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(54) **Improvements in sprayed water distribution**

(57) This invention relates to a shower head (2) that has a shower head inlet (4) for receiving a flow of water and at least two outlet openings (8, 10). A vortex chamber (12) is associated with each outlet opening. Each vortex chamber (12) has at least one substantially tangential vortex inlet (32) for receiving water from the shower head

inlet (4) and an axial vortex outlet (30) leading directly to an outlet opening (8, 10) aligned with the axial vortex outlet (30). The outlet openings (8, 10) are positioned such that the water emitting each opening impinges on the flow of the water emitting from at least one other opening.

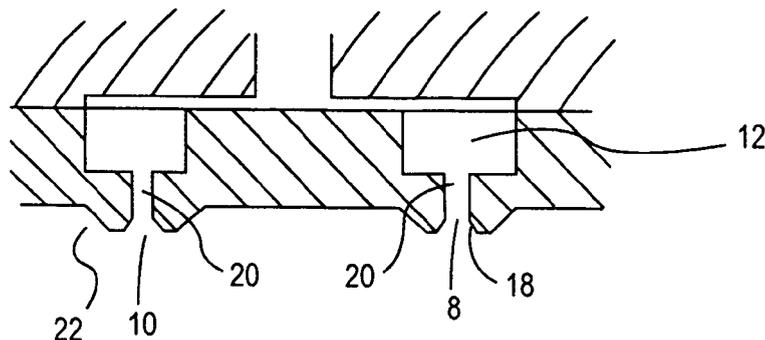


Fig 5

Description

[0001] The present invention relates to sprayed water distribution, in particular to improved sprayed water distribution from shower heads.

[0002] Conventional shower heads distribute water in a spray pattern therefrom through a plurality of holes. This forms a regular pattern of water distribution of droplets or a quite regular size. While such shower heads provide adequate distribution of water in higher flow environments, in conditions where there is only a low flow of water the water distribution, and in particular the wetted surface area provided by the water emitting from the shower head is poor and does not provide for a good showering experience.

[0003] It is the purpose of the present invention to provide a shower head that has improved water distribution, in particular with low flow rates.

[0004] According to the present invention there is provided a shower head having a shower head inlet for receiving a flow of water and at least two outlet openings, a vortex chamber associated with each outlet opening, each vortex chamber having a substantially tangential vortex inlet for receiving water from the shower head inlet and an axial vortex outlet leading directly to an outlet opening aligned with the axial vortex outlet, wherein the outlet openings are positioned such that, in use, water exiting each outlet opening impinges on the flow of the water emitting from at least one other outlet opening.

[0005] As the water exiting the outlet openings has a radial component to its flow and as these radial flows impinge upon one another a random dispersion of droplets of different sizes is achieved. This random dispersion and random droplet size causes a dispersed water distribution that falls in an irregular flow pattern that improves the showering experience as, for a user the water will directly wet their entire skin as opposed to regular droplets of water falling in a regular pattern. Furthermore the vortex chamber technology accelerates the water flow without the need to pass it through very small holes which, in low pressure and low flow situations further decreases the flow rate due to the induced back pressure.

[0006] Preferably rotary movement of the water in the vortex induces the water to exit the outlet openings substantially as a continuous sheet of water prior to disintegrating into a spray and the outlet openings are positioned such that the water exiting from each outlet opening impinges on the flow of the water exiting from the other outlet opening prior to the continuous sheet of water disintegrating into a spray.

[0007] Impingement during the phase of the water flow prior to the flow disintegrating into individual droplets ensures maximum interference between fluid flow exiting the outlet openings.

[0008] In a preferred embodiment the vortex chamber and outlet openings cause the rotating water exiting each outlet opening to, in use, follow a divergent/convergent flow path wherein the water initially diverges as it exits

each nozzle and then converges back upon itself before dispersing in a spray and the water exiting from each outlet opening impinges on the flow of the water exiting from the at least one other outlet opening prior to the water converging back upon itself. In one preferred embodiment the flow path between the axial vortex outlet and the outlet opening may be outwardly tapered so that its diameter increases as the water moves towards the outlet opening.

