TITLE

Breast shield for expressing human breast milk

TECHNICAL FIELD

The present invention relates to a breast shield for expressing human breast milk according to the preamble of patent claim 1 and to a breast shield set according to the preamble of patent claim 10.

PRIOR ART

Devices for expressing human breast milk are well known. In principle, there are two different types: the first device type is operated manually, *i.e.* the negative pressure required for the expressing operation is generated by manual actuation of the vacuum pump. In the devices of the second type, the vacuum pump is operated electrically, it being possible for the vacuum pump to be connected to the power supply network and/or to be operated via a battery or another energy accumulator. Examples for this include WO 96/22116, US 2009/0099511, US 2008/0287037, US 7 094 217 and US 2008/0039781.

Said vacuum pumps are connected to a breast shield either directly or via vacuum lines. The breast shield usually has a funnel-shaped part for receiving part of the mother's breast including the nipple. As a rule, said funnel-shaped part merges into a part, which is in the shape of a hollow cylinder and to which, firstly, either the vacuum pump is connected directly or via a suction line and which, secondly, is likewise connected directly or via a milk line to a milk collecting container. It is known to select breast shields in accordance with the size of the breast. In particular breast shield sets are known, in which the size of the funnel-shaped part can be selected according to the mother.

Relatively small breast shields are also known in the prior art. US 6 379 327 discloses a

portable, "hands-free" expressing device. In this context, "hands-free" means that, once switched on, the entire device functions without hands, *i.e.* that neither the pump nor the breast shield have to be held by hand. In US'327, a small funnel-shaped breast shield is fastened for this purpose to the breast using straps. A first tube leads from the breast shield to a vacuum pump, which is held in a belt. A second tube leads from the breast shield into a milk collecting container, which can be carried in the same belt.

WO 02/102437 and WO.2008/137678 show "hands-free" expressing devices. The breast shield here is in each case integrated in a pump housing and serves at the same time as a diaphragm for generating a negative pressure.

US 949 414 describes a funnel-shaped breast shield, which can be arranged under a bra. Rather than a vacuum being applied, a tube leads from the breast shield to a baby who is intended to obtain the milk desired by sucking on the tube.

US 6 440 100 shows a device for expressing breast milk with a small breast shield that can be worn under the bra. A milk tube leads from the breast shield to a milk collecting container. The latter is connected via a vacuum tube to a vacuum source. The milk collecting container is evacuated by means of the vacuum source, with the negative pressure being applied to the breast shield via the milk tube. Owing to the negative pressure prevailing in the milk collecting container, expressed milk is now intended to pass into the milk collecting container via the milk tube. As an alternative, the milk collecting container itself can serve as a vacuum pump. Said device has the disadvantage that the relatively large volume of the milk collecting container likewise has to be evacuated. Said "dead volume" considerably restricts the productivity of the device.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved breast shield, which is pleasant for the mother to wear and which minimizes the air-filled dead volume.

This object is achieved by a breast shield having the features of claim 1, and a breast shield set having the features of claim 10.

The breast shield according to the invention has a tubular connector and a funnel that is integrally formed thereon and is intended for resting on a mother's breast, wherein the funnel widens toward the free side thereof that faces away from the connector, and wherein there is a passage, which extends continuously from a breast-side end of the funnel as far as a pump-side end, being opposite said breast-side end, of the connector and which serves to apply a vacuum to the mother's breast and for the flowing away of the expressed breast milk. According to the invention, the funnel is of more flexible design than the connector. The funnel has a main region extending over a substantial part of the length thereof with a first opening angle of the passage, and a breast-side end region with a second opening angle of the passage. When not in use, the first opening angle is smaller than the second opening angle, wherein, in the use state, at least the first opening angle can be enlarged by axial pressure on the breast shield.

This breast shield adapts itself optimally to the shape of the human mother's breast and creates a tight or less tight connection to the breast, depending on requirements and contact pressure, respectively.

It is pleasant to wear and reduces the air-filled or milk-filled dead volume thanks to its adaptability.

