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(54) **FOAM PUMP**

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Description

[0001] The present invention relates to a foam pump, for use particularly, but not exclusively, to generate foamed soap products from a liquid soap and air.

[0002] Foam pumps are well known, and comprise separate fluid and air cylinders adapted to force a subject liquid and air together inside a mixing chamber. The co-mingled liquid and air is then forced over one or more foaming meshes, before being dispensed from a nozzle. The liquid is drawn from a cartridge to which the pump is attached, and air is drawn from atmosphere, either through the nozzle or from an inlet elsewhere on the device.

[0003] In many cases the fluid and air cylinders are co-axial, which is to say one is arranged inside the other on the same axis. Most pumps are constructed about a fluid throughflow axis, with a fluid inlet, mixing chamber, foaming chamber and fluid outlet arranged sequentially on said axis, and with the co-axial fluid and air cylinders also arranged on said axis, either sequentially or radially in relation to the other features.

[0004] Such pumps are manually operated by a plunger part, depression of which forces the fluid and air cylinders to perform a dispensing stroke in unison, which forces fluid and air therein into the mixing chamber, through into the foaming chamber and then out of the nozzle. A return spring is provided somewhere on the pump, or on the dispensing device with which it is used, which forces the fluid and air cylinders to perform a priming stroke in unison, which draws fluid and air therein, ready for the dispensing stroke.

[0005] Typical examples of such foam pumps are shown in EP0613728 to Daiwa Can Company, EP0703831 to Sprintvest Corporation N. V., EP0853500 to Park Towers International B. V., EP0984715 to DEB IP Limited, EP1266696 to Taplast S.p.A., EP1444049 to Bentfield Europe B.V., WO 2004/044534 to Continental AFA Dispensing Company, WO 2005/105320 to Airspray N.V., and US6409050 and GB2362340 to Ophardt.

[0006] In all of the above cases, because the fluid and air cylinders are arranged on the fluid throughflow axis, the plunger part also moves back and forth along said axis. This is appropriate when the pump is located at the top of a container of fluid, and is operated by a downward push on the operating plunger, but it is not particularly suitable for use inside a wall mounted dispensing device which dispenses foam from an underside thereof. Such dispensers are commonly operated by lateral movement of a cover or trigger, which movement is substantially normal to the fluid throughflow axis of the pump mounted underneath the container of fluid.

[0007] In EP0703831 to Sprintvest Corporation N. V., EP0984715 to DEB IP Limited and US6409050 to Ophardt, the pumps are arranged inside wall-mounted dispensers underneath containers of fluid mounted therein, and in order to deal with the vertical alignment of the fluid throughflow axis of the pump a special springloaded trigger is provided in each case, which converts a lateral movement into a vertical one to operate the pump. These constructions are not ideal because the transmission of the lateral movement of the trigger into a vertical one is not well controlled, leading to an adverse twisting of the pump which results in leakages and failures. Further, these constructions comprise an excess of independent parts, which adds costs.

[0008] EP1444049 to Bentfield Europe B.V. provides a slightly different solution, by arranging the pump at an angle to vertical, but this is also not ideal because it increases the size of the wall-mounted dispensing device.

[0009] However, US2005258192 to Matthews Et Al, discloses a wall mounted pump in which the fluid and air cylinders are arranged horizontally, and therefore in line with the laterally operated trigger. This overcomes some of the above described problems, however in none of the various pumps shown in this document is the mixing chamber located effectively. In most cases the mixing chamber is also arranged horizontally, and positioned below the fluid and air cylinders. The pumps are arranged this way to save space, but the result is that the fluid throughflow axis of the pump is not linear, or vertical, which reduces the operational effectiveness of the pumps. In other examples the mixing chamber is arranged vertically, but again it is positioned below the fluid and air cylinders, which significantly increases the height of the pump.

[0010] Therefore, a first object of the present invention is to provide a foaming pump which overcomes some of the above problems and is more suitable for use in a wall-mounted dispenser.

[0011] With any foam pump, it is necessary to force the fluid and air together to create a mixture which is then forced over one or more foaming meshes to create the foam. The more thorough the mixing the better the resulting foam may be.

[0012] In addition, if a foam pump is mounted to the underside of a fluid container in a wall-mounted dispenser, it can suffer from leakage if the fluid and air are not thoroughly mixed. In particular, known foaming meshes naturally resist the flow of unmixed fluid therethrough due to the very small size of the through holes and the surface tension of the fluid, however they are only capable of holding back a particular height of unmixed fluid. Therefore, if a greater height of unmixed fluid remains inside the mixing chamber after a dispensing stroke, some of it can pass through the meshes and leak from the dispenser. This can occur, for example, if air is injected laterally into the mixing chamber below the fluid inlet, and after a dispensing stroke unmixed fluid remains in the mixing chamber above the air inlet.

[0013] In the prior art devices referred to above the fluid and air are mixed together in a variety of ways. In EP1266696 to Taplast S.p.A., EP1444049 to Bentfield Europe B.V., WO 2004/044534 to Continental AFA Dispensing Company, and WO 2005/105320 to Airspray N.V., the fluid and air are both pumped into the mixing chamber in the same fluid throughflow direction. This results in a low degree of mixing which produces an inferior foam, and which leaves a body of unmixed fluid inside the mixing chamber after a dispensing stroke.

[0014] However, in EP0613728 to Daiwa Can Company, the air enters the mixing chamber at 90 degrees to the flow of fluid therethrough. This results in a more efficient co-mingling effect of the fluid and air, because turbulence is generated between the two substances. (The same arrangement is provided in another prior art form pump shown in GB2193904 to Ballard Medical Products.) EP0853500 to Park Towers International B. V., also has a similar arrangement, but in that case the foaming mesh is directly adjacent to where the fluid and air mix, which negates any reasonable degree of mixing. In EP0703831 to Sprintvest Corporation N. V. and US6409050 and GB2362340 to Ophardt, the opposite arrangement is provided, with the fluid forced into the mixing chamber at 90 degrees to the path of air therethrough. Again this provides an advantageous co-mingling effect. However, the mixing effect in these documents is still not optimal, and in some cases would still result in a body of unmixed fluid remaining in the mixing chamber after a dispensing stroke.

[0015] This concept is taken a step further in EP0984715 to DEB IP Limited, in which the fluid is forced into the mixing chamber in generally the opposite direction to the air. This is achieved by having an inlet pipe arranged on the fluid through flow axis and in the direction of fluid flow of the pump generally, the open end of which is fitted with a top-hat valve. Therefore the flow of fluid through the inlet pipe is reversed when it reaches the top-hat valve, and it is fed into the path of air travelling down the outside of the inlet pipe. This results in a greater degree of turbulence and co-mingling of the fluid and air. However, this arrangement is specifically adapted for a foam pump in which all the parts are arranged on the fluid throughflow axis, and it also suffers from the disadvantage that when the top-hat valve is open in use it disrupts the flow of co-mingled fluid and air out of the mixing chamber, and actually urges it in the opposite direction. As the fluid inlet is effectively inverted no unmixed fluid is left in the mixing chamber after a dispensing stroke, but inverting the fluid inlet in this way adds considerable complexity to the foam pump, and does not allow for the fluid to enter the mixing chamber from above, which is desirable because it assists with the flow of fluid through the foam pump generally.

[0016] In US 2005258192 to Matthews Et Al the air enters the mixing chamber in all radial directions through a cylindrical porous mandrel which is shaped like a test tube, and which axially is arranged on the fluid throughflow axis, while the fluid enters the mixing chamber from a lateral inlet which is at right angles to the fluid throughflow axis. This configuration results in the air and fluid being formed into a foam, and as such no downstream foaming mesh is required. However, only a poor quality foam is generated with this arrangement because there is no pre-mixing of the air and fluid. In addition, the mixing chamber has to be a relatively large annular shape to allow for the air to enter in all directions in this way.

[0017] In all of the examples given above, the mixing chamber, if there is one to speak of, is cylindrical. As such, the shape of the mixing chamber has no role to play in the efficient co-mingling of the fluid and air pumped therein.

[0018] Therefore, a second object of the present invention is to overcome some of the above described problems, and to provide a more efficient pre-mixing of the fluid and air prior to being subjected to any foaming mesh, to improve the quality of the foam, and to prevent a body of unmixed fluid remaining in the mixing chamber after a dispensing stroke.

[0019] Therefore, according to the present invention a foam pump comprises a fluid cylinder, an air cylinder and a mixing chamber, in which the mixing chamber comprises a fluid throughflow axis, a fluid inlet and an air inlet, in which the fluid cylinder and the air cylinder both comprise a stroke axis which is substantially normal to said fluid throughflow axis, in which the fluid cylinder is adapted to draw a fluid therein in a priming stroke and to pump said fluid into said mixing chamber through said fluid inlet in a dispensing stroke, in which the air cylinder is adapted to draw air therein in a priming stroke and to pump said air into said mixing chamber through said air inlet in a dispensing stroke, characterised in that said fluid inlet faces in a fluid flow direction of the mixing chamber, and in that said air inlet is arranged downstream of said fluid inlet and faces against said fluid flow direction.

[0020] Thus, the present invention provides a foaming pump in which an axis of operation of the fluid and air cylinders is normal to the fluid throughflow axis of the pump. As such, the pump of the present invention is suitable for use in a wall-mounted foam dispenser which dispenses foam from an underside thereof and is operated by lateral depression of the cover, because the fluid throughflow axis can be substantially vertical, while the operational axis of the fluid and air cylinders can be aligned with lateral movement of the cover.

[0021] (The term "substantially normal to" with regard to the relationship between the stroke axes of the fluid and air cylinders and the fluid throughflow axis is intended to include a range of 15 degrees or so either side of 90 degrees, so the invention includes a slight canting of the fluid through flow axis in relation to said stroke axes to allow for foam to be dispensed at a slight angle towards a user, and not directly downwards.)

