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(72) Inventor: **Slade, Brian**
Ashford, Kent TN24 8BX (GB)

(74) Representative: **Harrison, David Christopher et al**
MEWBURN ELLIS
York House
23 Kingsway
London WC2B 6HP (GB)

(71) Applicant: **Slade, Brian**
Ashford, Kent TN24 8BX (GB)

(54) Liquid dosing devices

(57) A device for dosing a liquid product into a flow of liquid, the device comprising a dosing chamber (6) for the liquid product (P), said chamber having a porous wall (26) through which the liquid product (P) is trans-

ported when the porous wall (26) is within the flow of liquid (F) but which retains the liquid product (P) within the dosing chamber (6) when the liquid flow (F) is removed.

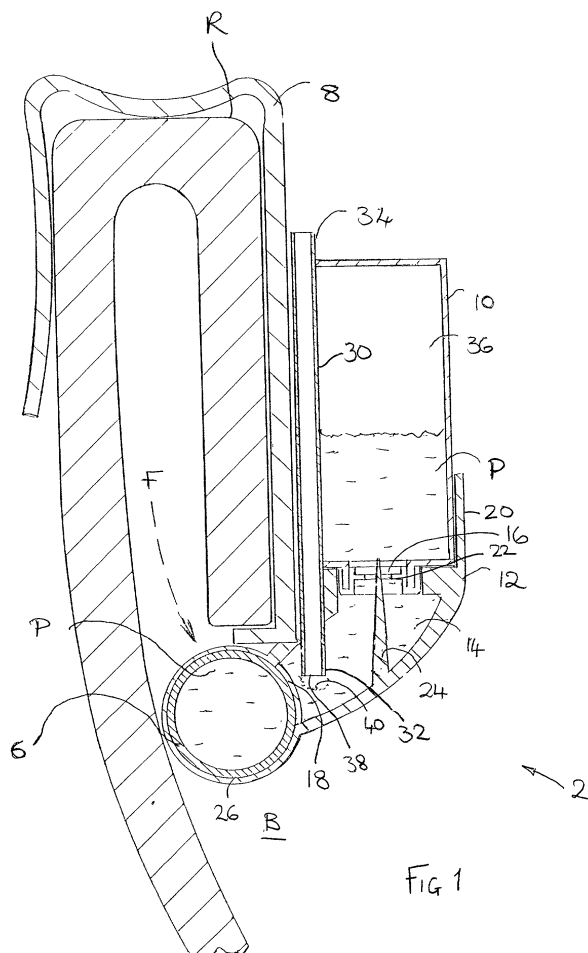


FIG 1

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Description

Field of the Invention

[0001] This invention relates to devices for dosing a liquid product into a flow of liquid, and especially to devices intended to be used in systems which have an intermittent flow of liquid. In one preferred form, the invention is particularly concerned with the dosing of a liquid product into a receiver such as a water closet or a urinal bowl in association with the flushing of the receiver. The invention has, however, wider applicability.

Background

[0002] The background to the present invention will be set with reference to the preferred application of a toilet freshener, although as already mentioned above, and as will be appreciated from the discussion further below, the invention has much wider applicability than this.

[0003] It has been known for a long time to provide so-called toilet fresheners in the form of a solid or semisolid product, a 'rim block', to be mounted within the inner rim of a water closet bowl where the flushing water will wash over the product and so dissolve or erode it to release active constituents into the water flow.

[0004] More recently, it has been proposed to use a liquid toilet freshening product in a similar manner. For example, EP-A-0538957 describes a device that can be mounted within the inner rim of a water closet bowl to dose a liquid freshening product into the flushing water.

[0005] In this device, the liquid product is dosed into the water flow from a porous substrate which is disposed in the path of the flushing water. The porous substrate is supplied with the liquid product from a reservoir disposed above the substrate, a mouth of the reservoir opening onto the upper surface of the substrate. Although this arrangement is simple in construction, it suffers from the drawback that the volume of liquid product that flows into the substrate between flushes is dependent, at least in part, on the head of liquid in the reservoir, since this directly influences the rate of flow from the reservoir onto the surface of the substrate. The result is an inconsistency in the dose of liquid product into the toilet bowl over time.

[0006] EP-A-0785315 describes a development of the device discussed above. The same basic principle of dosing a liquid product into a flow of water from a porous substrate is employed. However, liquid product from a reservoir is deposited onto the upper surface of the substrate via a regulating channel. The liquid is metered into the channel through an orifice and a separate air opening to the interior of the reservoir is provided. The sizes of the metering orifice and the air opening are strictly regulated to the viscosity of the liquid being dosed. This is described as having the effect of providing a substantially constant head of the liquid above the

substrate, independent of the level in the reservoir. However, although this arrangement provides a consistent flow rate of liquid product to the absorbent substrate, inconsistent dosing of the flushing water can still result, dependent at least in part on the duration of the periods between flushes. This is thought to be due to the reliance of this device on coagulation of the liquid product to stem its flow onto the substrate, a mechanism which is very dependent on the environment in which the device is operated. It is also thought that the head of liquid bearing down on the substrate can lead to 'supersaturation' of the substrate, so it becomes over loaded with product.

Summary of the Invention

[0007] In one aspect, the present invention provides a device for dosing a liquid product into a flow of liquid, the device comprising a dosing chamber for the liquid product, said chamber having a porous wall through which the liquid product is transported when the porous wall is within the flow of liquid but which retains the liquid product within the dosing chamber when the liquid flow is removed.

[0008] This desired "on-off" effect can be achieved by appropriate selection of the resistance of the porous dosing chamber wall to movement of the liquid product through it, for instance by selection of the pore size of the wall, based on the rheology of the liquid product, in particular its viscosity. More specifically, the resistance of the wall is selected to be sufficient to substantially resist any flow of the liquid product from the chamber when the outside of the chamber wall is exposed to ambient pressure. However, as the liquid into which the product is dosed flows over the porous wall of the dosing chamber there is a resulting drop in static pressure to the outside of the wall. The resistance of the porous wall is chosen such that the resultant pressure difference across the wall causes the liquid product to flow outwardly through the wall into the liquid flow. When the flow stops, or the dosing chamber is removed from the flow, the pressure balance across the wall of the chamber is almost instantaneously regained and the liquid product ceases to move through the wall.