[0009] In this initial convergent/divergent part of the flow the fluid flow is confined to a relatively compact area and as such results in maximum interference of the flows, which results in the flows breaking up into a randomly distributed spray pattern.

[0010] Preferably, in use, water exiting each outlet opening impinges on the flow of the water emitting from at least one other outlet opening at a flow rate in the range of 2 litres per minute to 6 litres per minute. It is at these low flow rates that conventional type showers give particularly poor showering experiences and wherein the beneficial effect of the present invention is most advantageous. The effect of the present invention at these low flow rates is comparable to traditional type shower heads operating at higher flow rates.

[0011] Preferably the outlet openings each have a chamfered edge.

[0012] The diameter of the axial vortex outlet may be in the range of 10 to 90 % of the vortex chamber diameter, preferably in the range of 40 to 90%. Alternatively, or additionally, the distance between the axial vortex outlet and the outlet opening may be in the range of 1 to 3 times the axial vortex outlet diameter.

[0013] In one preferred arrangement the outlet openings are radially arranged about a common mid point and the outlet openings are angled towards said mid point. The angle may be in the region of 1 to 30 degrees, preferably 4 to 15 degrees. By angling the openings towards one another, not only is a greater impingement achieved but the outer diameter of the spray pattern is reduced and a more concentrated spray pattern is achieved.

[0014] In one preferred arrangement the edge to edge separation of the outlet openings is in the range of 3 to 6 times the outlet opening diameter.

[0015] In a preferred embodiment each vortex chamber comprises a plurality of equally spaced tangential inlets.

[0016] By using a number of equally spaced tangential inlets a far more even radial flow is produced which is particularly beneficial in achieving an even flow out of the nozzle. In particular, when the flow from the nozzle produces a thin continuous sheet of water, a plurality of tangential vortex inlets is beneficial for achieving an even and regular sheet of water.

[0017] In one embodiment the outlet openings comprise nozzles that extend from the shower head.

[0018] Specific embodiments of the invention are described below, without limitation, with reference to the drawings, in which:

Figure 1 shows a shower head in accordance with the invention having two outlet openings;

Figure 2 shows a shower head in accordance with the invention having three outlet openings;

Figure 3 shows a shower head in accordance with the invention having four outlet openings;

Figure 4 shows a Cross section through the flow of adjacent outlet openings;

Figure 5 shows a cross section through the shower head of Figure 1; and

Figure 6 shows an exploded view of the shower head in accordance with the invention

[0019] Referring to Figure 1 a shower head 2 is shown having an inlet 4 for water, an handle 6 by which a user can hold the shower head, or by which it can be attached to a shower raiser rail in the conventional manner, and two outlet openings 8, 10 through which water can exit the shower head. Figures 2 and 3 show similar shower heads with three and four outlet openings respectively. It will be appreciated by the skilled person that more outlet openings can be used.

[0020] Referring now also to Figures 4 and 5, water enters the shower head via the inlet 4, passes up the handle and splits into flow paths each feeding a vortex chamber 12 associated with each outlet opening 8, 10. The water enters the vortex chamber tangentially, spins in the chamber 12 and exits via vortex chamber outlet 14. The spinning water flows then pass through a short channel 16 and exit the shower head 2 via the outlet openings 8, 10. The outlet openings each 8, 10 have a chamfered inner edge 18. The water exits the outlet opening 8, 10 it does so in a convergent/divergent flow pattern. The water initially diverges 14 and then converges 16 back in on itself. The exact reason or this is not fully established but it is believed to be because the water exits the outlet opening 8, 10 in a sheet that later breaks down into droplets, the water pattern exiting the outlet opening 8, 10 in a diverging rotating sheet has a surface tension associated therewith and the divergent/convergent flow experienced is a result of this surface tension and the rotational water flow at the point of exit from the outlet opening. Irrespective of the cause of this effect the flow acts in this manner.

