pore size zone 88 as best seen in figure 9. In another embodiment the porous foaming element is manufactured to have different pour sizes and to fill the area between the liquid  
15 chamber 80 and the venturi ring 76.

Referring to figures 11 and 12, another example of a porous foaming assembly 90 is similar to that shown in US patent 5,443,569 issued to Uehira et al. on August 22, 1995 but modified to include a porous foaming element 106.

The porous foaming assembly 90 includes a pump head 92, a bottle  
20 cap 94, an air piston 96, a piston 98 and a main body 100. The main body 100 and piston 98 define the liquid chamber 102 and the pump head 92, bottle cap 94, air piston 96, piston 98 and main body 100 define the air chamber 104. Movement inwardly of the pump head 92 into the main body 100 decreases the liquid volume of the liquid chamber 102 and the air chamber 104 thereby forcing, under pressure, air  
25 and liquid into a porous foaming element 106.

The porous foaming assembly 90 includes a valve stem 108 and air valve 110, a valve step 112, liquid valve 114 and main body seal 116. A spring 118 biases pump head 92 into an at rest position. Moving the pump head 92 into the main body 100 and into an activation position decreases the air volume of the air  
30 chamber 104 and liquid chamber 102. A mixing chamber 101 is filled with a porous foaming element and the shape of the porous foaming element 106 is defined by the geometry of the air piston 96 and the pump head 92 defining a smaller pore size

zone 120 and a larger pore size zone 122.

Referring to figures 13 and 14, dispenser 10 may further include a housing 124. The housing 124 has an actuator 126 that engages foam cone 14 such that moving the actuator 126 moves the foam cone 14. Housing 124 may  
5 include a sensor 128 that activates the sensor response to the sensor sensing the presence of a user.

It will be appreciated by those skilled in the art that by combining the mixing chamber and the porous media into one element the size of the overall space package may be reduced when compared to using a separate mixing  
10 chamber and porous media.

Various embodiments and aspects of the disclosure will be described with reference to details discussed below. The following description and drawings are illustrative of the disclosure and are not to be construed as limiting the disclosure. Numerous specific details are described to provide a thorough  
15 understanding of various embodiments of the present disclosure. However, in certain instances, well-known or conventional details are not described in order to provide a concise discussion of embodiments of the present disclosure.

As used herein, the terms, "comprises" and "comprising" are to be construed as being inclusive and open ended, and not exclusive. Specifically, when  
20 used in the specification and claims, the terms, "comprises" and "comprising" and variations thereof mean the specified features, steps or components are included. These terms are not to be interpreted to exclude the presence of other features, steps or components.

As used herein, the term "exemplary" means "serving as an example, instance, or illustration," and should not be construed as preferred or advantageous  
25 over other configurations disclosed herein.

As used herein, the terms "about" and "approximately" are meant to cover variations that may exist in the upper and lower limits of the ranges of values, such as variations in properties, parameters, and dimensions. In one non-limiting  
30 example, the terms "about" and "approximately" mean plus or minus 10 percent or less.

As used herein, the term "substantially" refers to the complete or

nearly complete extent or degree of an action, characteristic, property, state, structure, item, or result. For example, an object that is "substantially" enclosed would mean that the object is either completely enclosed or nearly completely enclosed. The exact allowable degree of deviation from absolute completeness may  
5 in some cases depend on the specific context. However, generally speaking the nearness of completion will be so as to have the same overall result as if absolute and total completion were obtained. The use of "substantially" is equally applicable when used in a negative connotation to refer to the complete or near complete lack of an action, characteristic, property, state, structure, item, or result.