[0009] It will be appreciated that in this way the invention provides a device of relatively simple construction which is nevertheless able to offer very good control of the dosing of the liquid product into the liquid flowing over the dosing chamber. As such, it has wide applicability. Examples of preferred uses include the dosing of a foaming bath product or the like into a bath along with the tap water and dosing an e.g. deodorising and/or disinfecting liquid product into a toilet bowl or urinal along with the flush water.

[0010] In another, more specific, aspect of the invention there is provided a device for dosing a liquid product into a receiver in conjunction with a liquid flow into said receiver, the device comprising a dosing chamber for

the liquid product, said chamber having a porous wall through which the liquid product is transported when the porous wall is within the flow of liquid but which retains the liquid product within the dosing chamber when the liquid flow is removed, and means for suspending the dosing chamber within the receiver in the path of said liquid flow.

[0011] The receiver may be, for example, a water closet bowl or a urinal.

[0012] In either of the above aspects, it is preferred that the device includes a reservoir from which the liquid product can be supplied to the dosing chamber, for example by gravity. With such an arrangement, however, particularly one which relies on a gravity feed, it may prove problematic if the full head of liquid in the reservoir acts in the dosing chamber. For instance, the resultant static pressure may cause seepage of the liquid product through the porous wall of the chamber when the reservoir is full. Alternatively, if the resistance of the wall is set sufficiently high to avoid this seepage, when the head in the reservoir reduces as the product is used, the static pressure in the dosing chamber may not be sufficient to cause a flow of liquid through the wall when liquid flows across the wall.

[0013] In preferred forms, therefore, dosing device is arranged such that the hydrostatic pressure in the dosing chamber can be set substantially independently of the head of liquid in the reservoir.

[0014] Conveniently, this can be achieved with an arrangement in which the reservoir is closed at its top end, and the device includes an air supply through which air can enter the lower end of the reservoir or the dosing chamber. The base of the reservoir is also closed save for an outlet to the dosing chamber.

[0015] In a similar manner to a traditional "chicken-feeder" this arrangement finds an equilibrium position in which, due to a reduction in pressure in an air space formed above the liquid in the reservoir at its closed, upper end, the column of liquid in the reservoir is supported by atmospheric pressure acting via the air supply on the liquid at the lower end of the reservoir or in the dosing chamber, as explained in more detail below.

[0016] Where such a pressure compensated arrangement is employed, it is also desirable to provide compensation for temperature variations, which it has been found can give rise to a significant expansion in the volume of the air pocket trapped at the upper end of the chamber and thus upset the pressure balance achieved. Thus, means are preferably provided to accommodate liquid displaced as a result of this expansion.

[0017] In a further aspect the invention provides a dosing closure for a container, e.g. a bottle, the closure comprising a dosing chamber supplied with a liquid product from the container, said chamber having a porous wall through which the liquid product is transported when the porous wall is disposed within a flow of liquid.

[0018] Where the closure is for instance installed in a top opening of a container, the dosing chamber may be

open to the interior of the container so that it can be filled simply by inverting the container. The inverted container can then be held with the dosing chamber under a flow of liquid, e.g. a running tap where the dosed product is a foam bath for instance, to dose the liquid product into the flowing liquid.

[0019] The liquid products used with each of the various aspects of the invention preferably comprise a component that has an affinity for the flowing liquid into which it is dispensed. For instance, where the flowing liquid is water, the liquid product may comprise a component having hydrophilic properties, such as a surfactant.

[0020] Embodiments of the invention are described below in more detail, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a sectioned side view of a dosing device of a first embodiment of the present invention;

Fig. 2 is a front elevation of the device of Fig. 1;

Fig. 3 is a sectioned side view of another dosing device of a second embodiment of the invention;

Fig. 4 is a front elevation of the device of Fig. 3 showing the reservoir substantially full;

Fig. 5 is a front elevation of the device of Fig. 3 showing the reservoir when depleted; and

Fig. 6 shows a dosing closure according to another embodiment of the invention installed in the dosing opening of a container.

[0021] The dosing devices 2, 2' of Figs. 1-2 and 3-5 are adapted for dosing a liquid product, such as a cleansing and/or deodorising product into the bowl B of a water closet, in conjunction with the flow of water F generated when the water closet is flushed. The dosing devices 2,2' each comprise a porous walled dosing chamber 6,6' of cylindrical form, suspended by a strap 8,8' from the rim R of the water closet bowl B in the path of the flushing water F. A liquid product P is supplied by gravity to the dosing chamber 6,6' from a reservoir 10,10' mounted above the chamber 6,6'.

[0022] A holder 12,12', to which the strap 8,8' is attached, serves as a support for both the dosing chamber 6,6' and the reservoir 10,10'. A cavity 14,14' within the holder 12,12' serves as a conduit between a reservoir outlet 16,16' and a centrally disposed inlet 18,18' to the dosing chamber 6,6'.

[0023] The reservoir 10,10' is detachably received within a correspondingly shaped seat 20,20' in the holder, allowing the reservoir to be removed and replaced or refilled once the liquid product it holds is exhausted. It is envisaged that the reservoirs will be provided in an initially sealed configuration. A seal 22,22' across outlet of the reservoir can be broken by a pointed element 24,24', which in these examples is moulded integrally with the holder, which pierces the seal when the reservoir 10,10' is installed on its seat 20,20'.

[0024] In use, the flush water F flows over the porous wall 26,26' of the dosing chamber 6,6' creating a reduc-

tion in pressure at its outer surface sufficient to create a large enough pressure difference across the wall 26,26' to cause the liquid product P to flow outwardly through the wall. The product P is therefore dosed in a controlled manner into the water flow F in the form of micro fine filaments excreted from the pores of the wall. This greatly enhances the solubility of the product P in the flowing water F, leading for instance to improved foaming of the product where that is desired.