The breast shield is preferably designed to be so small that it merely surrounds the nipple and at maximum the aerola. Not only can said breast shield be used in a simple manner in a "hands-free" system, for example it can be kept in a bra, said breast shield also has scarcely any air-filled regions because of its small size. This has a positive effect on the vacuum pump since the latter requires less power and can therefore operate more quietly. Furthermore, for said reason, said vacuum pump can also be made smaller.

In addition, these small breast shields have the advantage that there can be less movement of the tissue of the breast within the shield. As a result, the breast shields can bear more tightly against the tissue. A lower pumping power is required in turn as a result. The pump

connector is designed such that it widens conically toward the funnel.

Said breast shield according to the invention is preferably manufactured from silicone and preferably has a Shore A hardness of 30 to 70. The funnel preferably has a Shore A hardness of about 50 and the connector has a shore A hardness of about 70.

So that said relatively small and compact breast shield can be readily held in the hand, said breast shield is preferably provided in a breast shield set with a coupling part. The coupling part serves to receive the breast shield connector in a sealing manner, wherein said coupling part is of cylindrical design and is closed on one side by a base such that a blind hole for receiving the connector is formed. There is at least one, preferably exactly one, port opening, which is connected to the passage of the breast shield in terms of fluid communication.

In the assembled state, an end side of the connector remote from the breast shield preferably ends at a distance from the base of the coupling part. The at least one port opening is preferably arranged eccentrically in the coupling part.

If the at least one port opening is arranged in an upper region of the coupling part and the coupling part has a marking which defines "this side up" in the space, then, during the expressing operation, stationary air bubbles are avoided in the coupling parts and air-filled dead spaces are eliminated.

In order to be able to insert the conical connector more simply, the blind hole of the coupling part also tapers in diameter toward the base.

The coupling part is preferably of stiff design, this facilitating the insertion of the connector and increasing the stability. The part can therefore be more easily held or fastened.

The breast shield preferably does not have any inserts whatsoever and consists merely of the abovementioned elements.

PATENT CLAIMS

1. A breast shield (4) for use in a device for expressing human breast milk, wherein the breast shield (4) has a tubular connector (40) and a funnel (42) that is integrally formed thereon and is intended for resting on a mother's breast (B), wherein the funnel (42) widens toward the free side thereof which faces away from the connector (40), and wherein there is a passage (43) which extends continuously from a breast-side end of the funnel (42) as far as a pump-side end, being opposite said breast-side end, of the connector (40) and which serves to apply a vacuum to the mother's breast and for the flowing away of the expressed breast milk, characterized in that the funnel (42) is of more flexible design than the connector (40), in that the funnel (42) has a main region (420) extending over a substantial part of the length thereof with a first opening angle (α_1) of the passage (43), and a breast-side end region (421) with a second opening angle (α_2) of the passage (43), wherein, when not in use, the first opening angle (α_1) is smaller than the second opening angle (α_2), and in that, in the use state, at least the first opening angle (α_1) can be enlarged by axial pressure on the breast shield (4).

2. The breast shield as claimed in claim 1, wherein the funnel (42) has a breast-side diameter (D) of 5 mm to 40mm and a length (L) of 10 mm to 40 mm, and therefore, in the use state, the nipple, and at maximum the areola, is surrounded by the breast shield (4).

3. The breast shield as claimed in either of claims 1 and 2, wherein there is a transition region (44) between the connector (40) and funnel (42), with a third opening angle (α_3) of the passage (43), wherein, when not in use, the third opening angle (α_3) is greater than the first opening angle (α_1).

4. The breast shield as claimed in one of claims 1 to 3, wherein the main region (420) directly adjoins the transition region (44) and/or wherein the end region (421) directly adjoins the main region (420).

5. The breast shield as claimed in one of claims 1 to 4, wherein the connector (40) has a much greater wall thickness than the wall thickness of the funnel (42).