[0021] At some point the sheet of water will break down into random droplets (see Figure 6), either before the point of re-convergence or at the point of re-convergence, depending on the exact flow rate. The outlet openings 8, 10 are spaced such that the flows from adjacent openings impinge on one another in this initial part of the water flow before the sheet of water breaks down into random droplets, preferably in the divergent flow section 14. This flow impingement assists in the breaking down of the flow but

also results in a spray distribution that is much more even. If for example the flows did not impinge then after the point of re-convergence the spray pattern of the shower head 2 would be that of two divergent rings of water. The impingement breaks this down and avoids potential "dry spots" within the spray pattern.

[0022] The angle and size of the chamfer 18 on the inner edge of the outlet openings can be modified to change the shape and size of the divergent/convergent spray pattern. The exact dimensions required will be dependant on a number of factors including the flow rate of water, the size of the orifices and the separation of the orifices 8, 10 and can be achieved through empirical experimentation. By way of example a two outlet shower head with outlet openings of 5mm diameter and 30mm edge to edge outlet separation with the outlets angled towards one another at 5 degrees.

[0023] As stated above the outlet openings 8, 10 are angled slightly towards one another. This assists in the impingement of the water exiting the openings and helps concentrate water towards the centre of the spray distribution.

[0024] The vortex chambers 12 comprise a main cylindrical shaped chamber having a tangential inlet and an axial vortex outlet, the diameter of the axial vortex outlet is in the range of 40 to 90% of the vortex chamber diameter. From the axial vortex outlet a short length of flow path 20 leads to the outlet openings that have the form of small nozzles 22 the length of the flow path 20 will depend on the design parameters, flow rate etc but typically will be in the range of 1 to 3 times the axial vortex outlet diameter. If it is much longer then the rotational element of the water flow becomes decreased due to frictional losses as the water passes through the flow path 20.

[0025] The invention allows a showering experience of good quality using substantially lower flow rates, and thus consuming less water and energy to heat it with, than conventional showers. Not only, therefore, does the shower head enable improved showering where only a low flow rate of water is available but generally permits showering to be undertaken in a manner that conserves both energy and water, thereby benefitting the environment.

[0026] Referring to Figure 7 an exploded view of the shower head 2 is shown comprising three main parts, the handle moulding 24, the spray head 26 and a distributor plate 28. When assembled the distributor plate 28 is sandwiched between the handle moulding and the spray head so that it is fully contained therein. As can be seen the spray head has two vortex chambers therein, each of which has a plurality of tangential inlet passages 32 leading thereinto and an axial vortex outlet (30). The tangential inlet passages 32 ensure an even radial distribution of flow. The distributor plate 28 takes the main flow and splits it into individual flows that enter each inlet passage 32 and pass therefrom into the vortex chambers. Seals 34 are placed between the distributor plate

28 and the spray head 26 to ensure a fluid tight connection. The entire shower head is then held together by screws 36, although it may alternatively be secured together by other means, for example adhesives or plastic welds.

