BREAST PUMP SYSTEM

Field of Invention

The present invention relates to a breast pump system for backflow prevention. The breast pump system is particularly relevant, but not limited to a portable breast pump system.

Background Art

The following discussion of the background to the invention is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge of the person skilled in the art in any jurisdiction as at the priority date of the invention.

For women to continue lactating a sufficient volume of milk, they typically empty their breasts of milk according to the feeding schedules and milk quantities demanded by their child. The women may use a breast pump to continue breastfeeding after they return to work. They may use the breast pump to express breast milk, which is later bottle fed to their child.

The breast pump is a device for drawing milk from breasts by suction. A conventional breast pump typically comprises a breast shield for resting against a woman's breast, a pump for providing suction force to an interior portion of the breast shield, a hose for connecting between the breast shield and the pump, and a storage container for receiving milk. The conventional breast pump further comprises an external element as a backflow preventer to prevent the milk from backflow down the hose which is connected to the pump.

Various problems can arise from the use of the conventional breast pump. For instance, when the breast pump is employed, it takes some time for the woman to set up, operate and clean the breast pump. Moreover, due to the volume of the breast pump, in particular the volume of the external element as the backflow preventer, the woman should frontally undress or wear a special brassiere adapted to the breast pump while

using the breast pump. Additionally, the conventional breast pump requires the woman to use both of her hands to keep the breast pump in position, which prevents the woman from being able to perform other tasks as may be required in the workplace.

In light of the above, there exists a need to develop a breast pump that ameliorates or overcomes the above disadvantages.

The present invention seeks to provide a breast pump that addresses the aforementioned need at least in part.

Summary of the Invention

The technical solution is provided in the form of a breast pump system having a membrane which functions as a backflow preventer. In particular, the breast pump system comprises an inner case, for resting against a portion of a breast, connected to an external suction source via a hose; a membrane arranged to enclose the inner case to form a first chamber between the inner case and the membrane; and an outer case arranged to enclose the membrane to form a second chamber between the membrane and the outer case to receive a nipple of the breast, wherein when air exits from the first chamber via the hose by the external suction source, the first chamber collapses and a vacuum is created on the second chamber so as to draw milk from the nipple.

The presence of the first chamber forms a backflow preventer to minimize milk flowing into the hose.

Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

Furthermore, throughout the specification, unless the context requires otherwise, the word "include" or variations such as "includes" or "including", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

In accordance with an aspect of the present invention, there is a breast pump system comprising: an inner case, for resting against a portion of a breast, connected to an external suction source via a hose; a membrane arranged to enclose the inner case to form a first chamber between the inner case and the membrane; and an outer case arranged to enclose the membrane to form a second chamber between the membrane and the outer case to receive a nipple of the breast, wherein when air exits from the first chamber via the hose by the external suction source, the first chamber collapses and a vacuum is created on the second chamber so as to draw milk from the nipple.

Preferably, when air enters the first chamber via the hose by the external suction source, the first chamber expands and the second chamber is filled with the air.

Preferably, the breast pump system further comprises a storage container for receiving the milk, wherein the outer case is coupled with the storage container.

Preferably, the breast pump system further comprises a valve for reducing volume of air that the external suction source needs for creating the vacuum on the second chamber, wherein valve is disposed between the outer case and the storage container.

Preferably, an area between an outer surface of the membrane and an inner surface of the outer case, is arranged to direct flow of the milk from the second chamber to the storage container.

Preferably, an edge of the inner case is curved back and extended.

Preferably, the inner case comprises at least one attachment point for attaching the hose.

Preferably, the attachment point is disposed on the extended surface of the inner case.

Preferably, the membrane is attached to the extended surface of the inner case.

Preferably, the membrane covers at least a portion of the extended surface except the attachment point.

Preferably, the membrane is attached to the inner case by an adhesive.

Preferably, the adhesive is a silicone based adhesive.

Preferably, the silicone based adhesive includes a sil-poly adhesive.

Preferably, the outer case is attached to the extended surface of the inner case.

Preferably, the inner case includes a first number of holes and the outer case includes a second number of hooks, and the inner case and the outer case are assembled by fitting the holes into the hooks.