[0022] In addition, the present invention also provides a foaming pump suitable for a wall-mounted dispenser, in which the fluid and air are pumped into the mixing chamber in opposite directions, which leads to an efficient co-mingling thereof, and in particular enough to provide a high quality foam, and to cause sufficient mixing and movement inside the mixing chamber to prevent any residue of unmixed fluid remaining therein after the dispensing stroke, which might leak therefrom.

[0023] In one embodiment of the invention, the mixing chamber can comprise a conical section. The purpose of this feature is to provide a high pressure area within the mixing chamber where the conical section decreases in volume, which can increase the mixing action and turbulence of the co-mingling fluid and air in use, and which can also be utilised to generate a movement of the fluid and air in a desired direction.

[0024] Because the fluid inlet faces in a fluid flow direction of the mixing chamber, and the air inlet is downstream of said fluid inlet and faces against said fluid flow direction, the fluid and air entering the mixing chamber are forced into each other's path, creating a high degree of mixing action and turbulence. This also means that there is no body of unmixed fluid inside the mixing chamber above the air inlet, which could leak from the foam pump after the dispensing stroke.

[0025] The conical section can comprise a truncated cone with a cone axis thereof aligned with said fluid throughflow axis, and with a base thereof downstream of an apex thereof. Therefore, the conical section can be arranged in such a way that a high pressure area where it reduces in volume is configured such that it generally forces the mixed fluid and air inside the mixing chamber to travel in a downstream direction from its apex to its base. The fluid collides with the air, and a turbulent co-mingling occurs, which is increased in the region of the apex of the truncated cone, leading to the mixture being urged back in the fluid flow direction. This turbulent movement inside the mixing chamber ensures that all the mixed fluid and air is cleared out of the mixing chamber, further preventing any unmixed fluid remaining therein after the dispensing stroke.

[0026] In a preferred embodiment the fluid inlet can be provided with an inlet valve comprising a resilient cone member mounted on a boss, which cone member can comprise an outer rim, which can be urged against an inner surface of said mixing chamber to shut the fluid inlet by a negative pressure generated during a priming stroke of said fluid cylinder, and which can be forced away from said inner surface to open the fluid inlet by a positive pressure generated during a dispensing stroke of said fluid cylinder. An underside of this cone member can comprise said conical section of said mixing chamber. Therefore, the valve used to control the flow of fluid into the mixing chamber can have the dual function of controlling the flow of fluid into the mixing chamber, and also defining the advantageous conical shape inside the mixing chamber.

[0027] This configuration also means that the fluid enters the mixing chamber below the base of the truncated cone, which allows it to collide with the air, before travelling up into the truncated cone, which increases the degree of movement and agitation inside the mixing chamber.

[0028] The boss can be mounted on a sleeve component provided in said mixing chamber, and an aperture can be formed between said boss and said sleeve through which mixed air and fluid can pass in use.

[0029] This sleeve component can also provide for the air to be directed to the mixing chamber in the manner described above. In particular, the air cylinder can be connected to said mixing chamber by an air passageway which extends from a first opening at a bottom of said air cylinder to said air inlet of said mixing chamber. The air passageway can comprise a first portion which extends from said first opening to an intermediary opening in said inner surface of said mixing chamber. The sleeve component can overlie said intermediary opening, and it can comprise an annular trough in an outer surface thereof which can be aligned with said intermediary opening and can define a second portion of the air passageway. The sleeve component can then comprise a flat wasted section extending axially from said annular trough to an upper rim of said sleeve component, and defining a third portion of the air passageway. Therefore, the air enters the trough, travels around it in both directions to opposed openings where the wasted section begins, and then up the wasted section and into the mixing chamber where it collides with the fluid entering from above.

[0030] Preferably the foam pump can comprise a valve chamber provided with a primary fluid inlet and a primary fluid outlet, which can be arranged on said fluid throughflow axis. The valve chamber and the mixing chamber can be sequentially aligned on the fluid throughflow axis, and the fluid cylinder can be in operative connection with the valve chamber. Therefore, the primary fluid outlet of the valve chamber referred to here is the same feature as the fluid inlet of the mixing chamber.

[0031] Further, the primary fluid inlet can be controlled by a primary fluid valve member adapted to open during a priming stroke of said fluid cylinder and to shut during a dispensing stroke of said fluid cylinder. In a preferred construction the primary fluid valve member can be a ball valve.

[0032] With this construction the positive and negative pressure generated by the movement of the fluid piston in use acts on a single valve chamber in a simple and efficient construction.

[0033] It is possible for the fluid cylinder and the air cylinder to be arranged next to one another, but in a preferred construction the fluid cylinder and the air cylinder can be co-axial with one another. In one construction the air cylinder can be disposed inside the fluid cylinder, but in a preferred embodiment the air cylinder can be radially arranged around the fluid cylinder. This is suitable when the valve chamber and the mixing chamber are sequentially aligned on said fluid throughflow axis, as described above, because the air cylinder can conveniently be in operative connection with the mixing chamber, downstream of the valve chamber.

[0034] Preferably the fluid cylinder and the air cylinder can be provided with a common piston member comprising a fluid piston and an air piston, which can be co-axial with one another and be disposed in said fluid cylinder and said air cylinder respectively.

[0035] In an expedient embodiment of the invention, the fluid piston and air piston can be self-sealing against the walls of the fluid cylinder and air cylinder respectively. This is a simple construction which saves on separate sealing components, and can be readily achieved with modem materials.

[0036] It is possible for the air cylinder to draw air therein from an outlet nozzle of the pump, however, in a preferred construction the air cylinder can be provided with one or more apertures through which air from atmosphere can be drawn. These apertures can be provided with a primary air valve member adapted to open during a priming stroke of the air cylinder and to shut during a dispensing stroke thereof.

[0037] The one or more apertures can be provided at the bottom of the air cylinder, and the primary air valve member can comprise a resilient annular disc disposed at the bottom of the air cylinder, overlying the apertures. The disc can be lifted away from the bottom of the air cylinder to open the apertures by a negative pressure generated inside the air cylinder during a priming stroke thereof, and the disc can be urged against the bottom of the air cylinder to shut the apertures by a positive pressure generated inside the air cylinder during a dispensing stroke thereof.

[0038] The co-mingled fluid and air exiting the mixing chamber is not a foam, so as in known foam pumps a foaming chamber can be provided, which can be sequentially aligned on said fluid throughflow axis after the mixing chamber. The foaming chamber can comprise one or more foaming meshes adapted to generate a foam to be dispensed from the mixed air and fluid forced into the foaming chamber. In a preferred construction two spaced apart foaming meshes can be provided.

[0039] In one embodiment of the invention the pump can be provided without any return spring. Such a pump can find application with a dispenser which comprises an integral return spring, which is adapted to bias the piston member to perform a priming stroke in some way. This can be achieved with a spring loaded trigger like that shown in the prior art, or with another type of wall-mounted dispenser in which a cover thereof is attached to a base with a hinge, and is rotatable about said hinge towards and away from said base, and in which the cover is connected to the foam pump via a pivoting linkage adapted to convert the rotational movement of the cover into a linear movement of the operating plunger. In such an arrangement the piston member is operatively connected to the cover via this pivoting linkage. The pivoting linkage can take one of several different forms, but an expedient arrangement comprises a track provided on the cover, through which a ball-shaped sliding member associated with the piston member can travel in use.

[0040] However, in an alternative embodiment of the invention the foam pump can comprise spring means adapted to bias the common piston member to perform a priming stroke of the fluid cylinder and the air cylinder. With this arrangement the pump automatically performs a priming stroke after each dispensing stroke.

[0041] The spring means can be any known type of spring which is capable of acting to bias the piston member, including any type of extension or compression spring external of the fluid or air cylinder, or any such spring inside the foam pump acting on the active surfaces of the fluid or air pistons. However, in a preferred construction the spring means can comprise a coil spring disposed in the air cylinder and around the fluid cylinder, which can act against said air piston.

[0042] A foam pump with its own return spring can be used with any type of dispenser, but in one construction it can be adapted to be used with a wall-mounted dispenser which is operated by generally lateral movement of a cover thereof. Therefore the piston member can comprise an operating plunger provided with an operative depression surface at an outer end thereof. The inside surface of the cover of a dispenser like that described above can bear against the operative surface when it is depressed, in order to operate the pump. The action of the spring can then push the operative surface back out again, returning the cover of the dispenser to its starting position.

[0043] Alternatively, if the foam pump comprises no return spring and is intended to be used with a wall-mounted dispenser in which the cover rotates in relation to the base, and is connected to the foam pump via a pivoting linkage comprising a track provided on the cover, through which a ball-shaped sliding member associated with the piston member can travel in use, then the piston member can comprise an operating plunger provided with a substantially ball-shaped resilient sliding member at an outer end thereof.

[0044] The invention can be performed in various ways, but three embodiments will now be described by way of example, and with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional side view of a first foam pump according to the invention;

Figure 2 is a cross-sectional perspective view of the first foam pump as shown in Figure 1;

Figure 3 is a cross-sectional perspective view of a part of the first foam pump as shown in Figure 1;

Figure 4 is a perspective view of internal stacked components forming a part of the first foam pump as shown in Figure 1;

Figure 5 is a cross-sectional side view of a second foam pump according to the present invention; and

Figure 6 is a cross-sectional side view of a third foam pump according to the present invention.