6. The breast shield as claimed in one of claims 1 to 5, wherein there is an outer stop (41), which protrudes over the outer circumference of the connector (40), in the transition region (44) between the connector (40) and funnel (42).

7. The breast shield as claimed in one of claims 1 to 6, wherein the outer circumference of the connector (40) is designed such that it widens conically toward the funnel (42).

8. The breast shield as claimed in one of claims 1 to 7, wherein it is manufactured from silicone.

9. The breast shield as claimed in one of claims 1 to 8, wherein the funnel (42) has a Shore-A hardness of about 50 and the connector (40) has a Shore-A hardness of about 70.

10. A breast shield set with a breast shield (4) as claimed in one of claims 1 to 9 and a coupling part (3) for receiving the connector (40) of the breast shield (4) in a sealing manner, wherein the coupling part (3) is of cylindrical design and is closed on one side by a base such that a blind hole for receiving the connector (40) is formed, and wherein there is at least one port opening (31) which is connected in terms of fluid communication to the passage (43) of the breast shield (4).

11. The breast shield set as claimed in claim 10, wherein, in the assembled state, a breast-shield-remote front end of the connector (40) ends at a distance from the base of the coupling part (3).

12. The breast shield set as claimed in either of claims 10 and 11, wherein the at least one port opening (31) is arranged eccentrically in the coupling part (3).

13. The breast shield set as claimed in claim 12, wherein the at least one port opening

(31) is arranged in an upper region of the coupling part (3), and wherein the coupling part (3) has a marking which defines "this side up".

14. The breast shield set as claimed in one of claims 10 to 13, wherein the blind hole of the coupling part (3) tapers in diameter toward the base.

15. The breast shield set as claimed in one of claims 10 to 14, wherein the coupling part (3) is of stiff design.

TITLE

Breast shield for expressing human breast milk

TECHNICAL FIELD

The present invention relates to a breast shield for expressing human breast milk.

PRIOR ART

Devices for expressing human breast milk are well known. In principle, there are two different types: the first device type is operated manually, *i.e.* the negative pressure required for the expressing operation is generated by manual actuation of the vacuum pump. In the devices of the second type, the vacuum pump is operated electrically, it being possible for the vacuum pump to be connected to the power supply network and/or to be operated via a battery or another energy accumulator. Examples for this include WO 96/22116, US 2009/0099511, US 2008/0287037, US 7 094 217 and US 2008/0039781.

Said vacuum pumps are connected to a breast shield either directly or via vacuum lines. The breast shield usually has a funnel-shaped part for receiving part of the mother's breast including the nipple. As a rule, said funnel-shaped part merges into a part, which is in the shape of a hollow cylinder and to which, firstly, either the vacuum pump is connected directly or via a suction line and which, secondly, is likewise connected directly or via a milk line to a milk collecting container. It is known to select breast shields in accordance with the size of the breast. In particular breast shield sets are known, in which the size of the funnel-shaped part can be selected according to the mother.

Relatively small breast shields are also known in the prior art. US 6 379 327 discloses a portable, "hands-free" expressing device. In this context, "hands-free" means that, once switched on, the entire device functions without hands, *i.e.* that neither the pump nor the

breast shield have to be held by hand. In US'327, a small funnel-shaped breast shield is fastened for this purpose to the breast using straps. A first tube leads from the breast shield to a vacuum pump, which is held in a belt. A second tube leads from the breast shield into a milk collecting container, which can be carried in the same belt.

WO 02/102437 and WO 2008/137678 show "hands-free" expressing devices. The breast shield here is in each case integrated in a pump housing and serves at the same time as a diaphragm for generating a negative pressure.

US 949 414 describes a funnel-shaped breast shield, which can be arranged under a bra. Rather than a vacuum being applied, a tube leads from the breast shield to a baby who is intended to obtain the milk desired by sucking on the tube.