Preferably, the first number and the second number are different so that the attachment point can be positioned in various directions from where the milk drops out.

Preferably, one of the first number and the second number is an integer multiple of the other of the first number and the second number so that the attachment point can be positioned in various directions from where the milk drops out, and the holes and the hooks are equally spaced.

Preferably, at least one of the inner case and the outer case is made of non-flexible material.

Preferably, a shape of the inner case is a funnel.

Preferably, a shape of a head of the outer case is a cone.

Preferably, the membrane is made of flexible material.

Preferably, a shape of the membrane is a truncated cone.

Other aspects of the invention will become apparent to those of ordinary skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying drawings.

Brief Description of the Drawings

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

Figs. 1 and 2 illustrate cross-sectional views of the breast pump system in accordance with an embodiment of the invention.

Figs. 3, 4 and 5 illustrate exploded views of the breast pump system in accordance with an embodiment of the invention.

Figs. 6 and 7 illustrate examples of the holes of the inner case and the hooks of the outer case in accordance with an embodiment of the invention.

Figs. 8, 9 and 10 illustrate perspective views of the breast pump system in accordance with an embodiment of the invention.

Other arrangements of the invention are possible and, consequently, the accompanying drawings are not to be understood as superseding the generality of the preceding description of the invention.

Description of Embodiments of the Invention

Figs. 1 and 2 illustrate cross-sectional views of the breast pump system in accordance with an embodiment of the invention.

In accordance with an embodiment of the invention, there is a breast pump system 100 comprising at least one inner case 110, at least one membrane 120 and at least one outer case 130. An inner chamber (hereinafter referred to as "a first chamber") 141 is formed by the inner case 110 and the membrane 120. An outer chamber (hereinafter referred to as "a second chamber") 142 is formed by the membrane 120 and the outer case 130.

As shown in the Figs. 1 and 2, the inner case 110 is for resting against a portion of a woman's breast. The width and length of the inner case 110 may be varied to meet the nipple size of women from a large sample group.

The inner case 110 may be made of non-flexible material, such as plastic (e.g. polyethersulfone (PES) and polyphenylsulfone (PPSU)). The shape of the inner case 110 may resemble a funnel. An edge of the inner case 110 is curved back and extended.

The inner case 110 comprises at least one attachment point 112 for attaching the hose 150. The attachment point 112 may be disposed on the extended surface 111 of the inner case 110. It is to be appreciated that the inner case 110 may comprise a plurality of attachment points 112 in order to connect to a plurality of hoses 150.

While one end of the hose 150 is connected to the inner case 110, the other end of the hose 150 is connected to an external suction source (not shown). The external suction source is adapted to provide suction force to an interior portion of the breast pump system 100 so as to facilitate flow of milk from the breast. In various embodiments, the external suction source may be an electric pump so that the breast pump system 100 is operated by means of an electric motor. Alternatively, the external suction source may be a manually operated pump, i.e. the negative pressure necessary for expressing is generated by manually operating the vacuum pump.

As shown in the Figs. 1 and 2, the membrane 120 is arranged to enclose the inner case 110 to form the first chamber 141 between the inner case 110 and the membrane 120.

The membrane 120 may be made of flexible material, such as silicone and rubber. The shape of the membrane 120 may be a truncated cone or frustoconical. The width and length of the membrane 120 may be varied so that the membrane 120 can be fitted to the inner case 110.

The membrane 120 is attached to the extended surface 111 of the inner case 110 by an adhesive, and in some embodiments, a silicone based adhesive. For example, a sil-poly adhesive may be used for the attachment. The sil-poly adhesive may include at least one of Smooth-On Sil-Poxy, Dow Corning 736 and 3M Scotch-Weld EC-2216. It is to be appreciated that the adhesive is not limited to the silicone based adhesive. In some embodiments, any adhesive for permanent bonding of silicone to plastic may be used for the attachment. The membrane 120 and the extended surface 111 of the inner case 110 therefore may be attached permanently.

In other embodiments, the membrane 120 and the extended surface 111 of the inner case 110 may be attachable and detachable by the user.