[0025] Once the water flow F stops, the pressure to the outside of the porous wall 26,26' returns almost instantaneously to ambient and the flow of liquid product through the wall stops. The more volatile perfume components of the liquid product, where they are present, are able to permeate through the wall, however, even in the absence of a flow of water, providing a continuous deodorising effect.

[0026] It is also notable that so long as the dosing chamber has a capacity greater than the dose of product per flush of the water closet, and/or the gravity supply from the reservoir is sufficiently fast, it can remain almost constantly primed, so that no matter how quickly successive flushes of the water closet follow one another the desired dose of product is introduced into the flow of water F.

[0027] The device can be used for dosing a variety of liquid products into a liquid flow. Typically, for the exemplary application described - cleansing and deodorising a water closet bowl - the product will include both surfactant and perfume components. The rheological behaviour of the material, in particular its viscosity, can be selected with regard to the physical properties of the porous wall of the dosing chamber 6,6', which will typically have pores of size 50 to 120 microns, or vice versa, to ensure that the liquid product P is appropriately dosed into the flush water F. Normally, the liquid product P will be more viscous than the flowing liquid F.

[0028] In order that the pressure difference across the wall 26,26' of the dosing chamber 6,6' can be kept substantially consistent from flush to flush, to ensure a consistent dose, it can be important to ensure that the hydrostatic pressure of the liquid product P within the chamber 6,6' is kept substantially constant, even though the head of liquid in the reservoir 10,10' will reduce with time as the product P is consumed. Figs. 1 and 3 illustrate two alternative arrangements used to achieve this.

[0029] Looking first at Fig. 1, it can be seen that an air supply tube 30 opens at its lower end 32 into the cavity 14 of the holder 12. The upper end 34 of this tube is open to atmosphere. When the reservoir 10 is initially installed on the holder 12, its outlet 16 is opened by the spike 24 and product P flows from the reservoir 10 down through the cavity 14 into the dosing chamber 6. The liquid escaping from the reservoir 10 is replaced by air, which enters the reservoir via the air supply tube 30. Once the liquid in the cavity 14 covers the lower end 32 of the supply tube 30, the passage of air to the reservoir 10 is cut off. This in turn causes a drop in pressure in

the free space 36 above the liquid product in the reservoir 10. A state of equilibrium is rapidly reached in which, given the reduction in pressure in the space 36, the liquid column in the reservoir 10 and cavity 14 above the lower end 32 of the air supply tube 30 is supported by atmospheric pressure at the liquid/air interface 38 at the lower end of the air supply tube 30.

[0030] As the product is dosed into the flush water F, the liquid level in the reservoir 10 falls further. This results in an increase of the volume of the sealed air space 36 and a consequential drop in the air pressure in this space 36. This in turn causes air to flow into the cavity 14 through the air tube 30, the air forming a series of bubbles 40 at the lower end 32 of the tube 30 to bubble upwardly through the reservoir to the air space 36, increasing the pressure in that space until an equilibrium is once again restored. Once the equilibrium is restored, the hydrostatic pressure of the liquid at the level of the lower end of the air tube 30 is equal to atmospheric pressure once more.

[0031] Significantly, since there is atmospheric pressure acting at the liquid/air interface 38 at the lower end of the air tube 30, then in the equilibrium condition shown the hydrostatic pressure of the liquid at the level of this interface 38 is equal to atmospheric pressure. Thus, the hydrostatic pressure at this level in the cavity 14, and hence the hydrostatic pressure within the dosing chamber 6, is maintained substantially constant irrespective of the level of the liquid in the reservoir 10.

[0032] Fig. 3 shows an alternative arrangement that operates in a very similar manner to achieve the desired substantially constant pressure within the dosing chamber 6'. The principle difference between the device of Fig. 1 and that illustrated in Fig. 3 is that the latter is specifically adapted to safeguard against seepage of product from the dosing chamber 6' as a result of ambient temperature variations.

[0033] In the Fig. 3 device, a delivery tube 50 extends downwardly from the reservoir outlet 16 into the cavity 14 of the holder. The liquid product P exits the reservoir through this tube 50, which in the present example is fixed to the reservoir 10', but which might equally be formed integrally with the seat 20' of the holder 12'. Otherwise, the structure of the device is very similar to that shown in Fig. 1, with the exception that the air supply tube 30' does not protrude so far into the cavity 14.

[0034] In use, as with the Fig. 1 device, when the reservoir 10' is installed on the holder 12' the liquid product P flows into the cavity 14' and from there into the dosing chamber 16'. However, unlike the Fig. 1 device in which the equilibrium position is only reached once the cavity 14 and dosing chamber 16 are full of the liquid product, the presence of the delivery tube 50 causes an equilibrium condition to be obtained whilst there remains a generally annular air space within the cavity 14 around this tube 50. The resulting free liquid level L in the cavity 14' is open to atmosphere via the air tube 30'. In this condition, the head of liquid above the lower end 52 of the

delivery tube 50 is negated by the negative pressure present in the air space 36' at the upper end of the reservoir 10'.

[0035] During operation of the device, as the liquid product is consumed, when the level of liquid in the cavity 14' will drop below the lower end 52 of the delivery tube 50, product flows from the reservoir 10 once more into the cavity, recovering the lower end 52 of the tube to return the device to its equilibrium condition. In this way, the free liquid level in the cavity 14 is maintained substantially constant at or around the bottom end of the delivery tube 50. Since this surface is open to atmosphere, this in turn means that the hydrostatic pressure in the dosing chamber 6' is also maintained substantially constant as desired.