[0045] As shown in Figure 1, a foam pump 1 comprises a fluid cylinder 2, an air cylinder 3, and a mixing chamber 4. The mixing chamber 4 comprises a fluid throughflow axis A - A, a fluid inlet 18 and an air inlet 44 (visible in Figure 3). The fluid cylinder 2 and the air cylinder 3 both comprise a stroke axis B - B which is substantially normal to said fluid throughflow axis A - A. As described further below, the fluid cylinder 2 is adapted to draw a fluid therein in a priming stroke, and to pump said fluid into said mixing chamber 4 in a dispensing stroke, and the air cylinder 3 is adapted to draw air therein in a priming stroke, and to pump said air into said mixing chamber 4 in a dispensing stroke. As is clear from the Figures, said fluid inlet 18 faces in a fluid flow direction of the mixing chamber 4, and said air inlet 44 is arranged downstream of said fluid inlet 18, and faces against said fluid flow direction.

[0046] The foam pump 1 comprises a body 7 with a bore 9 arranged on the axis A - A. A container coupling 10 is provided at a first end 11 of the bore 9, and an outlet nozzle component 12 is attached to a second end 9a of the bore 9. Arranged sequentially in the bore 9 is a fluid inlet funnel 13, a valve chamber 14, the mixing chamber 4, and a foaming chamber 15.

[0047] The fluid cylinder 2 and the air cylinder 3 are co-axial with one another and are aligned on the stroke axis B - B. The fluid and air cylinders 2 and 3 are integrally formed as a part of the body 7, and as is clear from Figure 1, the fluid cylinder 2 is arranged inside the air cylinder 3, and is aligned, and in operative connection with, the valve chamber 14. The air cylinder 3 is in operative connection with the mixing chamber 4, downstream of the valve chamber 14, as described further below.

[0048] The valve chamber 14 is provided with a primary fluid inlet 16 controlled by ball valve 17, and a primary fluid outlet, being the same part as the fluid inlet 18 into the mixing chamber 4. The fluid inlet 18 is provided with an inlet valve comprising resilient cone member 19. Referring to Figure 2, the cone member 19 is mounted on a boss 20 and comprises an outer rim 21, which is urged against an inner surface 22 of the mixing chamber 4 to shut the fluid inlet 18 by negative pressure generated during a priming stroke of the fluid cylinder 2, and which is lifted away from the inner surface 22 to open the fluid inlet 18 by a positive pressure generated during a dispensing stroke of the fluid cylinder 2.

[0049] As is clear from the Figures, the foam pump 1 has a fluid flow direction in which fluid passes through the bore 9 from its first end 11 to its second end 9a. The fluid inlet 18 faces in this fluid flow direction, and the air inlet 44 is arranged downstream of the fluid inlet 18 and faces against the fluid flow direction.

[0050] Referring to Figure 3, an underside of the cone member 19 provides the mixing chamber 4 with a conical section 54, in the form of a truncated cone with a cone axis thereof aligned with said fluid throughflow axis A - A, and with a base 19a thereof downstream of an apex 19b thereof. Therefore, the fluid inlet 18 is arranged below the conical section 54, and the air inlet 44 faces towards it.

[0051] The boss 20 is mounted on a sleeve component 23 disposed in the mixing chamber 4, and an aperture 24 is formed between the boss 20 and the sleeve 23, through which mixed fluid and air passes in use, as described further below.

[0052] The fluid cylinder 2 and the air cylinder 3 are provided with a common piston member 5, which comprises a fluid piston 25 and an air piston 26, which are both self-sealing against the fluid and air cylinders 2 and 3 respectively, by virtue of resilient flanges 27 and 28 in each case.

[0053] The piston member 5 has an operating plunger 29, which comprises an operative depression surface 30 at an outer end 31 thereof, which is adapted to co-operate with the inside surface of a dispensing device with which the foam pump 1 is used, as described further below. The piston member 5 is secured inside the fluid and air cylinders 2 and 3 by an annular end cap 32, fastened to the air cylinder 3 with a snap-fit coupling 33.

[0054] The air cylinder 3 is provided with four apertures (not visible) at a bottom 34 thereof, through which air from atmosphere can be drawn. A resilient annular disc 35 is disposed at the bottom 34 of the air cylinder 3, overlying the apertures. The disc 35 lifts away from the bottom 34 of the air cylinder 3 to open the apertures when a negative pressure is generated inside the air cylinder 3 during a priming stroke thereof, and the disc 35 is urged against the bottom 34 of the air cylinder 3 to shut the apertures when a positive pressure is generated inside said air cylinder 3 during a dispensing stroke thereof.

[0055] Referring to Figure 2, the air cylinder 3 is connected to the mixing chamber 4 by an air passageway 36. This begins at a first opening 37 at the bottom 34 of the air cylinder 3, which opening 37 is radially located outside the disc 35. The opening 37 is a part of an elongate trough 38 which extends under the disc 35 to a bore 39 perpendicular thereto, which leads to an intermediary opening 40 in the inner surface 22 of the mixing chamber 4. As is clear from Figure 2, the sleeve component 23 overlies this opening 40.

[0056] Referring now to Figure 4, which shows the sleeve component 23 and its axially associated parts in isolation, the sleeve component 23 comprises an annular trough 41 in an outer surface 42 thereof. As is clear from Figures 1 and 2, this trough 41 is aligned with the intermediary opening 40. The sleeve component 23 also comprises a flat wasted section 43 extending axially from the annular trough 41 to an upper rim 44 of the sleeve component 23.

[0057] As shown in Figure 3, this wasted section 43 defines a passageway from the trough 41 to the air inlet 44 of the mixing chamber 4, which as described above faces in an opposite direction to the flow of fluid entering the mixing chamber 4 around the outer rim 21 of the cone member 19.

[0058] Referring back to Figure 1, the foaming chamber 15 comprises two foaming meshes 45 and 46. The first mesh 45 is disposed between the sleeve component 23 and a mounting sleeve 47, while the second mesh 46 is disposed between the mounting sleeve 47 and the nozzle component 12. The nozzle component 12 is fastened to the body 7 with a snap-fit coupling 48, and this holds the second mesh 46, the mounting sleeve 47, the first mesh 45 and the sleeve component 23 in position inside the bore 9.

[0059] As shown in Figure 1, coil spring 6 is disposed in the air cylinder 3, and around the fluid cylinder 2. It is a compression coil spring, which acts against the air piston 26 to bias the piston member 5 to perform a priming stroke. The coil spring 6 is mounted inside the foam pump 1 in a state of compression by the end cap 32, and it performs three functions: i) it works to hold the piston member 5 in an outermost position after a priming stroke, ii) it acts as a dampening means during the performance of a dispensing stroke, and iii) it acts as a return spring to urge the piston member 5 to perform a priming stroke.

[0060] The foam pump 1 shown in the Figures is adapted to co-operate with a container of soap to be dispensed. Referring to Figure 2, the container coupling 10 is a snap-fit coupling comprising an annular boss 49 with four resilient part-annular arms 50 arranged around it (only two of which are visible in Figure 2). The coupling 10 is adapted to fasten to a mounting boss provided on a container of soap (not shown). In this particular case, the foam pump 1 is disposable, and is intended to be supplied ready affixed to a container of soap, and disposed of when the container is spent.

[0061] The foam pump 1 is also provided with an annular mounting boss 51 which is clipped to its rear. This mounting boss 51 comprises a pair of bayonet locking pins 52 adapted to co-operate with a bayonet socket on a dispensing device to which it is intended to be mounted (not shown). The mounting boss 51 also comprises a shaped profile 53, which is adapted to co-operate with a corresponding shaped profile provided on the dispensing device. This feature is designed to prevent incorrect containers of soap being fitted to particular dispensers.

[0062] The foam pump 1 operates as follows. The pump 1 is mounted to the underside of a container of liquid soap to be dispensed (not shown), and affixed thereto by the coupling 10. A clear fluid passageway from the container is created, and the fluid inlet funnel 13 is flooded with liquid soap.

[0063] To prime the pump 1 the piston member 5 is driven by the coil spring 6 up the fluid and air cylinders 2 and 3. The negative pressure generated by the movement of the fluid piston 25 sucks soap from the fluid inlet funnel 13 into the valve chamber 14, through the primary fluid inlet 16. The ball valve 17 is drawn away from the primary fluid inlet 16 so it stays open. The negative pressure also urges the outer rim 21 of the cone member 19 against the inner surface 22 of the mixing chamber 4, so it stays shut. Soap floods the valve chamber 14 and is drawn into the fluid cylinder 2.

[0064] At the same time, the negative pressure generated by the movement of the air piston 26 lifts the resilient disc 35 off the bottom 34 of the air cylinder 3, and draws air therein.

[0065] The movement of the piston member 5 is arrested by the end cap 32, and the foam pump 1 is primed with liquid soap and air, ready to be mixed and dispensed as a foam.

[0066] The pump 1 is fitted in use inside a dispensing device comprising a base and a cover hinged thereto (not shown). The mounting boss 51 co-operates with a bayonet socket provided on the base, and the cover is applied in a floating manner to the operative surface 30 of the piston member 5. To perform a dispensing stroke the cover is depressed by the user, and it drives the piston member 5 down the fluid and air cylinders 2 and 3.

[0067] The positive pressure generated by the movement of the fluid piston 25 forces the soap from the fluid cylinder 2 and the valve chamber 14 into the mixing chamber 4, through the fluid inlet 18. The outer rim 21 of the cone valve 19 is lifted away from the inner surface 22 of the of the mixing chamber 4, creating an annular opening. The ball valve 17 is forced into the primary fluid inlet 16, so it shuts.

[0068] At the same time, the positive pressure generated by the movement of the air piston 26 forces the air therein into the mixing chamber 4, through the air passageway 36 and the air inlet 44. The air travels along the elongate trough 38, through the bore 39, before it enters the trough 41, travels around it in both directions and then goes up the wasted section 43. The disc 35 is urged against the bottom 34 of the air cylinder 3, so the air apertures are shut.