Claims

1. A shower head having a shower head inlet for receiving a flow of water and at least two outlet openings, a vortex chamber associated with each outlet opening, each vortex chamber having at least one substantially tangential vortex inlet for receiving water from the shower head inlet and an axial vortex outlet leading directly to an outlet opening aligned with the axial vortex outlet, wherein the outlet openings are positioned such that the water emitting each outlet opening impinges on the flow of the water emitting from at least one other opening. 5
2. A shower head according to claim 1 wherein rotary movement of the water in the vortex induces the water to exit the outlet openings substantially as a continuous sheet of water prior to disintegrating into a spray and wherein outlet openings are positioned such that the water emitting from each outlet opening impinges on the flow of the water emitting from the other outlet opening prior to the continuous sheet of water disintegrating into a spray 10
3. A shower head according to claim 1 or claim 2 wherein the vortex chamber and outlet openings cause the rotating water exiting each outlet opening to follow a divergent/convergent flow path wherein the water initially diverges as it exits each nozzle and then converges back upon itself before dispersing in a spray and wherein the water emitting from each outlet opening impinges on the flow of the water emitting from the other outlet opening prior to the water converging back upon itself. 15
4. A shower head according to any previous claim wherein the water emitting from each outlet opening impinges on the flow of the water emitting from at least one other outlet opening at a flow rate in the range of 2 litres per minute to 6 litres per minute. 20
5. A shower head according to any previous claim wherein the outlet openings each have a chamfered edge. 25
6. A shower head according to any previous claim wherein the diameter of the axial vortex outlet is in the range of 40 to 90 % of the vortex chamber diameter. 30
7. A shower head according to any previous claim wherein the distance between the axial vortex outlet and the outlet opening is in the range of 1 to 3 times the axial vortex outlet diameter. 35
8. A shower head according to any previous claim wherein the outlet openings are radially arranged about a common mid point and the outlet openings are angled towards said mid point. 40
9. A shower head as claimed in claim 8 wherein the angle is in the region of 1 to 30 degrees. 45
10. A shower head wherein the outlet openings comprise nozzles that extend from the shower head. 50
11. A shower head according to any preceding claims wherein each vortex chamber has a plurality of inlet passageways, each terminating in a substantially tangential vortex inlet. 55
12. A shower head according to any previous claim wherein there is a flow path between each axial vortex outlet and the associated outlet opening that tapers outwardly towards the outlet opening.