[0036] An increase in ambient temperature will cause the air trapped in the space 36' above the liquid product in the reservoir 10' to expand. This expansion will displace liquid product from the reservoir 10' into the cavity 14' raising the liquid level in the cavity. With an arrangement of the form seen in Fig. 1, this would drive liquid product up the air supply tube 30, increasing the head of liquid above the dosing chamber, possibly leading to seepage of the product through the wall of the chamber due to the increased hydrostatic pressure. However, with the arrangement of Fig. 3, in which the cavity 14 is not full, a much greater volume of product must be displaced from the reservoir 10' into the cavity 14' before any appreciable rise in the liquid level L is seen. Thus, the effects of an ambient temperature rise are significantly less, and most likely negligible with this arrangement.

[0037] A similar compensation for temperature variations could be provided in the embodiment of Fig. 1 by giving a portion of the air supply tube 30 at or near its lower end 32 an enlarged cross-section, thus increasing the area volume into which the liquid can expand without travelling a significant distance up that tube 30.

[0038] Turning to Fig. 6, a container 60 having a closure 62 in accordance with another embodiment of the invention is illustrated, suitable for instance for dosing a foam bath product P' at a controlled rate into a bath B' with water F' flowing from a tap T.

[0039] The closure 62 includes a porous, dome shaped plug 64, which has a hollow interior to define a dosing chamber 66. The plug 64 is open to the interior of the container 60, this open end of the plug 64 being sealed to ring 68, which surrounds the end of the plug 64 and is received in the mouth 70 of the container to close it.

[0040] An annular recess 72 is formed in the ring 68, facing away from the mouth 70 of the container. This recess 72 receives the base of a cap (not shown) which can be used to cover the plug 64 when the container 60 is not in use.

[0041] A U-shape air supply tube 74 opens at one end into the dosing chamber 66, close to the closed end of the plug 64, and opens at the other end into the annular

recess 72, thus providing a conduit for air from outside the container 60 into the dosing chamber 66. Conveniently, the outer end of the air tube 74 in the recess 72 is blocked off by the cap (not shown) when in place, to prevent any inadvertent spillage of the liquid product P' through this tube when the container 60 is upright.

[0042] In use, the container 60 is inverted (as shown in Fig. 6). The liquid product P', for example a bath foam product, flows into the dosing chamber 66 from the interior of the container 60. As it does so, the pressure of the air trapped in the space 76 above the product P' at the base 78 of the container 60, is reduced and, as in the devices of Figs. 1 and 3, an equilibrium position is reached in which the column of liquid P' in the inverted container 60 is supported by a combination of the partial vacuum created in the space 76 and atmospheric pressure acting at the liquid/air interface 80 at the inner end of the air supply tube 74. The pore size of the porous wall of the dosing chamber 66 is selected, based on the viscosity of the liquid product P', to ensure that in this equilibrium condition, with the container inverted, no product escapes through the wall.

[0043] When the container is positioned with the plug 64 in a flow of water F', e.g. from a tap T, the reduction in static pressure to the outside of the porous wall brought about by the flowing water F', creates a pressure differential across the wall sufficient to cause the liquid product P' to travel through the wall to be taken up by the flowing water F'.

[0044] Similarly to the other embodiments described above, as the product P' is dispensed, the level in the container 60 drops, reducing further the air pressure in space 76. The resulting imbalance in pressures across the liquid column causes air to bubble in through the air tube 74 until an equilibrium is attained once more. The result is a generally constant hydrostatic pressure within the dosing chamber 66, at or about atmospheric pressure (this being the pressure that acts at the liquid/air interface 80 within the chamber 66), irrespective of the head of liquid product P' in the inverted container 60.

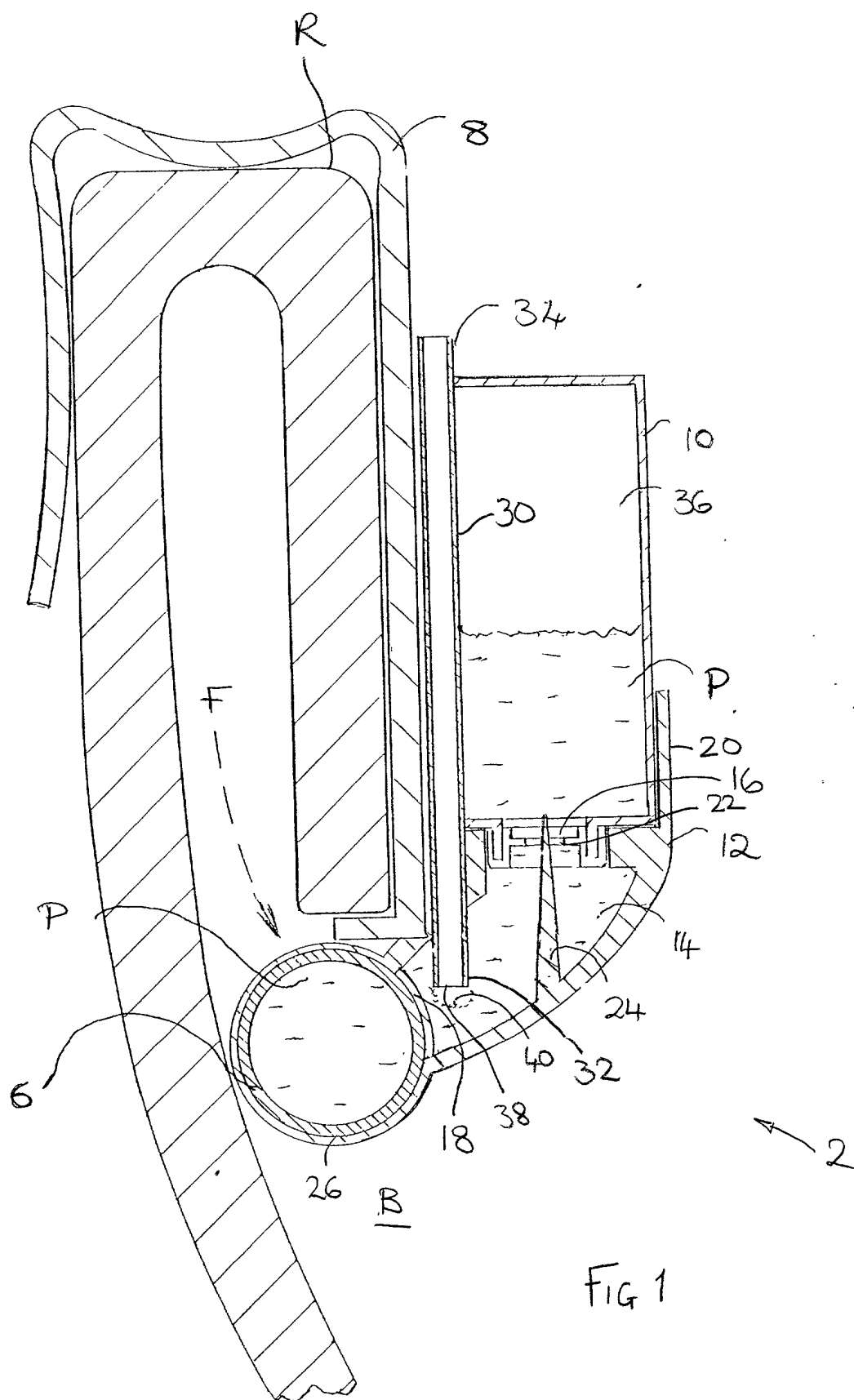
[0045] When the product P' is a bath foam for instance, dosing it in the manner described above, using the container 60 of Fig. 6, can create a great deal of foam with very little effort on the part of the user, particularly since there is no need for the container to be squeezed. Moreover, the dosing is very controllable, being dependent almost entirely on the length of time the plug 64 is held under the running tap T.