[0069] As referred to above, the air inlet 44 faces in the opposite direction to the flow of liquid soap entering the mixing chamber 4. As such, the air and liquid soap collide, and this leads to a thorough initial mixing of the two substances, at least in the region of the air inlet 44, which assists in the formation of high quality foam.

[0070] Further, the high degree of turbulence generated inside the mixing chamber 4 forces the soap and air to circulate thoroughly therein, which ensures that it efficiently clears out of the mixing chamber 4, preventing any unmixed soap from remaining therein after the dispensing stroke.

[0071] In addition, referring to Figure 3, the shape of the conical section 54 of the mixing chamber 4 provided by the underside of the cone member 19 creates a high pressure area where the volume of the cone member 19 reduces adjacent to the boss 20. This high pressure area increases the mixing action and turbulence of the co-mingling soap and air, and as the high pressure area is at the opposite end of the mixing chamber 4 to the aperture 24, it urges the soap and air mixture to generally travel in the fluid flow direction and out through the aperture 24. This further assists in preventing any unmixed soap from remaining in the mixing chamber after the dispensing stroke.

[0072] It should be noted that the air inlet 44 is at 90 degrees to the stroke axis B-B, and that the aperture 24 is at 90 degrees to the air inlet 44, and is aligned with said stroke axis B-B at the opposite side of the mixing chamber 4 to the fluid cylinder 2. This configuration generates a degree of rotational flow inside the mixing chamber 4, because both the soap and the air have to travel around the boss 20 to reach the aperture 24. This also contributes to the beneficially high degree of movement and turbulence inside the mixing chamber, which thoroughly mixes the soap and air and ejects it all through the aperture 24.

[0073] The co-mingled liquid soap and air is forced by the combined pressure of the fluid and air pistons 25 and 26 through the aperture 24 into the foaming chamber 15. This pressure then forces the co-mingled soap and air over the two meshes 45 and 46, which turns the mixture into a foam. The generated foam then exits the pump 1 under pressure through the nozzle component 12, and drops into the hand or hands of the user.

[0074] Once the dispensing stroke has been completed and the user removes pressure from the cover of the dispenser, the foam pump 1 performs another automatic priming stroke as described above, loading the fluid and air cylinders 2 and 3 with liquid soap and air, and pushing the cover of the dispenser back out again.

[0075] As referred to above, at the end of the dispensing stroke a quantity of mixed soap and air remains inside the foaming chamber 15 and the mixing chamber 4, but any unmixed soap therein is not sufficient to pass over the foaming meshes 45 and 46 and leak from the foam pump 1, due to the efficient mixing effect described above.

[0076] The above described embodiment can be altered without departing from the scope of Claim 1. In particular, in one alternative embodiment shown in Figure 5, a foam pump 100 is like foam pump 1 described above, except that it is adapted to be used with a particular type of wall-mounted dispenser, in which the cover thereof is attached to a base with a hinge, and is rotatable about said hinge towards and away from said base, and in which the cover is connected to the foam pump via a pivoting linkage adapted to convert the rotational movement of the cover into a linear movement of the operating plunger. The pivoting linkage comprises a track provided on the cover, through which a ball shaped sliding member can travel in use, and as such the operating plunger 101 comprises a substantially ball-shaped resilient sliding member 102 at an outer end thereof.

[0077] Of note is that foam pump 1 does not comprise any return spring, as the dispenser described above comprises its own return springs which act to return the cover to its starting position after it has been depressed. As the operating plunger 101 is fixed to the cover, the piston member 103 is made to automatically perform a priming stroke when the cover is forced back to its starting position.

[0078] In another alternative embodiment shown in Figure 6, a foam pump 200 is the same as foam pump 1 described above, except that it does not comprise any return spring. Foam pump 200 can find application with a dispenser which comprises an integral return spring, which is adapted to bias the operating plunger 201 to perform a priming stroke in some way. This can be achieved with a spring loaded trigger like those shown in the prior art and described above. The foam pump 200 could also be operated entirely manually, with the operating plunger being pushed in and pulled out by hand.

[0079] In other alternative embodiments (not shown) the spring means of the invention comprises other springs capable of acting to bias the piston member, including extension and compression springs external of the fluid or air cylinder, and a compression spring inside the fluid cylinder.

[0080] In another alternative embodiment (not shown) the fluid and air cylinders can not be co-axial, and instead can simply be arranged one next to the other on parallel stroke axes.

[0081] Some of the features forming a part of the foam pumps 1, 100 and 200 are not essential to the invention, and could be omitted, for example the container coupling 10 and mounting boss 51 which are specific to particular applications. Therefore, in other embodiments (not shown) these features are dispensed with, or replaced with other known soap container and/or dispenser interfaces.

[0082] Thus, the present invention provides a foam pump suitable for use inside a wall-mounted dispensing device, by virtue of the perpendicular arrangement of the fluid throughflow axis A - A and the co-axial fluid and air cylinders 2 and 3. In addition, the manner in which the air and soap collide and are moved and agitated under pressure inside the mixing chamber 4 leads to a high degree of premixing of the soap and air prior to foaming, which results in a high quality foam being produced, and which also ensures that no residue of unmixed soap is left inside the mixing chamber after each dispensing stroke, which prevents leakage.

Claims

1. A foam pump (1) comprising a fluid cylinder (2), an air cylinder (3) and a mixing chamber (4), in which the mixing chamber (4) comprises a fluid throughflow axis (A-A), a fluid inlet (18) and an air inlet (44), in which the fluid cylinder (2) and the air cylinder (3) both comprise a stroke axis (B-B) which is substantially normal to said fluid throughflow axis (A-A), in which the fluid cylinder (2) is adapted to draw a fluid therein in a priming stroke and to pump said fluid into said mixing chamber (4) through said fluid inlet (18) in a dispensing stroke, in which the air cylinder (3) is adapted to draw air therein in a priming stroke and to pump said air into said mixing chamber (4) through said air inlet (44) in a dispensing stroke, **characterised in that** said fluid inlet (18) faces in a fluid flow direction of the mixing chamber (4), and **in that** said air inlet (44) is arranged downstream of said fluid

inlet (18) and faces against said fluid flow direction.

2. A foam pump (1) as claimed in Claim 1 in which said mixing chamber (4) comprises a conical section (54).

3. A foam pump (1) as claimed in Claim 2, in which said conical section (54) comprises a truncated cone with a cone axis thereof aligned with said fluid throughflow axis (A-A), and with a base (19a) thereof downstream of an apex (19b) thereof.

4. A foam pump (1) as claimed in Claim 3 in which said fluid inlet (18) is provided with an inlet valve (19) comprising a resilient cone member (19) mounted on a boss (20), in which said cone member (19) comprises an outer rim (21), in which said outer rim (21) is urged against an inner surface (22) of said mixing chamber (4) to shut the fluid inlet (18) by a negative pressure generated during a priming stroke of said fluid cylinder (2), in which said outer rim (21) is forced away from said inner surface (22) to open the fluid inlet (18) by a positive pressure generated during a dispensing stroke of said fluid cylinder (2), and in which an underside of said cone member (19) comprises said conical section (54) of said mixing chamber (4).

5. A foam pump (1) as claimed in Claim 4 in which said boss (20) is mounted on a sleeve component (23) provided in said mixing chamber (4), in which an aperture (24) is formed between said boss (20) and said sleeve component (23) through which mixed air and fluid passes in use.

6. A foam pump (1) as claimed in Claim 5 in which the air cylinder (3) is connected to said mixing chamber (4) by an air passageway (36) which extends from a first opening (37) at a bottom (34) of said air cylinder (3) to said air inlet (44) of said mixing chamber (4), in which said air passageway (36) comprises a first portion (38, 39) which extends from said first opening (37) to an intermediary opening (40) in said inner surface (22) of said mixing chamber (4), in which said sleeve component (23) overlies said intermediary opening (40), in which said sleeve component (23) comprises an annular trough (41) in an outer surface (42) thereof which is aligned with said intermediary opening (40) and defines a second portion (41) of said air passageway (36), and in which said sleeve component (23) comprises a flat wasted section (43) extending axially from said annular trough (41) to an upper rim (44) of said sleeve component (23) and defining a third portion of said air passageway (36).

7. A foam pump (1) as claimed in any of the preceding Claims further comprising a valve chamber (14) comprising a primary fluid inlet (16) and a primary fluid outlet (18), in which said primary fluid inlet (16) and said primary fluid outlet (18) are arranged on said fluid throughflow axis (A-A), in which the valve chamber (14) and the mixing chamber (4) are sequentially aligned on said fluid throughflow axis (A-A), and in which the fluid cylinder (2) is in operative connection with said valve chamber (14).

8. A foam pump (1) as claimed in Claim 7 in which said primary fluid inlet (16) is controlled by a primary fluid valve member (17) adapted to open during a priming stroke of said fluid cylinder (2) and to shut during a dispensing stroke of said fluid cylinder (2)

9. A foam pump as (1) claimed in any of the preceding Claims in which the fluid cylinder (2) and the air cylinder (3) are co-axial with one another.

10. A foam pump (1) as claimed in Claim 9 in which said air cylinder (3) is radially arranged around said fluid cylinder (2).

11. A foam pump (1) as claimed in Claim 10 in which the fluid cylinder (2) and the air cylinder (3) are provided with a common piston member (5) comprising a fluid piston (25) and an air piston (26), in which said fluid piston (25) and said air piston (26) are co-axial with one another and disposed in said fluid cylinder (2) and said air cylinder (3) respectively.

12. A foam pump (1) as claimed in any of the preceding Claims in which the air cylinder (3) is provided with one or more apertures through which air from atmosphere is drawable, in which said one or more apertures are provided with a primary air valve member (35) adapted to open during a priming stroke of said air cylinder (3) and to shut during a dispensing stroke of said air cylinder (3).