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WHAT IS CLAIMED IS:

## 1. A foaming assembly comprising;

a porous foaming element having an air inlet, a liquid inlet and an outlet, the porous foaming element having at least two zones of different pore sizes;

a liquid chamber in flow communication with the porous foaming element, the liquid chamber having a liquid volume that is movable between an at rest position to an activation position;

an air chamber in flow communication with the porous foaming element, the air chamber having an air volume that is movable between an at rest position to an activation position; and

whereby liquid and air are forced into the porous foaming element under pressure and air from the air inlet and liquid from the liquid inlet mix in the porous foaming element to form foam which exits through the outlet.

2. The foaming assembly of claim 1 wherein the porous foaming element has a smaller pore size zone and a larger pore size zone.

3. The foaming assembly of claim 2 wherein the smaller pore size zone is downstream of the larger pore size zone.

4. The foaming assembly of claim 2 wherein the smaller pore size zone is upstream of the larger pore size zone.

5. The foaming assembly of any one of claims 1 to 4 wherein the porous foaming element is generally bow tie shape in cross section.

6. The foaming assembly of any one of claims 1 to 4 wherein the foaming assembly further includes a foam cone, a piston and a bottle seal and wherein the piston and bottle seal define the liquid chamber, the foam cone, bottle seal and piston define the air chamber and movement inwardly of the foam cone into the bottle seal decreases the liquid volume of the liquid chamber and the air chamber thereby forcing under pressure air and liquid into the porous

foaming element.

7. The foaming assembly of claim 6 wherein the porous foaming element is positioned in the foam cone between the foam cone and the piston.

8. The foaming assembly of claim 6 or 7 wherein the shape of the porous foaming element is defined by the geometry of the piston and the foam cone.

9. The foaming assembly of any one of claims 1 to 4 wherein the foaming assembly further includes a piston dome, a liquid and air bore and a main pump body and the piston dome, liquid and air bore and main pump body define the liquid chamber, the piston dome and liquid and air bore define the air chamber and movement inwardly of the piston dome into the main pump body decreases the liquid volume of the liquid chamber and the air chamber thereby forcing under pressure air and liquid into the porous foaming element.

10. The foaming assembly of claim 9 wherein the main pump body includes an exit nozzle and the porous foaming element is positioned in the exit nozzle between the liquid chamber and a venturi ring.

11. The foaming assembly of claim 10 wherein the shape of the porous foaming element is defined by the geometry of the exit nozzle and the venturi ring.

12. The foaming assembly of any one of claims 1 to 4 wherein the foaming assembly further includes a pump head, a bottle cap, an air piston, a liquid piston and a main body and the main body and piston define the liquid chamber and the pump head, bottle cap, air piston, piston and main body define the air chamber movement inwardly of the pump head into the main body decreases the liquid volume of the liquid chamber and the air chamber thereby forcing, under pressure, air and liquid into the porous foaming element.

13. The foaming assembly of claim 12 wherein the shape of the porous

foaming element is defined by the geometry of the air piston and the pump head.

14. The foaming assembly of any one of claims 1 to 13 wherein the porous foaming element is made of compressible material and a smaller pore size zone is where the compressible material is more compressed than in a larger pore size zone.

15. A foam dispenser comprising:

a liquid container;

a porous foaming element having an air inlet, a liquid inlet and an outlet, the porous foaming element having at least two zones of different pore sizes, a liquid chamber in flow communication with the porous foaming element, the liquid chamber having a liquid volume that is movable between an at rest position to an activation position, an air chamber in flow communication with the porous foaming element, the air chamber having an air volume that is movable between an at rest position to an activation position; and

whereby liquid and air are forced into the porous foaming element under pressure wherein they mix to form foam which exits through the outlet.

16. The foam dispenser of claim 15 further including a housing having an actuator wherein activating the actuator causes the air chamber and the liquid chamber to move between the at rest position to the activation position.

17. The foam dispenser of claim 16 wherein the housing further includes at least one sensor and the actuator is activated responsive to the sensor sensing the presence of a user.

18. A method of making foam including the steps of forcing air and liquid under pressure into a porous foaming element having at least two zones of different pore sizes wherein they mix to form foam which exits through the outlet.