[0046] Various modifications to the embodiments specifically described can be made without departing from the invention. For instance, although the porous walls of the dosing chambers 6,66 in the described examples are substantially rigid to retain their shape, they might be replaced, for example, by a semi-permeable membrane or the like which, if not itself sufficiently rigid to form the dosing chamber, may be supported by other means.

Claims

opening.

1. A device for dosing a liquid product (P) into a flow of liquid (F), the device comprising a dosing chamber (6) for the liquid product, said chamber (6) having a porous wall (26) through which the liquid product (P) is transported when the porous wall (26) is within the flow of liquid (F) but which retains the liquid product (P) within the dosing chamber (6) when the liquid flow (F) is removed. 5 10
2. A device according to claim 1, for dosing a liquid product (P) into a receiver (B) in conjunction with a liquid flow (F) into said receiver (B), comprising means (8) for suspending the dosing chamber (6) within the receiver (B) in the path of said liquid flow (F) . 15
3. A device according to claim 1 or claim 2, comprising a reservoir (10) from which the liquid product (P) is supplied to the dosing chamber (6). 20
4. A device according to claim 3, wherein said supply of liquid product from the reservoir (10) to the dosing chamber (6) is by gravity. 25
5. A dosing device according to claim 3 or claim 4, wherein the hydrostatic pressure in the dosing chamber (6) can be maintained substantially independently of the head of liquid in the reservoir (10). 30
6. A dosing device according to claim 5, wherein the reservoir (10) is closed at its top end, and the device includes an air supply (30) through which air can enter the lower end of the reservoir (10) or the dosing chamber (6). 35
7. A dosing device according to claim 5 or claim 6, comprising means (14') for accommodating liquid displaced as a result of expansion due to a rise in temperature of an air pocket (36) trapped at the closed upper end of the reservoir (10). 40
8. A dosing closure for a container, e.g. a bottle, the closure comprising a dosing chamber supplied with a liquid product from the container, said chamber having a porous wall through which the liquid product is transported when the porous wall is disposed within a flow of liquid. 45 50
9. A dosing closure according to claim 8, wherein the dosing chamber is open to the interior of the container so that it can be filled by inverting the container. 55
10. A container for a liquid product, the container comprising a dosing opening and a dosing closure according to claim 8 or claim 9 installed in said dosing opening.
11. A dosing device according to any one of claims 1 to 7 or a container according to claim 10 in combination with a liquid products comprising a component that has as affinity for the flowing liquid into which it is dispensed.