13. A foam pump (1) as claimed in Claim 12 in which said one or more apertures are provided at the bottom (34) of the air cylinder (3), in which said primary air valve member (35) comprises a resilient annular disc (35) disposed at the bottom (34) of the air cylinder (3) and overlying said one or more apertures, in which said annular disc is (35) lifted away from the bottom (34) of the air cylinder (3) to open said one or more apertures by a negative pressure generated inside said air cylinder (3) during a priming stroke thereof, and in which said annular disc (35) is urged against the bottom (34) of the air cylinder (3) to shut said one or more apertures by a positive pressure generated inside said air cylinder (3) during a dispensing stroke thereof.

14. A foam pump (1) as claimed in Claim 11 in which the foam pump (1) comprises spring means (6) adapted to bias said common piston member (5) to perform a priming stroke of the fluid cylinder (2) and the air cylinder (3).

15. A foam pump (1) as claimed in Claim 14 in which said spring means (6) comprises a coil spring (6) disposed in said air cylinder (3) and around said fluid cylinder (2), and which acts against said air piston (26).

16. A foam pump (1) as claimed in Claim 11, 14 or 15 in which said common piston member (5) comprises an operating plunger (29) provided with an operative depression surface (30) at an outer end (31) thereof.

17. A foam pump (1) as claimed in Claim 11, 14 or 15 in which said common piston member (5) comprises an operating plunger (101) provided with a substantially ball-shaped resilient sliding member (102) at an outer end thereof.

Patentansprüche

1. Schäumerpumpe (1) umfassend einen Flüssigkeitszylinder (2), einen Luftzylinder (3) und eine Mischkammer (4), wobei die Mischkammer (4) eine Flüssigkeit-Durchströmachse (A-A), einen Flüssigkeitseinlass (18) und einen Lufteinlass (44) aufweist, wobei der Flüssigkeitszylinder (2) und der Luftzylinder (3) eine Hubachse (B-B) aufweisen, welche im Wesentlichen senkrecht zur Flüssigkeit-Durchströmachse (A-A) ist, wobei der Flüssigkeitszylinder (2) angepasst ist, um in einem Saughub eine Flüssigkeit in sich einzusaugen und die Flüssigkeit in einem Ausgabehub durch den Flüssigkeitseinlass (18) in die Mischkammer (4) zu pumpen, wobei der Luftzylinder (3) angepasst ist, um in einem Saughub Luft in sich einzusaugen und die Luft in einem Ausgabehub durch den Lufteinlass (18) in die Mischkammer (4) zu pumpen, **dadurch gekennzeichnet, dass** der Flüssigkeitseinlass (18) in eine Flüssigkeitsströmrichtung der Mischkammer (4) weist, und dass der Lufteinlass (44) stromabwärts des Flüssigkeitseinlasses (18) angeordnet ist und gegen die Flüssigkeitsströmrichtung weist.

2. Schäumerpumpe (1) nach Anspruch 1, wobei die Mischkammer (4) einen konischen Abschnitt (54) umfasst.

3. Schäumerpumpe (1) nach Anspruch 2, wobei der konische Abschnitt (54) einen abgeschnittenen Konus umfasst, dessen Konusachse mit der Flüssigkeit-Durchströmachse (A-A) ausgerichtet ist, und dessen Basis (19a) sich stromabwärts seines Apex (19b) befindet.

4. Schäumerpumpe (1) nach Anspruch 3, wobei der Flüssigkeitseinlass (18) mit einem Einlassventil (19) umfassend ein auf einem Sitz (20) angeordnetes elastisches Konuselement (19) versehen ist, wobei das Konuselement (19) einen äußeren Rand (21) umfasst, wobei der äußere Rand (21) zum Schließen des Flüssigkeitseinlasses (18) durch einen während eines Saughubs des Flüssigkeitszylinders (2) erzeugten negativen Druck gegen eine innere Oberfläche (22) der Mischkammer (4) gezwungen wird, wobei der äußere Rand (21) zum Öffnen des Flüssigkeitseinlasses (18) durch einen während eines Ausgabehubs des Flüssigkeitszylinders (2) erzeugten positiven Druck von der inneren Oberfläche (22) der Ventilkammer (14) weggezwungen wird, und wobei eine Unterseite des Konuselements (19) einen konischen Abschnitt (54) der Mischkammer (4) umfasst.

5. Schäumerpumpe (1) nach Anspruch 4, wobei der Sitz (20) auf einer in der Mischkammer (4) vorgesehenen Hülsenkomponente (23) befestigt ist, wobei eine Öffnung (24) zwischen dem Sitz (20) und der Hülsenkomponente (23) gebildet ist, durch welche im Betrieb Luft-Flüssigkeits-Gemisch durchgeht.

6. Schäumerpumpe (1) nach Anspruch 5, wobei der Luftzylinder (3) mit der Mischkammer (4) durch einen Luftdurchgang (36) verbunden ist, welcher sich von einer ersten Öffnung (37) an einem Boden (34) des Luftzylinders (3) zu der zweiten Öffnung (44) der Mischkammer (4) erstreckt, wobei der Luftdurchgang (36) einen sich von der ersten Öffnung (37) zu einer Zwischenöffnung (40) in der inneren Oberfläche (22) der Mischkammer (4) erstreckenden ersten Teilbereich (38, 39) aufweist, wobei die Hülsenkomponente (23) die Zwischenöffnung (40) überlagert, wobei die Hülsenkomponente (23) in ihrer äußeren Oberfläche (42) eine mit der Zwischenöffnung (40) ausgerichtete und einen zweiten Teilbereich (41) des Luftdurchgangs (36) definierende ringförmige Vertiefung (41) aufweist, und wobei die Hülsenkomponente (23) einen sich axial von der ringförmigen Vertiefung (41) zu einem oberen Rand (44) der Hülsenkomponente (23) erstreckenden und einen dritten Teilbereich des Luftdurchgangs (36) definierenden flach verschwindenden Abschnitt (43) aufweist.

7. Schäumerpumpe (1) nach einem der voranstehenden Ansprüche, weiter umfassend eine mit einem Primärflüssigkeitseinlass (16) und einem Primärflüssigkeitsauslass (18) versehene Ventilkammer (14), wobei der Primärflüssigkeitseinlass (16) und der Primärflüssigkeitsauslass (18) auf der Flüssigkeit-Durchströmachse (A-A) angeordnet sind, wobei die Ventilkammer (14) und die Mischkammer (4) sequenziell auf der Flüssigkeit-Durchströmachse (A-A) ausgerichtet sind, und wobei der Luftzylinder (3) in Wirkverbindung mit der Mischkammer (4) steht, und wobei der Flüssigkeitszylinder (2) in Wirkverbindung mit der Ventilkammer (14) steht.

8. Schäumerpumpe (1) nach Anspruch 7, wobei der Primärflüssigkeitseinlass (16) durch einen erstes Primärflüssigkeitsventilelement (17) kontrolliert wird, welches angepasst ist, um während eines Saughubs des Flüssigkeitszylinders (2) zu öffnen und während eines Ausgabehubs des Flüssigkeitszylinders (2) zu schließen

9. Schäumerpumpe (1) nach einem der voranstehenden Ansprüche, wobei der Flüssigkeitszylinder (2) und der Luftzylinder (3) zueinander koaxial sind.

10. Schäumerpumpe (1) nach Anspruch 9, wobei der Luftzylinder (3) radial um den Flüssigkeitszylinder (2) angeordnet ist.

11. Schäumerpumpe (1) nach Anspruch 10, wobei der Flüssigkeitszylinder (2) und der Luftzylinder (3) mit einem gemeinsamen Kolbenelement (5) umfassend einen Flüssigkeitskolben (25) und einen Luftkolben (26) ausgestattet sind, wobei der Flüssigkeitskolben (25) und der Luftkolben (26) zueinander koaxial und in dem Flüssigkeitszylinder (2) bzw. dem Luftzylinder (3) angeordnet sind.

12. Schäumerpumpe (1) nach einem der voranstehenden Ansprüche, wobei der Luftzylinder (3) mit einer oder mehreren Öffnungen versehen ist, durch die Luft aus der Atmosphäre eingesaugt werden kann, wobei die eine oder mehreren Öffnungen mit einem Primärluftventilelement (35) ausgestattet sind, welches zum Öffnen während eines Saughubs des Luftzylinders (3) und zum Schließen während eines Ausgabehubs des Luftzylinders (3) eingerichtet ist

13. Schäumerpumpe (1) nach Anspruch 12, wobei eine oder mehrere der Öffnungen an dem Boden (34) des Luftzylinders (3) vorgesehen sind, wobei das Primärluftventilelement (35) eine am Boden (34) des Luftzylinders (3) angeordnete und die eine oder mehreren Öffnungen überlagernde elastische ringförmige Scheibe (35) umfasst, wobei die ringförmige Scheibe (35) zum Öffnen der einen oder mehreren Öffnungen durch einen im Inneren des Luftzylinders (3) während dessen Saughubs erzeugten negativen Druck vom Boden (34) des Luftzylinders (3) abgehoben wird, und wobei die ringförmige Scheibe (35) zum Schließen der einen oder mehreren Öffnungen durch einen im Inneren des Luftzylinders (3) während seines Ausgabehubs erzeugten positiven Druck gegen denen Boden (34) des Luftzylinders (3) gezwungen wird

14. Schäumerpumpe nach (1) nach Anspruch 11, wobei die Schäumerpumpe (1) Federmittel (6) umfasst, welche angepasst sind, um das gemeinsame Kolbenelement (5) vorzuspannen, um einen Saughub des Fluidzylinders (2) und des Luftzylinders (3) auszuführen,

15. Schäumerpumpe (1) nach Anspruch 14, wobei die Federmittel (6) eine in dem Luftzylinder (3) und um den Flüssigkeitszylinder (2) angeordnete Spiralfeder (6) umfassen, welche gegen den Luftkolben (26) wirkt.