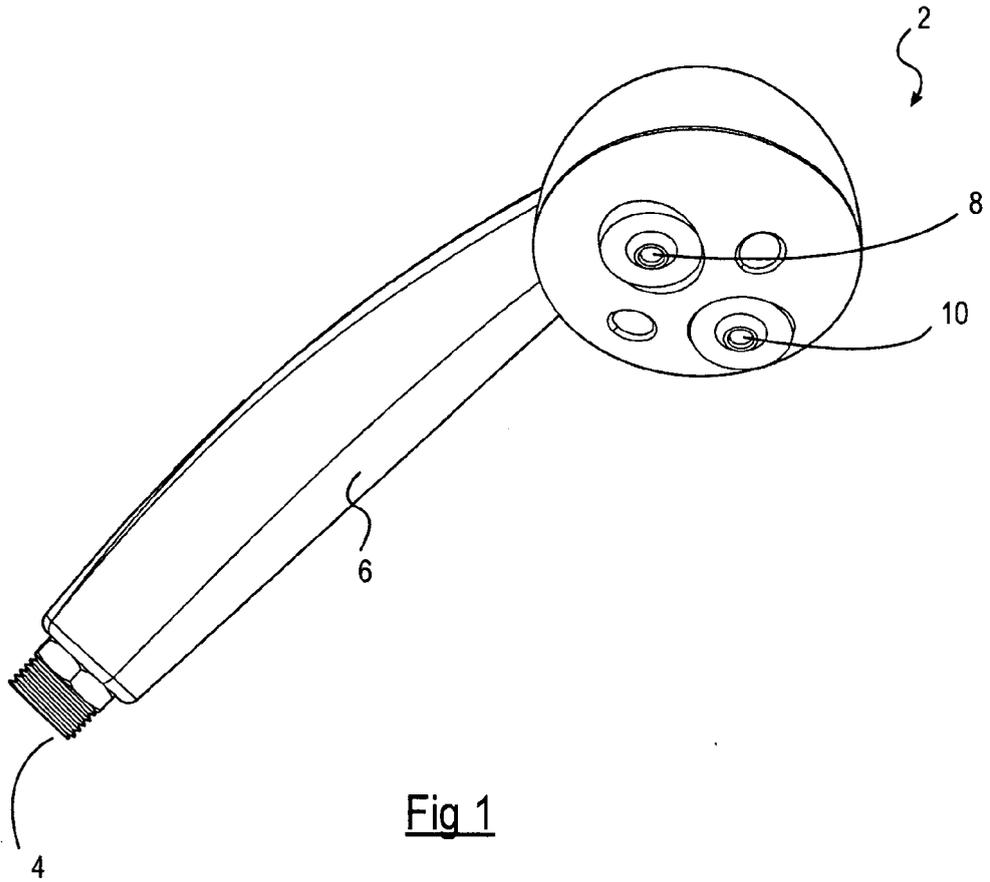


Fig 1

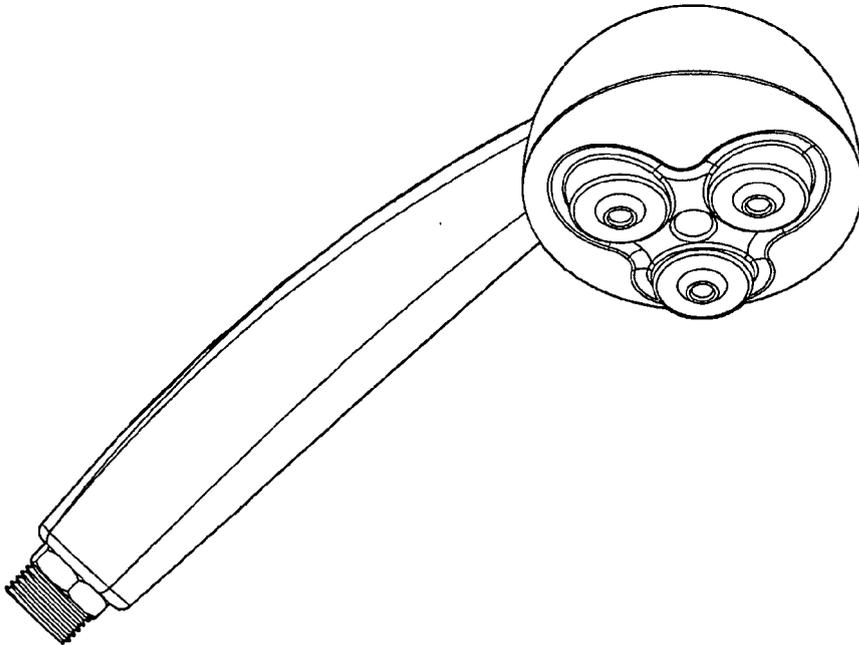


Fig 2

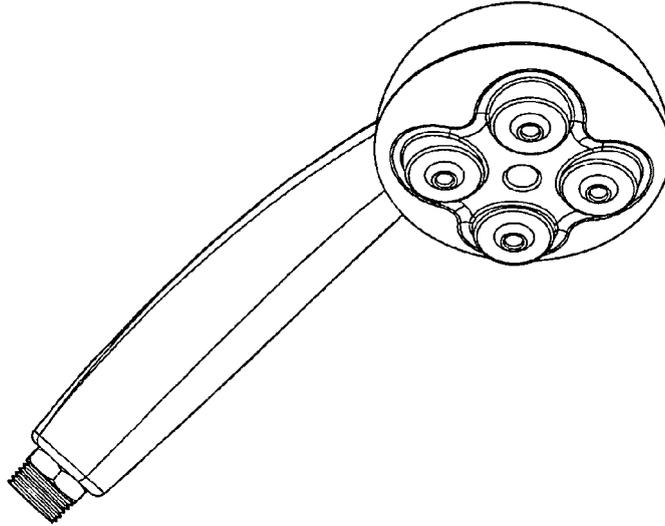


Fig 3

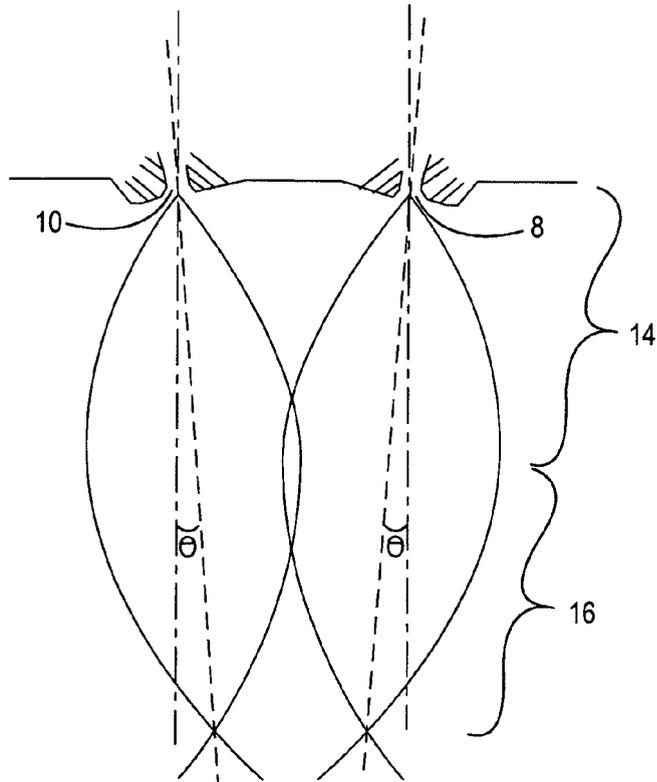


Fig 4

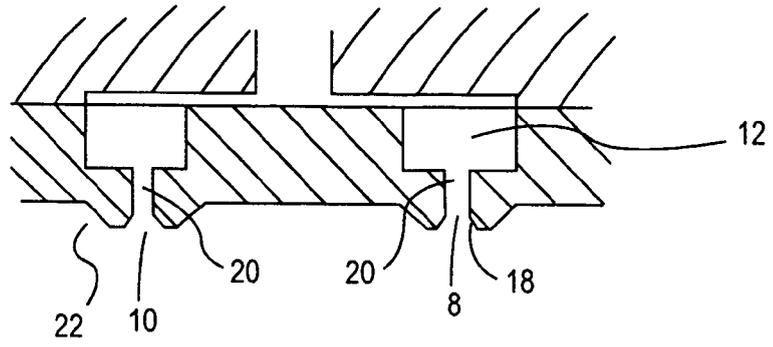


Fig 5

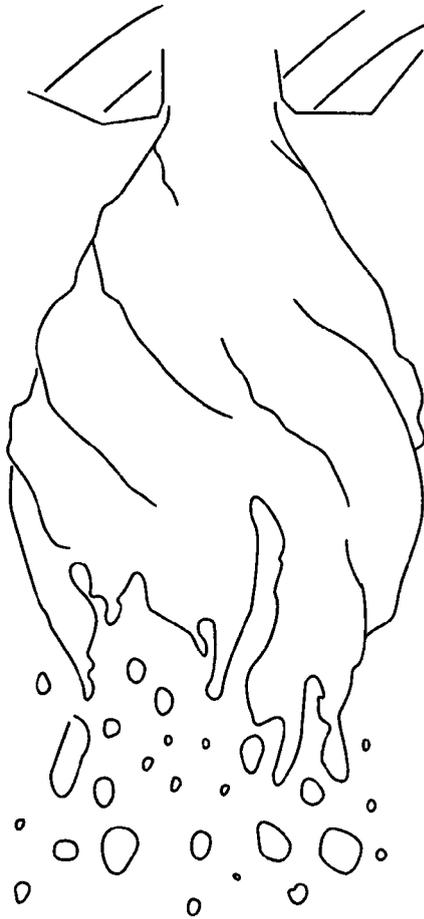


Fig 6

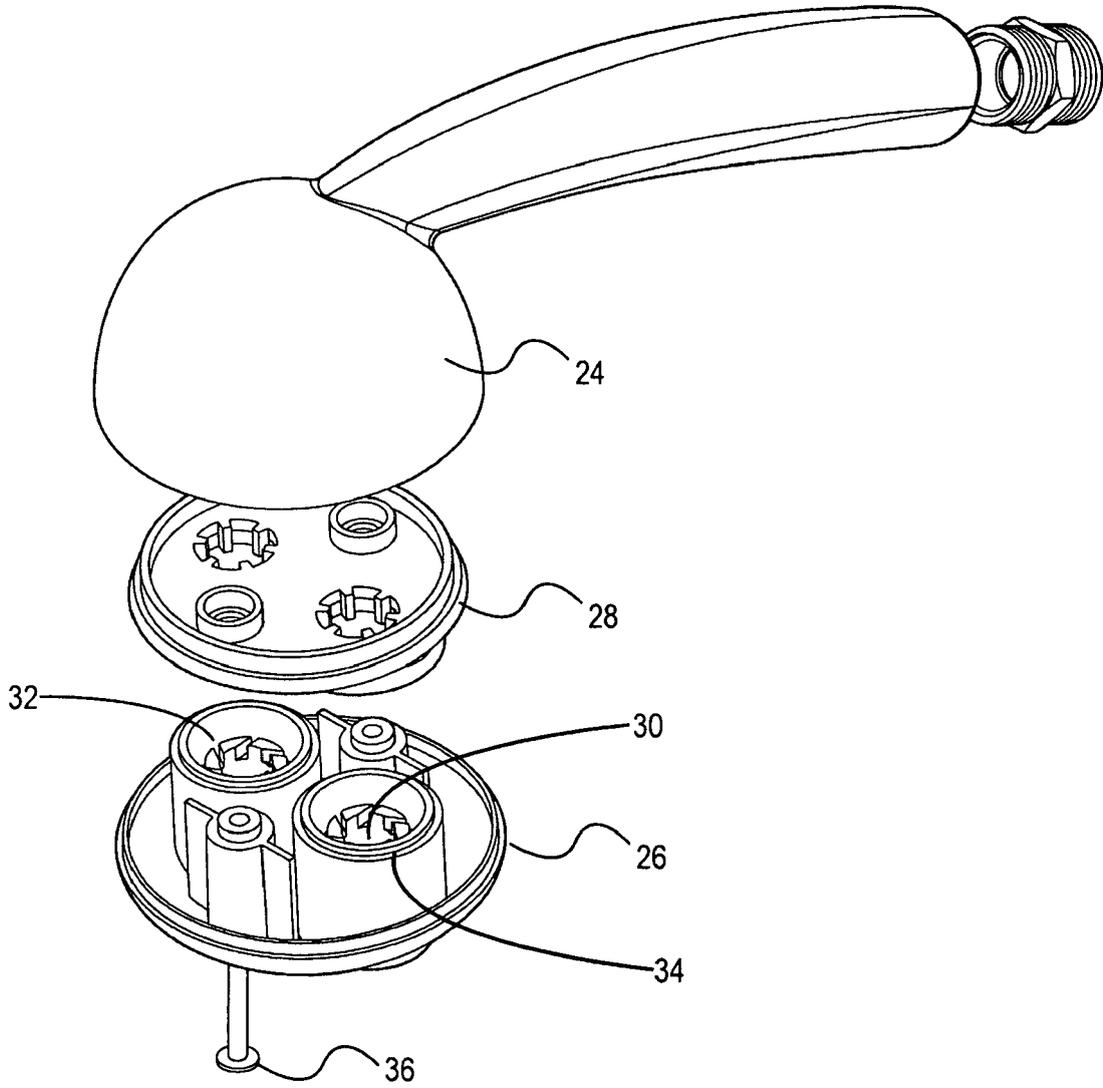


Fig 7



EUROPEAN SEARCH REPORT

Application Number
EP 12 25 0010

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 462 795 A (DOYLE GARY PHILIP [GB]; TAYLOR PAUL PHILLIP [GB]) 24 February 2010 (2010-02-24) * the whole document * -----	1-12	INV. B05B1/18 B05B1/34
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			TECHNICAL FIELDS SEARCHED (IPC)
			B05B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 May 2012	Examiner Eberwein, Michael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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23-05-2012

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