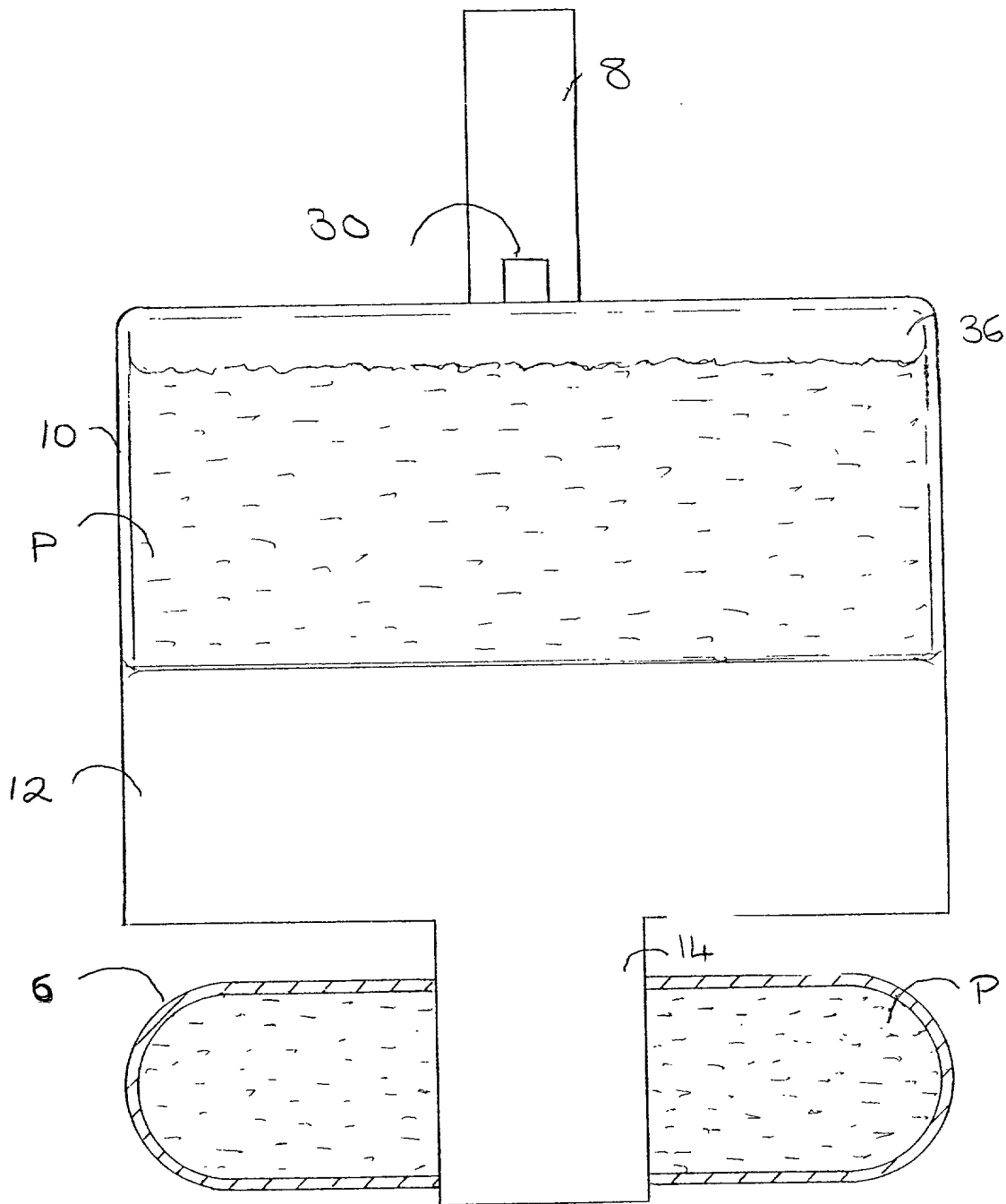
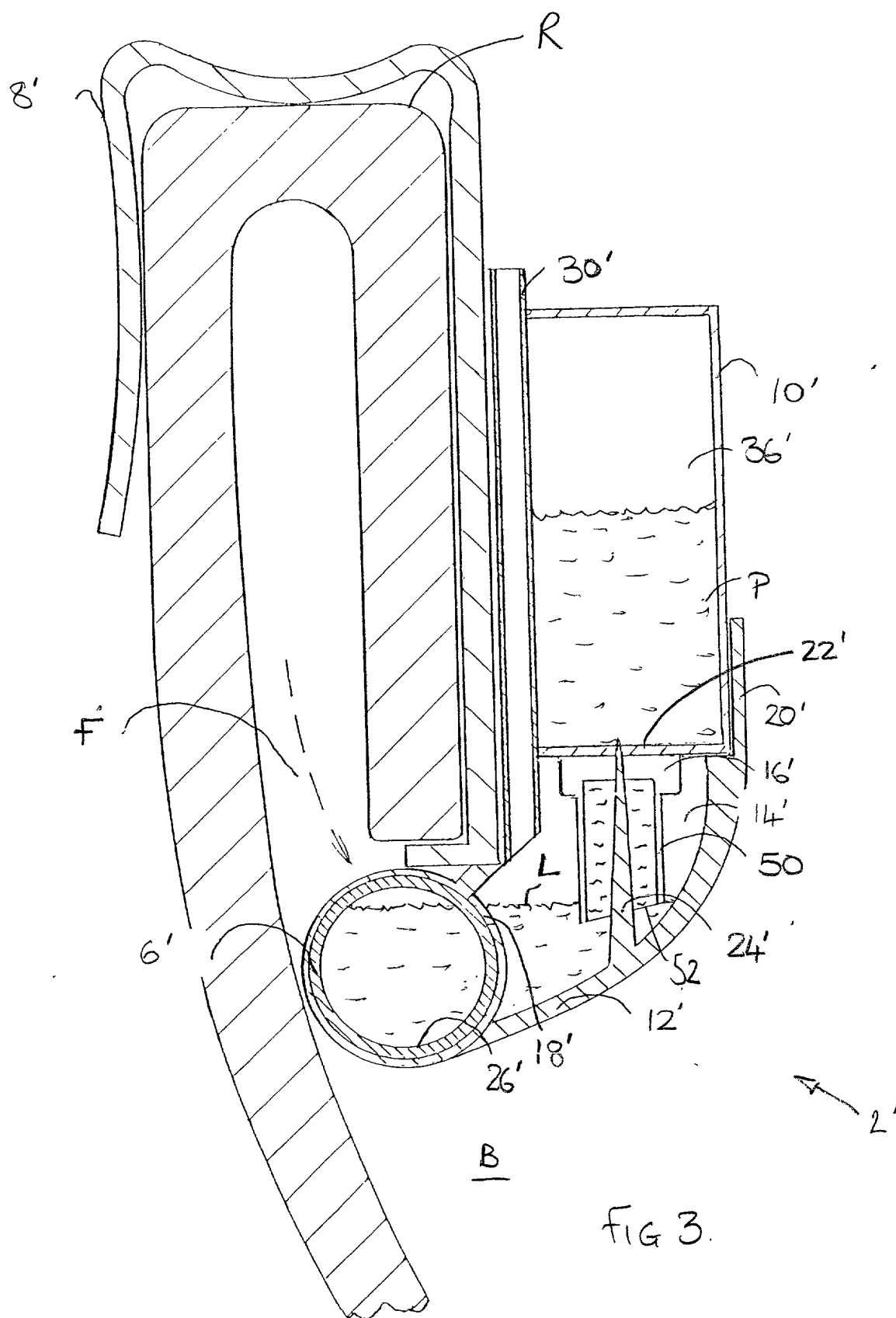


FIG 2.