16. Schäumerpumpe (1) nach Anspruch 11, 14 oder 15, wobei das Kolbenelement (5) einen an seinem äußeren Ende (31) mit einer Wirkvertiefungsoberfläche (30) versehenen Bedienkolben (29) umfasst.

17. Schäumerpumpe (1) nach Anspruch 11, 14 oder 15, wobei das Kolbenelement (5) einen an seinem äußeren Ende mit einem im wesentlichen kugelförmigen elastischen Gleitelement (102) versehenen Bedienkolben (101) umfasst.

Revendications

1. Pompe à mousse (1) comprenant un cylindre de fluide (2), un cylindre d'air (3) et une chambre de mélange (4), dans laquelle la chambre de mélange (4) comprend un axe d'écoulement traversant de fluide (A - A), un orifice d'entrée de fluide (18) et un orifice d'entrée d'air (44), dans laquelle le cylindre de fluide (2) et le cylindre d'air (3) comprennent tous deux un axe de course (B - B) qui est sensiblement normal audit axe d'écoulement traversant de fluide (A - A), dans laquelle le cylindre de fluide (2) est adapté de façon à aspirer un fluide à l'intérieur de celui-ci dans une course d'amorçage, et à pomper ledit fluide dans ladite chambre de mélange (4) à travers ledit orifice d'entrée de fluide (18) dans une course de délivrance, dans laquelle le cylindre d'air (3) est adapté de façon à aspirer de l'air à l'intérieur de celui-ci dans une course d'amorçage, et à pomper ledit air dans ladite chambre de mélange (4) à travers ledit orifice d'entrée d'air (44) dans une course de délivrance, **caractérisé en ce que** ledit orifice d'entrée de fluide (18) est dirigé dans une direction d'écoulement de fluide de la chambre de mélange (4), et **en ce que** ledit orifice d'entrée d'air (44) est disposé en aval dudit orifice d'entrée de fluide (18) et est dirigé à l'encontre de ladite direction d'écoulement de fluide.

2. Pompe à mousse (1) selon la revendication 1, dans laquelle ladite chambre de mélange (4) comprend une section conique (54).

3. Pompe à mousse (1) selon la revendication 2, dans laquelle ladite section conique (54) comprend un tronc de cône avec un axe de cône de celui-ci aligné avec ledit axe d'écoulement traversant de fluide (A - A), et avec une base (19a) de celui-ci en aval d'un sommet (19b) de celui-ci.

4. Pompe à mousse (1) selon la revendication 3, dans laquelle ledit orifice d'entrée de fluide (18) est muni d'une vanne d'entrée (19) comprenant un élément de cône résilient (19) monté sur une protubérance (20), dans laquelle ledit élément de cône (19) comprend un rebord extérieur (21), dans laquelle ledit rebord extérieur (21) est poussé contre une surface intérieure (22) de ladite chambre de mélange (4) de façon à fermer l'orifice d'entrée de fluide (18) par une pression négative générée durant une course d'amorçage dudit cylindre de fluide (2), dans laquelle ledit rebord extérieur (21) est forcé à s'éloigner de ladite surface intérieure (22) de façon à ouvrir l'orifice d'entrée de fluide (18) par une pression positive générée durant une course de délivrance dudit cylindre de fluide (2), et dans laquelle un côté inférieur dudit élément de cône (19) comprend ladite section conique (54) de ladite chambre de mélange (4).

5. Pompe à mousse (1) selon la revendication 4, dans laquelle ladite protubérance (20) est montée sur un composant de manchon (23) disposé dans ladite chambre de mélange (4), dans laquelle une ouverture (24) est formée entre ladite protubérance (20) et ledit composant de manchon (23), à travers laquelle passent de l'air et du fluide mélangés lors de l'utilisation.

6. Pompe à mousse (1) selon la revendication 5, dans laquelle le cylindre d'air (3) est relié à ladite chambre de mélange (4) par un passage d'air (36) qui s'étend d'une première ouverture (37) au niveau d'un fond (34) dudit cylindre d'air (3) audit orifice d'entrée d'air (44) de ladite chambre de mélange (4), dans laquelle ledit passage d'air (36) comprend une première partie (38, 39) qui s'étend de ladite première ouverture (37) à une ouverture intermédiaire (40) dans ladite surface intérieure (22) de ladite chambre de mélange (4), dans laquelle ledit composant de manchon (23) recouvre ladite ouverture intermédiaire (40), dans laquelle ledit composant de manchon (23) comprend une auge annulaire (41) dans une surface extérieure (42) de celui-ci, qui est alignée avec ladite ouverture intermédiaire (40), et qui définit une deuxième partie (41) dudit passage d'air (36), et dans laquelle ledit composant de manchon (23) comprend une section perdue plate (43) s'étendant axialement de ladite auge annulaire (41) à un rebord supérieur (44) dudit composant de manchon (23), et définissant une troisième partie dudit passage d'air (36).

7. Pompe à mousse (1) selon l'une quelconque des revendications précédentes, comprenant de plus une chambre de vanne (14) comprenant un orifice d'entrée de fluide primaire (16) et un orifice de sortie de fluide primaire (18), dans laquelle ledit orifice d'entrée de fluide primaire (16) et ledit orifice de sortie de fluide primaire (18) sont disposés sur ledit axe d'écoulement traversant de fluide (A - A), dans laquelle la chambre de vanne (14) et la chambre de mélange (4) sont alignées en séquence sur ledit axe d'écoulement traversant de fluide (A - A), et dans laquelle le cylindre de fluide (2) est en liaison opérationnelle avec ladite chambre de vanne (14).

8. Pompe à mousse (1) selon la revendication 7, dans laquelle ledit orifice d'entrée de fluide primaire (16) est commandé par un élément de vanne de fluide primaire (17) adapté de façon à s'ouvrir durant une course d'amorçage dudit cylindre de fluide (2) et à se fermer durant une course de délivrance dudit cylindre de fluide (2).

9. Pompe à mousse (1) selon l'une quelconque des revendications précédentes, dans laquelle le cylindre de fluide (2) et le cylindre d'air (3) sont coaxiaux l'un à l'autre.

10. Pompe à mousse (1) selon la revendication 9, dans laquelle ledit cylindre d'air (3) est disposé radialement autour dudit cylindre de fluide (2).

11. Pompe à mousse (1) selon la revendication 10, dans laquelle le cylindre de fluide (2) et le cylindre d'air (3) sont munis d'un élément de piston commun (5) comprenant un piston de fluide (25) et un piston d'air (26), dans laquelle ledit piston de fluide (25) et ledit piston d'air (26) sont coaxiaux l'un à l'autre et disposés dans ledit cylindre de fluide (2) et ledit cylindre d'air (3), respectivement.

12. Pompe à mousse (1) selon l'une quelconque des revendications précédentes, dans laquelle le cylindre d'air (3) est muni d'une ou de plusieurs ouvertures à travers lesquelles de l'air venant de l'atmosphère peut être aspiré, dans laquelle lesdites ouvertures au nombre d'une ou de plusieurs sont munies d'un élément de vanne d'air primaire (35) adapté de façon à s'ouvrir durant une course d'amorçage dudit cylindre d'air (3) et à se fermer durant une course de délivrance dudit cylindre d'air (3).

13. Pompe à mousse (1) selon la revendication 12, dans laquelle lesdites ouvertures au nombre d'une ou de plusieurs sont disposées au fond (34) du cylindre d'air (3), dans laquelle ledit élément de vanne d'air primaire (35) comprend un disque annulaire élastique (35) disposé au fond (34) du cylindre d'air (3) et recouvrant lesdites ouvertures au nombre d'une ou de plusieurs, dans laquelle ledit disque annulaire (35) est soulevé de façon à être éloigné du fond (34) du cylindre d'air (3) de façon à ouvrir lesdites ouver-

tures au nombre d'une ou de plusieurs par une pression négative générée à l'intérieur dudit cylindre d'air (3) durant une course d'amorçage de celui-ci, et dans laquelle ledit disque annulaire (35) est poussé contre le fond (34) du cylindre d'air (3) de façon à fermer lesdites ouvertures au nombre d'une ou de plusieurs par une pression positive générée à l'intérieur dudit cylindre d'air (3) durant une course de délivrance de celui-ci.

14. Pompe à mousse (1) selon la revendication 11, dans laquelle la pompe à mousse (1) comprend des moyens formant ressort (6) adaptés de façon à solliciter ledit élément de piston commun (5) de façon à effectuer une course d'amorçage du cylindre de fluide (2) et du cylindre d'air (3).

15. Pompe à mousse (1) selon la revendication 14, dans laquelle lesdits moyens formant ressort (6) comprennent un ressort hélicoïdal (6) disposé dans ledit cylindre d'air (3) et autour dudit cylindre de fluide (2), et qui agit à l'encontre dudit piston d'air (26).

16. Pompe à mousse (1) selon la revendication 11, 14 ou 15, dans laquelle ledit élément de piston commun (5) comprend un plongeur opérationnel (29) muni d'une surface en dépression opérationnelle (30) à une extrémité extérieure de celui-ci.

17. Pompe à mousse (1) selon la revendication 11, 14 ou 15, dans laquelle ledit élément de piston commun (5) comprend un plongeur opérationnel (101) muni d'un élément de coulissement élastique sensiblement en forme de bille (102) à une extrémité extérieure de celui-ci.