In some embodiments, the membrane 120 may be attached to the extended outer surface of the inner case 110. In alternative embodiments, the membrane 120 may be attached to the extended inner surface of the inner case 110. At least a portion of the extended surface 111 of the inner case 110 is covered with the membrane 120, but the attachment point 112 is not covered with the membrane 120 to facilitate air flow. The

hose 150 is connected to the first chamber 141 via the attachment point 112. Once connected, air is able to enter the first chamber 141 and exit from the first chamber 141 via the hose 150.

As shown in the Figs. 1 and 2, the outer case 130 is arranged to enclose the membrane 120 to form the second chamber 142 between the membrane 120 and the outer case 130. The second chamber 142 is for receiving a nipple of the breast. The width and length of the outer case 130 may be varied to be fitted to the inner case 110.

The outer case 130 may be made of non-flexible material, such as plastic (e.g. polyethersulfone (PES) and polyphenylsulfone (PPSU)). The shape of an upper part (also referred to as a "head") of the outer case 130 may resemble a cone. The outer case 130 is attached to the inner case 110 which has been already attached to the membrane 120. More specifically, the outer case 130 may be attached to the extended surface 111 of the inner case 110. It is to be appreciated that the assembly process of the breast pump system 100 may be varied.

When air exits from the first chamber 141 via the hose 150 by the external suction source, the first chamber 141 collapses and a vacuum is created on the second chamber 142 so as to draw the milk from the nipple. Thereafter, when air provided by the external suction source enters the first chamber 141 via the hose 150, the first chamber 141 expands and the second chamber 142 is filled with the air. These actions are repeated until the external suction source is powered off.

Due to the actions above, the milk is expressed from the nipple of the breast and travels from the second chamber 142 to an area 140 which is formed between an outer surface of the membrane 120 and an inner surface of the outer case 130. The area 140 is arranged to direct flow of the milk from the second chamber 142 to a storage container (not shown) due to the slope of the area 140. As the hose 150 does not connect to the area 140, the breast pump system 100 is able to prevent the milk from backflow down the hose 150 which is connected to the external suction source.

In this regard, the membrane 120 acts as a backflow preventer since the membrane 120 divides the first chamber 141, the second chamber 142 and the area 140. In light of

the above, if there is no membrane 120 in the breast pump system 100, the breast pump system 100 could still function, but there is a higher probability of milk getting into the hose 150 (especially in case the attachment point 112 is located at a low position).

The storage container is for receiving the milk. A lower part of the outer case 130 is coupled with the storage container. The lower part of the outer case 130 may be varied to be connected to conventional feeding bottles. The storage container may be at least one of a bottle and a deformable plastic bag.

Although not shown, the breast pump system 100 may further comprise a valve for reducing volume of air that the external suction source needs for creating the vacuum on the second chamber 142. The valve is disposed between the lower part of the outer case 130 (e.g. connecter 132) and the storage container. The lower part of the outer case 130 may be varied to be connected to existing valves on the market. It is to be appreciated that the valve may be surrounded by the lower part of the outer case 130 and/or the storage container. The valve may alternately open and close fluid communication between the outer case 130 and the storage container.

Figs. 3, 4 and 5 illustrate exploded views of the breast pump system in accordance with an embodiment of the invention.

As shown in the Figs. 3, 4, and 5, the breast pump system 100 comprises the inner case 110, the membrane 120 and the outer case 130.

The edge of the inner case 110 is curved back and extended. The at least one attachment point 112 is disposed on the extended surface 111 of the inner case 110. The attachment point 112 may be connected to the hose 150 which is connected to the external suction source. For example, the attachment point 112 may be a protruding nipple to fit the hose 150.

The membrane 120 is attached to the extended surface 111 of the inner case 110. Specifically, the membrane 120 may be attached to one of the extended outer surface and the extended inner surface of the inner case 110. At least a portion of the extended

surface 111 of the inner case 110, except the attachment point 112, is covered with the membrane 120. In this regard, the hose 150 connects to the first chamber 141 via the attachment point 112. Therefore, the air is able to enter the first chamber 141 and exit from the first chamber 141 via the hose 150.