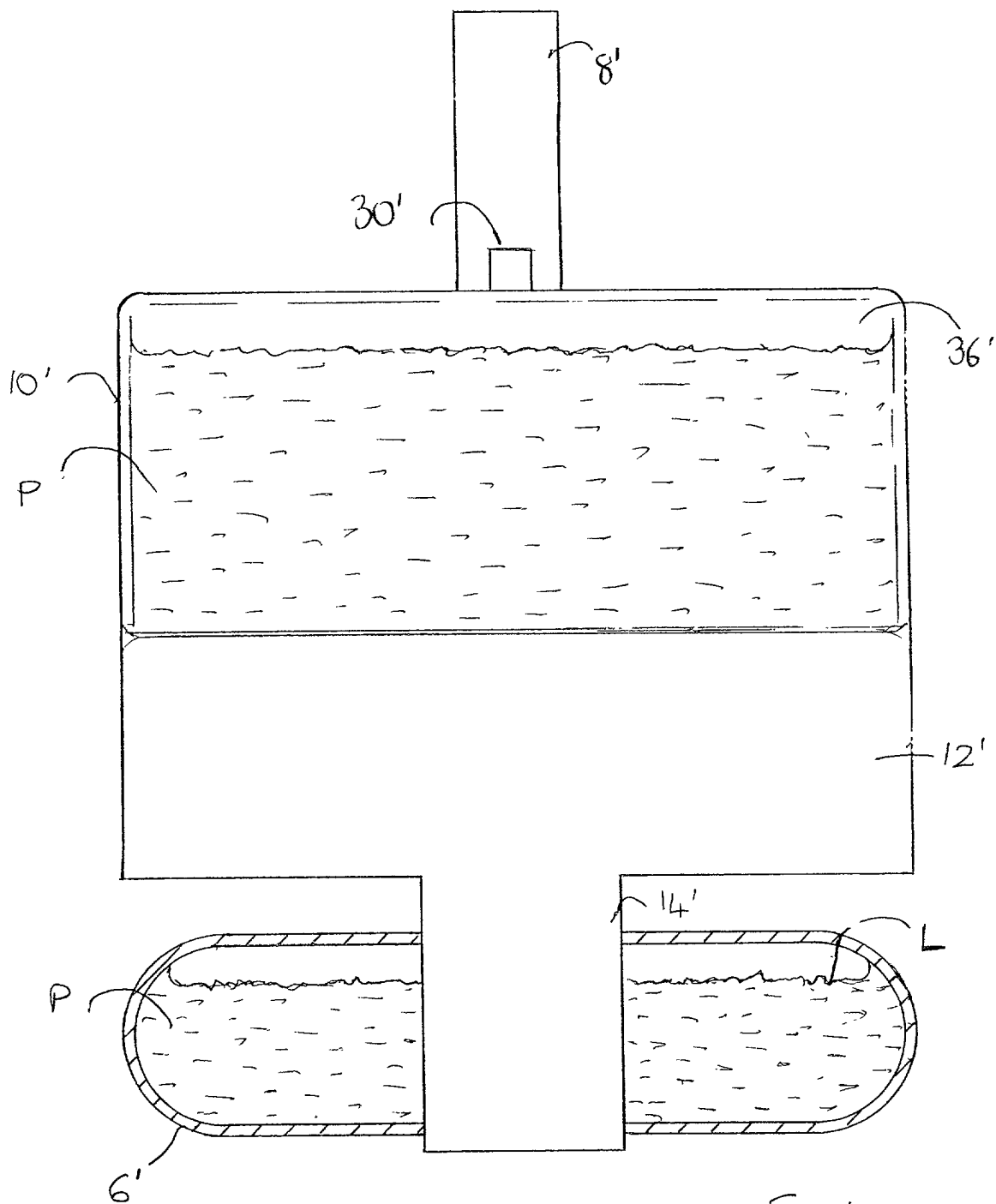


FIG. 4

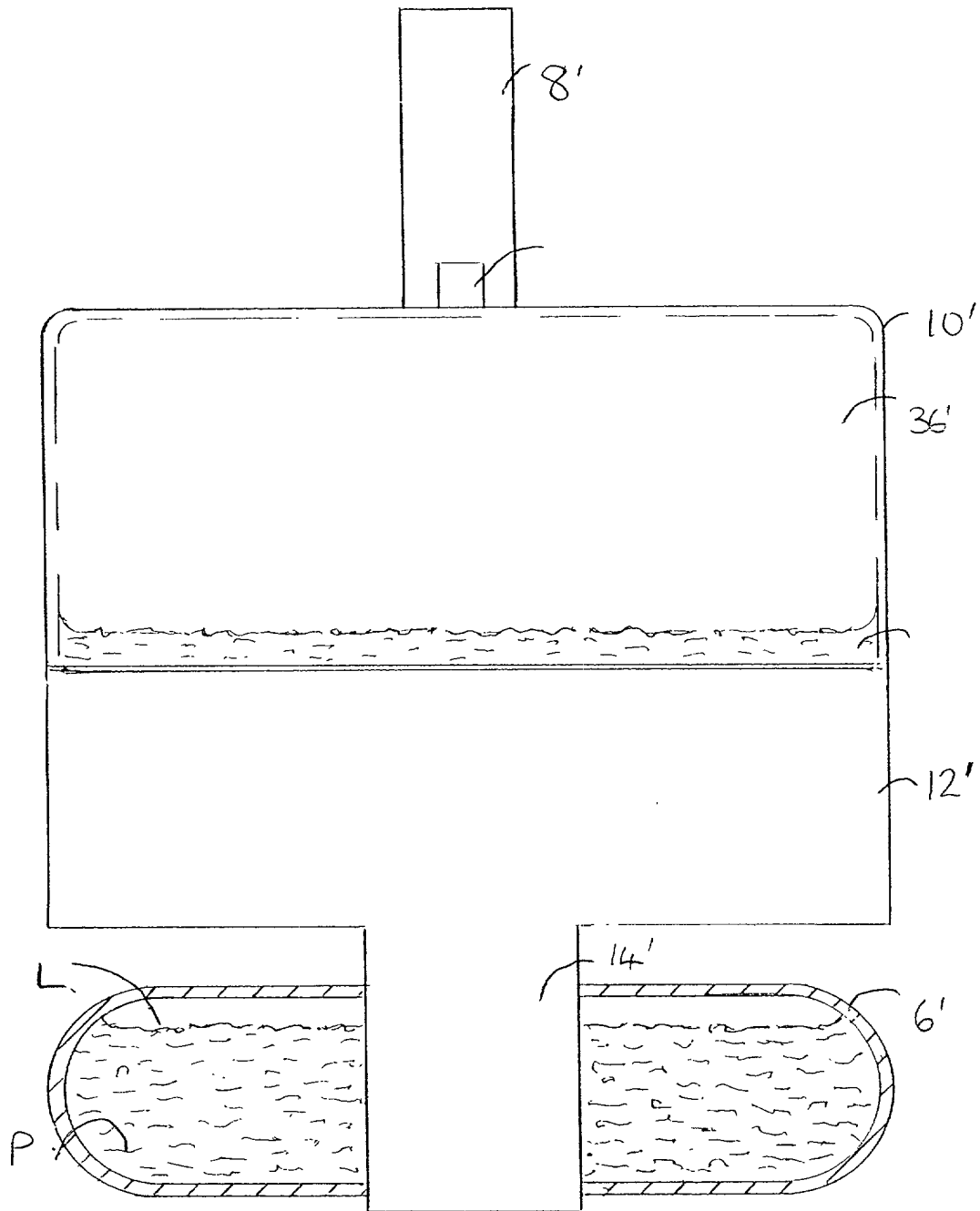
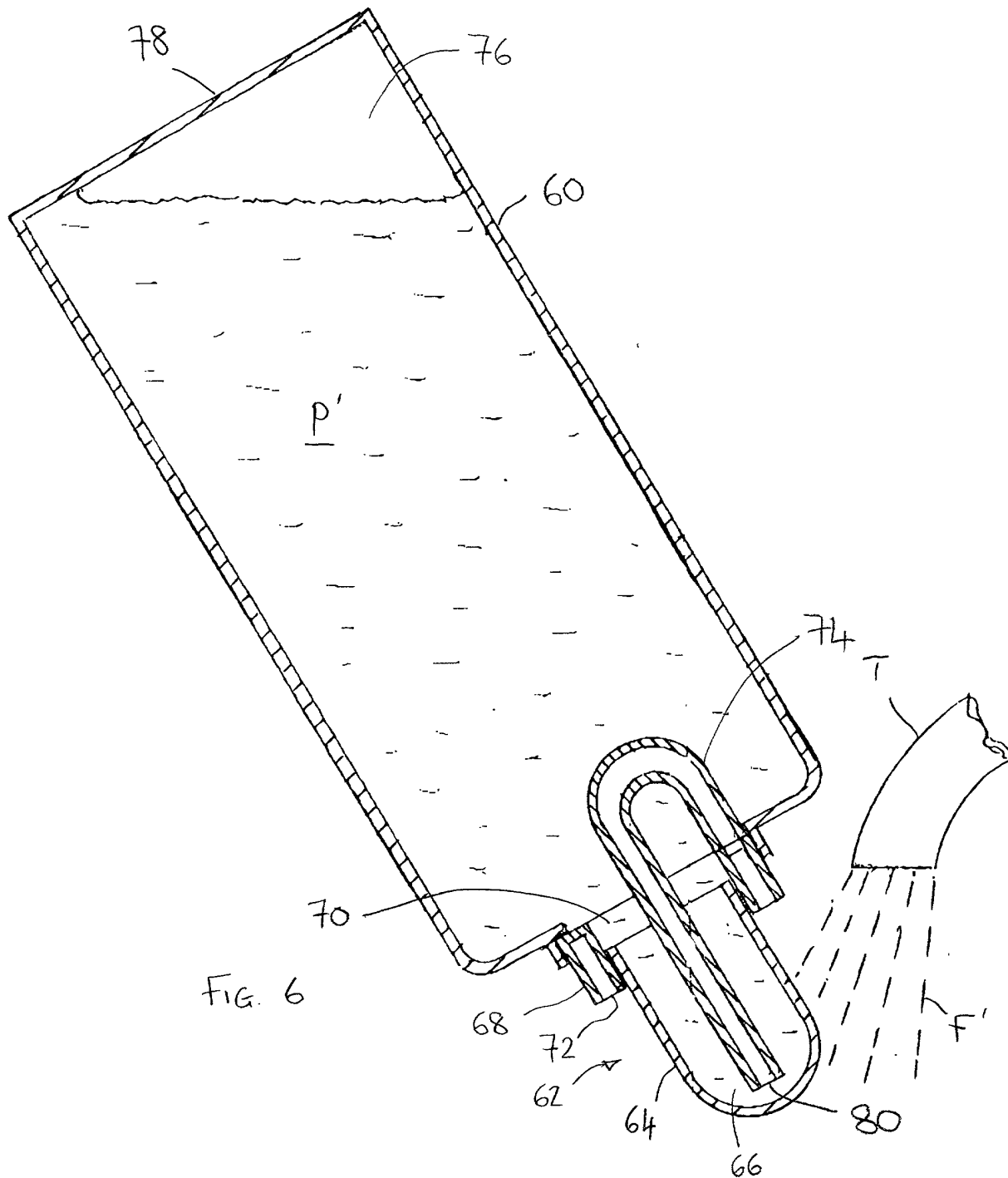


FIG. 5





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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 9776

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7) E03D A47K B65D
Place of search		Date of completion of the search	Examiner
THE HAGUE		9 April 2001	Urbahn, S
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			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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