Fig 1

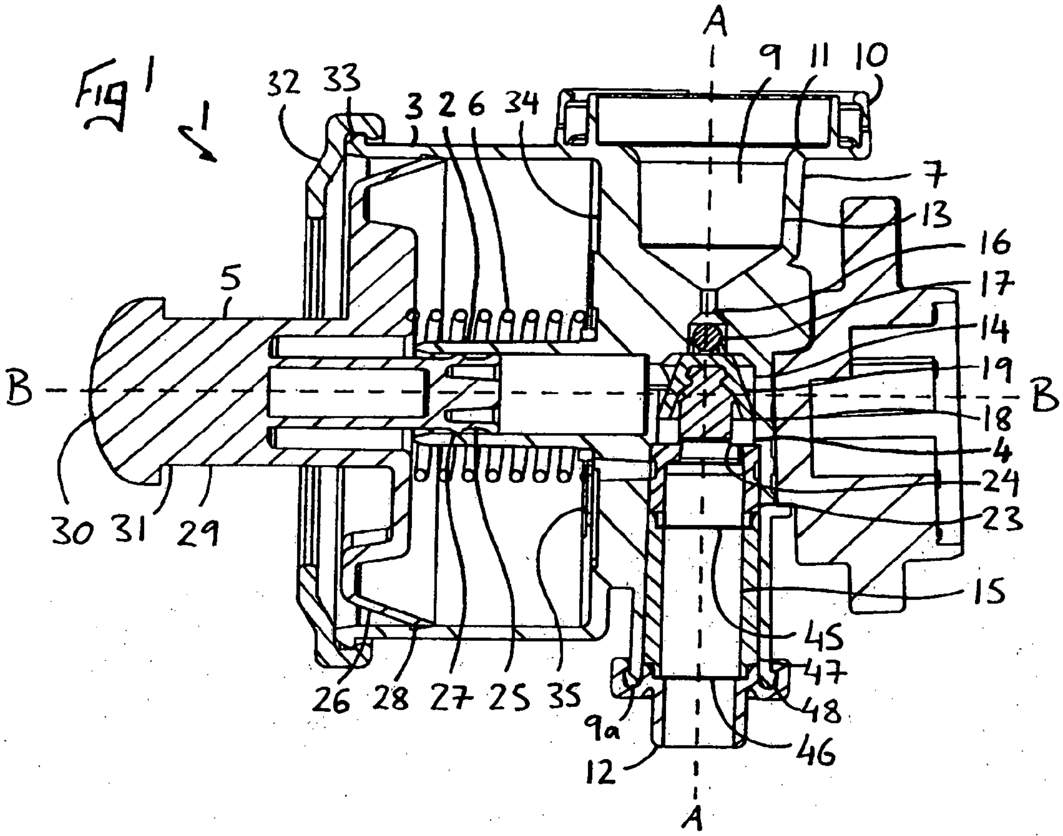
A
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Fig 2

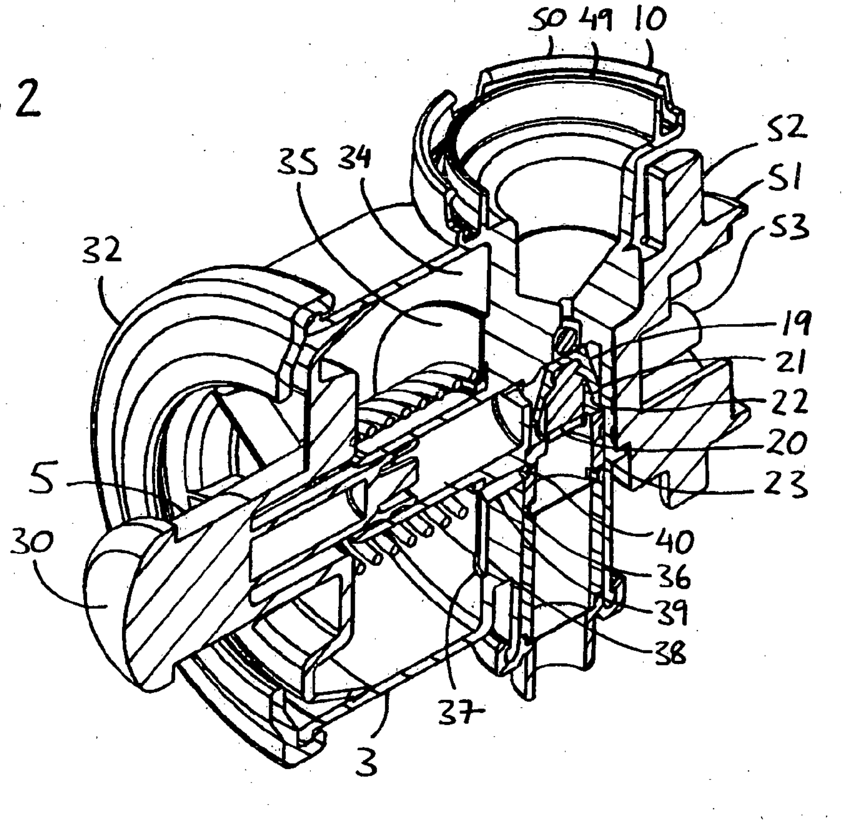
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Fig 3

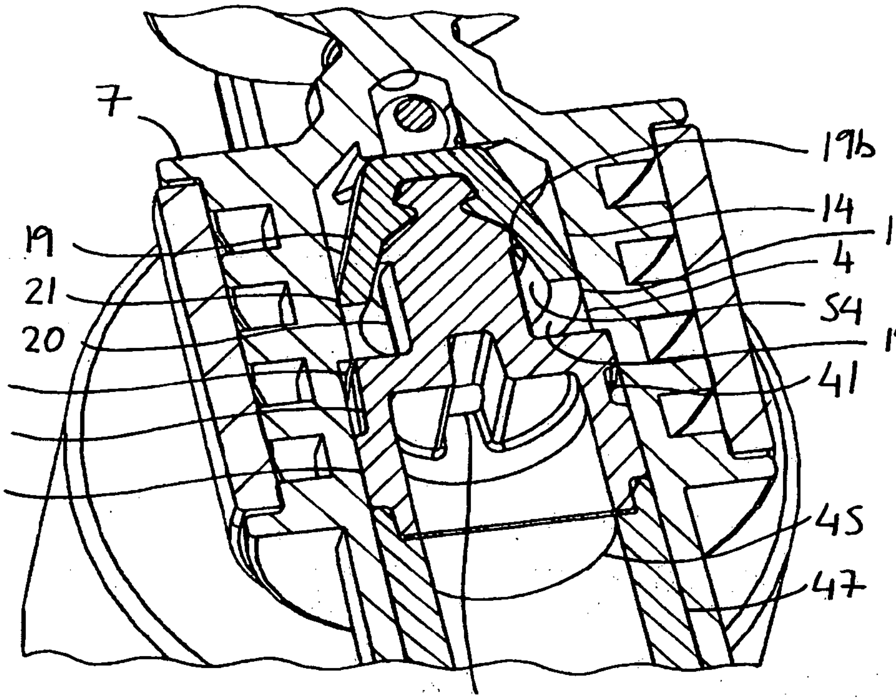


Fig 4

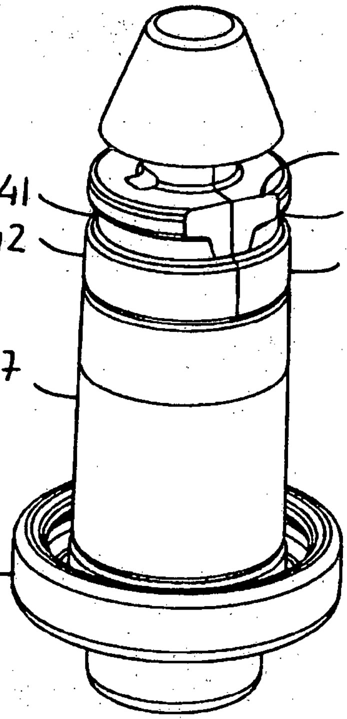


Fig 5

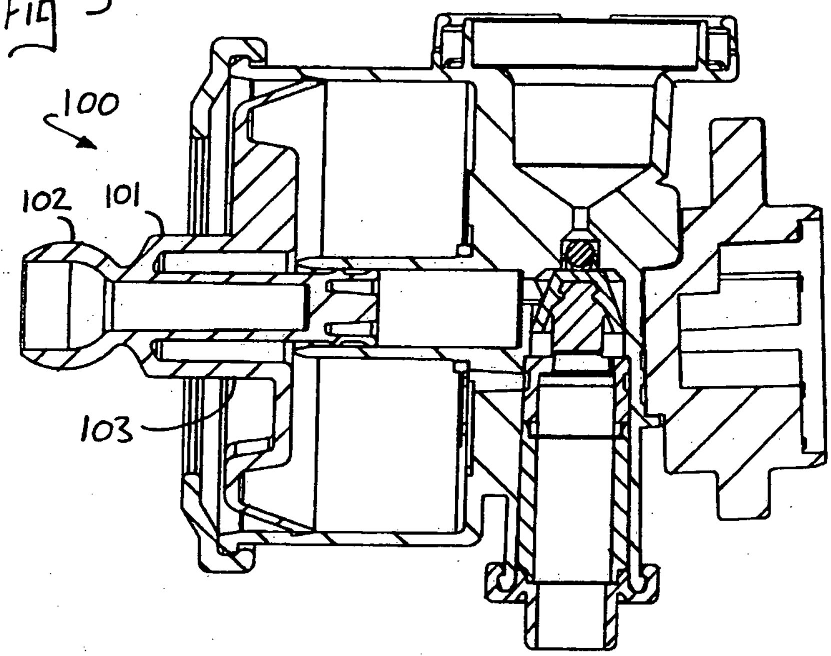
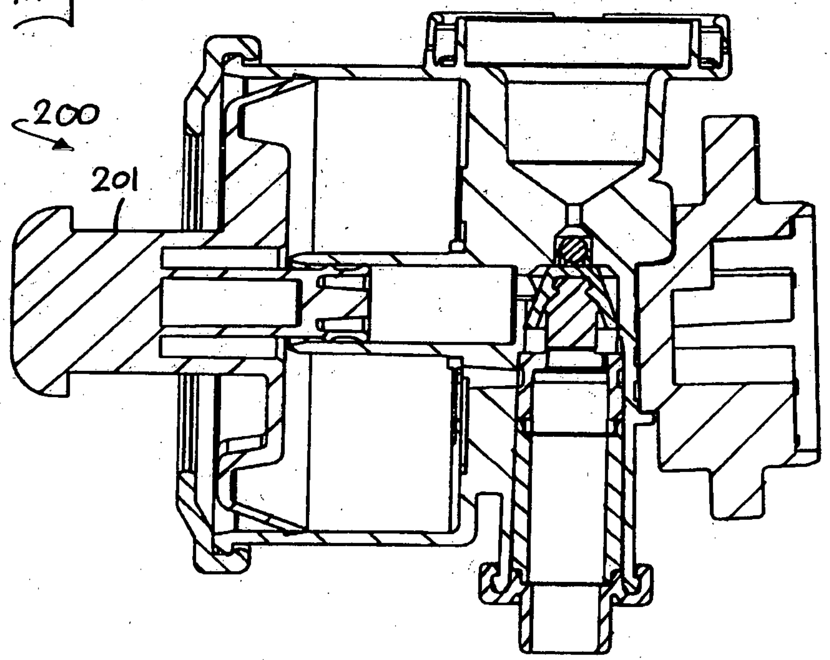