Further, the outer case 130 is attached to the inner case 110. Here, the inner case 110 has at least one hole 113 and the outer case 130 has at least one hook 131 so that the inner case 110 and the outer case 130 are assembled by fitting the hole 113 into the hook 131. Specifically, the first number of holes 113 are disposed on the extended surface 111 of the inner case 110 and the second number of hooks 131 are disposed on the edge of the outer case 130.

It is to be appreciated that the first number and the second number may be different so that the attachment point 112 can be positioned in various directions from where the milk drops out.

It is also to be appreciated that one of the first number and the second number is an integer multiple of the other of the first number and the second number so that the attachment point 112 can be positioned in various directions from where the milk drops out. In some embodiments, the second number may be a multiple of the first number. Here, the holes 113 may be equally spaced. Also, the hooks 131 may be equally spaced. For example, if the first number is three (3) and the second number is six (6), the breast pump system 100 may have six (6) positions.

It is also to be appreciated that the first number and the second number may be same, and the holes 113 may be equally spaced and the hooks 131 may be equally spaced. For example, if the first number is three (3) and the second number is three (3), the breast pump system 100 may have three (3) positions.

The attachment method is not limited to fit the hole 113 into the hook 131. For example, although not shown, a user may screw the outer case 130 on the inner case 110 to assemble them.

Figs. 6 and 7 illustrate examples of the holes of the inner case and the hooks of the outer case in accordance with an embodiment of the invention.

The inner case 110 may have eight (8) holes 113a-113h and the outer case 130 may have four (4) hooks 131a-131d. The attachment point 112 for connecting to the hose 150 may be disposed between the first hole 113a and the second hole 113b.

It is to be appreciated that the number of holes 113 may be a multiple of the number of hooks 131. For example, the ratio of holes 113 to hooks 131 may be X:1, where X is any number equal to or greater than 1. Here, the holes 113 may be equally spaced. Also, the hooks 131 may be equally spaced. As the above example, if the number of holes 113 is eight (8) and the number of hooks 131 is four (4), the breast pump system 100 may have eight (8) positions.

It is also to be appreciated that the number of hooks 131 may be a multiple of the number of holes 113. For example, the ratio of hooks 131 to holes 113 may be X:1, where X is any number equal to or greater than 1. Here, the holes 113 may be equally spaced. Also, the hooks 131 may be equally spaced. For example, if the number of holes 113 is four (4) and the number of hooks 131 is eight (8), the breast pump system 100 may have eight (8) positions.

As shown in the Fig. 6, for one example, the woman may be comfortable when the attachment point 112 is positioned at the north-northeast ("NNE") direction. In this case, the first hole 113a is fitted into the first hook 131a, the third hole 113c is fitted into the second hook 131b, the fifth hole 113e is fitted into the third hook 131c, and the seventh hole 113g is fitted into the fourth hook 131d.

As shown in the Fig. 7, for another example, the woman may be comfortable when the attachment point 112 is positioned at the south-southeast ("SSE") direction. In this case, the sixth hole 113f is fitted into the first hook 131a, the eighth hole 113h is fitted into the second hook 131b, the second hole 113b is fitted into the third hook 131c, and the fourth hole 113d is fitted into the fourth hook 131d.

Likewise, there would be eight (8) positions at 45 degree intervals regarding the attachment point 112, so the woman finds comfortable position based on her clothing and/or pump location.

It is to be appreciated that the inner case 110 and the outer case 130 can have more or less positions in accordance with the number and/or position of the holes 113 and/or the hooks 131.

Figs. 8, 9 and 10 illustrate perspective views of the breast pump system in accordance with an embodiment of the invention.

As shown in the Figs. 8, 9 and 10, the breast pump system 100 can be assembled with the inner case 110, the membrane 120 and the outer case 130. As described above, the inner case 110 and the membrane 120 may be attached by a silicone based adhesive. Further, the inner case 110 and the outer case 130 may be attached by fitting the holes 113 into the hooks 131.