Fig 6



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714175/DO

HABPUMPA

SZABADALMI IGÉNYPONTOK

1. Habpumpa (1), amely tartalmaz egy folyadék hengert (2) egy levegő hengert (3) és egy keverőkamrát (4), amelyben a keverőkamra (4) tartalmaz egy folyadék átfolyó tengelyt (A-A), egy folyadék beömlőnyílást (18) és egy levegő beömlő nyílást (44), ahol a folyadék henger (2) és a levegő henger (3) mindegyike tartalmaz egy lényegében a folyadék átfolyó tengelyre (A-A) merőleges nyomó tengelyt (B-B), ahol a folyadék henger (2) úgy van kialakítva, hogy a feltöltési ütem során egy folyadékot felszívjon, és a kinyomó ütem során a folyadékot a folyadék beömlőnyíláson (18) keresztül a keverő kamrába (4) nyomja, ahol a levegő henger (3) arra van kialakítva, hogy a feltöltési ütem során levegőt szívjon fel, és a kinyomó ütem során a levegőt a levegő beömlőnyíláson (44) keresztül a keverő kamrába (4) nyomja, azzal jellemezve, hogy a folyadék beömlőnyílás (18) a keverőkamra (4) folyadékáramlásának irányába, és a levegő beömlőnyílás (44) a folyadék beömlőnyílástól (18) lefelé a folyadékáramlás irányával szembe van elrendezve.

2. Az 1. igénypont szerinti habpumpa (1), amelyben a keverőkamra (4) egy kúpos részt (54) tartalmaz.

3. A 2. igénypont szerinti habpumpa (1), amelyben a kúpos rész (54) tartalmaz egy csonka kúpot egy, a folyadék átfolyó tengellyel (A-A) megegyező kúptengellyel és egy alapjától (19a) lefelé mutató csúccsal (19b).

4. A 3. igénypont szerinti habpumpa (1), amelyben a folyadék beömlőnyílásnak (18) van egy bemeneti szelepe (19), amely tartalmaz egy dudorra (20) felfekvő rugalmas kúpos tagot (19), amely kúpos tag (19) tartalmaz egy külső peremet (21), amely külső perem (21) a folyadék henger (2) egy feltöltési üteme közben a negatív nyomás hatására nekifeszül a szelepkamra (4) belső felületének (22) a folyadék beömlőnyílás (18) elzárására, és amely külső perem (21) a folyadék henger (2) egy kilökési üteme közben a pozitív nyomás hatására eltávolodik a belső felülettől (22) a folyadék beömlőnyílás (18) kinyitására, és ahol a kúpos tag (19) alsó oldala tartalmazza a keverőkamra (4) kúpos részét (54).

5. A 4. igénypont szerinti habpumpa (1), amelyben a dudoron (20) egy, a keverőkamra (4) befogadott hüvelyelem (23) ül fel, amelyben a dudor (20) és a hüvelyelemen (23) között egy nyílás (24) van kialakítva, amelyen keresztül a levegő és folyadék keveréke működés közben áthalad.

6. Az 5. igénypont szerinti habpumpa (1), amelyben a levegő henger (3) a keverőkamrához (4) egy levegő átjárón (36) keresztül van csatlakoztatva, amely egy, a

levegő henger (3) alján (34) lévő első nyílástól (37) a keverőkamra (4) nyílásáig (44) terjed ki, ahol a levegő átjáró (36) tartalmaz egy első nyílástól (37) a keverőkamra (4) belső felületén (22), egy köztes nyílásig (40) tartó első részt (38, 39) ahol a hüvelyelem *(23) ráfekszik a köztes nyílásra (40);* a hüvelyelem (23) a külső felületén (42) tartalmaz egy gyűrűs hornyot (41), amely összhangban van a köztes nyílással (40) és meghatározza a levegő átjáró (36) egy második részét (41), és amelyben a hüvelyelem (23) tartalmaz lapos elvékonyodó részt (43) amely tengelyirányban a gyűrűs horonytól (41) a hüvelyelem (23) egy felső pereméig (44) terjed ki és a levegő átjáró (36) egy harmadik részét határozza meg.

7. Az előző igénypontok bármelyike szerinti habpumpa (1), amelynek van továbbá egy szelepkamrája (14), amely tartalmaz egy elsődleges folyadék beömlőnyílást (16) és ez elsődleges folyadék kiömlőnyílást (18), amelyben az elsődleges folyadék beömlőnyílás (16) és az elsődleges folyadék kiömlőnyílás (18) a folyadék átfolyó tengelyen (A-A) van elrendezve, ahol a szelepkamra (14) és a keverőkamra (4) sorban a folyadék átfolyó tengely (A-A) mentén van elhelyezve, és ahol a folyadék henger (2) működő kapcsolatban van a szelepkamrával (14).

8. A 7. igénypont szerinti habpumpa (1), amelyben az elsődleges folyadék beömlőnyílás (16) egy elsődleges folyadék szelep taggal (17) van irányítva nyitásra kialakítva a folyadék henger (2) feltöltési ütem során és zárásra kialakítva a folyadék henger (2) kilökési üteme során.

9. Az előző igénypontok bármelyike szerinti habpumpa (1), amelyben a folyadék henger (2) és a levegő henger (3) egymással egytengelyű.

10. A 9. igénypont szerinti habpumpa (1), amelyben a levegő henger (3) sugár irányban a folyadék henger (2) körül van elhelyezve.

11. A 10. igénypont szerinti habpumpa (1), amelyben a folyadék henger (2) és a levegő henger (3) egy közös dugattyú taggal (5) van ellátva, amely tartalmaz egy folyadék dugattyút (25) és egy levegő dugattyút (26), amelyben a folyadék dugattyú (25) és a levegő dugattyú (26) egymással egytengelyű és a folyadék hengerben (2) és a levegő hengerben (3) vannak elhelyezve.

12. Az előző igénypontok bármelyike szerinti habpumpa (1), amelyben a levegő henger (3) egy vagy több nyílást tartalmaz, amelyen keresztül az atmoszférikus levegő felszívható, ahol az egy vagy több nyílás egy elsődleges levegő szelep taggal (35) van ellátva nyitásra kialakítva a levegő henger (3) feltöltési ütem során és zárásra kialakítva a levegő henger (3) kilökési üteme során.

13. A 12. igénypont szerinti habpumpa (1), amelyben az egy vagy több nyílás a levegő henger (3) alján (34) van, ahol az elsődleges levegő szelep tag (35) tartalmaz egy rugalmas gyűrűs lemezt (35) a levegő henger (3) aljához (34) igazítva, az egy vagy több nyílást átfedően, amelyben a gyűrűs lemez (35) a feltöltési ütem során a levegő

henger (3) aljáról (34) elemelkedik a levegő hengerben (3) keletkező negatív nyomás által az egy vagy több nyílás nyitására, és amelyben a gyűrűs lemez (35) a kinyomó ütem során a levegő henger (3) aljához (34) nyomódik levegő hengerben (3) keletkező *pozitív nyomás által az egy vagy több nyílás zárására.*

14. A 11. igénypont szerinti habpumpa (1), amelyben a habpumpa (1) tartalmaz egy rugó eszközt (6) arra kialakítva, hogy kényszerítse a közös dugattyú tagot (5) a folyadék henger (2) és a levegő henger (3) feltöltési ütemének megvalósítására.

15. A 14. igénypont szerinti habpumpa (1), amelyben a rugó eszköz (6) egy spirálrugót (6) tartalmaz a levegő hengerben (3) és a folyadék henger (2) körül elhelyezve és a levegő dugattyú (26) ellen hatóan.

16. A 11, 14 vagy 15 igénypont szerinti habpumpa (1), amelyben a közös dugattyú elem (5) tartalmaz egy működtető nyomórudat (29), amely a külső végén (31) egy működtető nyomó felülettel (30) van ellátva.

17. 16. A 11, 14 vagy 15 igénypont szerinti habpumpa (1), amelyben a közös dugattyú elem (5) tartalmaz egy működtető nyomórudat (101), amely a külső végén egy lényegében gömb alakú rugalmas csúszó taggal (102) van ellátva.

A meghatalmazott

SBGK Szabadalmi Ügyvivői Iroda