More specifically, the air pulls between the inner case 110 and the membrane 120. The inner case 110 and the membrane 120 are connected at both ends. The inner case 110 curves back on itself to give a place for the membrane 120 to bond to, a place to have the attachment point 112 for the hose 150 to connect to, and a place for the outer case 130 to attach to. On the opposite side, the membrane 120 is moulded such that it cups the end of the inner case 110 but leaving the attachment point 112 exposed. The second chamber 142 that the milk gets drawn into is formed once the outer case 130 is attached to the inner case 110. As long as there is no failure of the bond at the tip between the inner case 110 and the membrane 120, no milk should get into the hose 150.

Since the breast pump system 100 in accordance with various embodiments of the invention has the backflow preventer built inside the head of the breast pump system 100, the volume of the same is smaller than the conventional breast pumps. Accordingly, the woman is able to place the head of the breast pump system 100 under the brassiere without need for a special brassiere. Moreover, as the head of the breast pump system

100 is kept in position under the brassiere, the woman is able to use both of her hands while using the breast pump system 100.

In addition, since the breast pump system 100 in accordance with various embodiments of the invention does not have an external element as a backflow preventer, there is no need to wash up the external element.

It should be appreciated by the person skilled in the art that variations and combinations of features described above, not being alternatives or substitutes, may be combined to form yet further embodiments falling within the intended scope of the invention.

CLAIMS

1. A breast pump system comprising:

an inner case, for resting against a portion of a breast, connected to an external suction source via a hose;

a membrane arranged to enclose the inner case to form a first chamber between the inner case and the membrane; and

an outer case arranged to enclose the membrane to form a second chamber between the membrane and the outer case to receive a nipple of the breast,

wherein when air exits from the first chamber via the hose by the external suction source, the first chamber collapses and a vacuum is created on the second chamber so as to draw milk from the nipple.

2. The breast pump system according to claim 1, wherein when air enters the first chamber via the hose by the external suction source, the first chamber expands and the second chamber is filled with the air.

3. The breast pump system according to claim 1 further comprising a storage container for receiving the milk, wherein the outer case is coupled with the storage container.

4. The breast pump system according to claim 3 further comprising a valve for reducing volume of air that the external suction source needs for creating the vacuum on the second chamber, wherein valve is disposed between the outer case and the storage container.

5. The breast pump system according to claim 3, wherein an area between an outer surface of the membrane and an inner surface of the outer case, is arranged to direct flow of the milk from the second chamber to the storage container.

6. The breast pump system according to claim 1, wherein an edge of the inner case is curved back and extended.

7. The breast pump system according to claim 6, wherein the inner case comprises at least one attachment point for attaching the hose.

8. The breast pump system according to claim 7, wherein the attachment point is disposed on the extended surface of the inner case.

9. The breast pump system according to claim 8, wherein the membrane is attached to the extended surface of the inner case.

10. The breast pump system according to claim 9, wherein the membrane covers at least a portion of the extended surface except the attachment point.

11. The breast pump system according to claim 9, wherein the membrane is attached to the inner case by an adhesive.

12. The breast pump system according to claim 11, wherein the adhesive is a silicone based adhesive.

13. The breast pump system according to claim 12, wherein the silicone based adhesive includes a sil-poly adhesive.

14. The breast pump system according to claim 8, wherein the outer case is attached to the extended surface of the inner case.

15. The breast pump system according to claim 14, wherein the inner case includes a first number of holes and the outer case includes a second number of hooks, and

the inner case and the outer case are assembled by fitting the holes into the hooks.

16. The breast pump system according to claim 15, wherein the first number and the second number are different so that the attachment point can be positioned in various directions from where the milk drops out.

17. The breast pump system according to claim 15, wherein one of the first number and the second number is an integer multiple of the other of the first number and the second number so that the attachment point can be positioned in various directions from where the milk drops out, and the holes and the hooks are equally spaced.

18. The breast pump system according to claim 1, wherein at least one of the inner case and the outer case is made of non-flexible material.

19. The breast pump system according to claim 18, wherein a shape of the inner case is a funnel.

20. The breast pump system according to claim 18, wherein a shape of a head of the outer case is a cone.

21. The breast pump system according to claim 1, wherein the membrane is made of flexible material.

22. The breast pump system according to claim 21, wherein a shape of the membrane is a truncated cone.