US 6 440 100 shows a device for expressing breast milk with a small breast shield that can be worn under the bra. A milk tube leads from the breast shield to a milk collecting container. The latter is connected via a vacuum tube to a vacuum source. The milk collecting container is evacuated by means of the vacuum source, with the negative pressure being applied to the breast shield via the milk tube. Owing to the negative pressure prevailing in the milk collecting container, expressed milk is now intended to pass into the milk collecting container via the milk tube. As an alternative, the milk collecting container itself can serve as a vacuum pump. Said device has the disadvantage that the relatively large volume of the milk collecting container likewise has to be evacuated. Said "dead volume" considerably restricts the productivity of the device.

SUMMARY OF THE INVENTION

The invention provides a breast shield for use in a device for expressing human breast milk, wherein the breast shield has a tubular connector and a funnel that is integrally formed thereon and is intended for resting on a mother's breast, wherein the funnel widens with a first opening angle toward a free side thereof which faces away from the connector, and wherein there is a passage for the expressed human breast milk, the passage extending continuously from a breast-side end of the funnel as far as a pump-side end, being opposite

said breast-side end, of the connector and which serving to apply a vacuum to the mother's breast and for the flowing away of the expressed breast milk, wherein the funnel is of more flexible design than the connector, in that wherein the funnel has a length, wherein the funnel has a main region extending over a substantial part of said length thereof with a first opening angle of the passage, and a breast-side end region with a second opening angle of the passage, wherein, when the breast shield is not in use, the first opening angle is smaller than the second opening angle, and in wherein, when the breast shield is in the use state, at least the first opening angle can be enlarged by axial pressure on the breast shield.

This breast shield adapts itself optimally to the shape of the human mother's breast and creates a tight or less tight connection to the breast, depending on requirements and contact pressure, respectively.

Some embodiments of the invention may be pleasant to wear and reduce the air-filled or milk-filled dead volume: this may be thanks to the adaptability in the present invention as defined above.

The breast shield is preferably designed to be so small that it merely surrounds the nipple and at maximum the aerola. Not only can said breast shield be used in a simple manner in a "hands-free" system, for example it can be kept in a bra, said breast shield also has scarcely any air-filled regions because of its small size. This has a positive effect on the vacuum pump since the latter requires less power and can therefore operate more quietly. Furthermore, for said reason, said vacuum pump can also be made smaller.

In addition, these small breast shields have the advantage that there can be less movement of the tissue of the breast within the shield. As a result, the breast shields can bear more tightly against the tissue. A lower pumping power is required in turn as a result. The pump

connector is designed such that it widens conically toward the funnel.

Said breast shield according to the invention is preferably manufactured from silicone and preferably has a Shore A hardness of 30 to 70. The funnel preferably has a Shore A hardness of about 50 and the connector has a shore A hardness of about 70.

So that said relatively small and compact breast shield can be readily held in the hand, said breast shield is preferably provided in a breast shield set with a coupling part. The invention therefore also provides a breast shield set with a breast shield and a coupling part for receiving the connector of the breast shield in a sealing manner, wherein the coupling part is of cylindrical design and is closed on one side by a base such that a blind hole for receiving the connector is formed, and wherein there is at least one port opening which is connected in terms of fluid communication to the passage of the breast shield.

In the assembled state, an end side of the connector remote from the breast shield preferably ends at a distance from the base of the coupling part. The at least one port opening is preferably arranged eccentrically in the coupling part.

If the at least one port opening is arranged in an upper region of the coupling part and the coupling part has a marking which defines "this side up" in the space, then, during the expressing operation, stationary air bubbles are avoided in the coupling parts and air-filled dead spaces are eliminated.

In order to be able to insert the conical connector more simply, the blind hole of the coupling part also tapers in diameter toward the base.

The coupling part is preferably of stiff design, this facilitating the insertion of the connector and increasing the stability. The part can therefore be more easily held or fastened.

The breast shield preferably does not have any inserts whatsoever and consists merely of the abovementioned elements.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A breast shield for use in a device for expressing human breast milk, wherein the breast shield has a tubular connector and a funnel that is integrally formed thereon and is intended for resting on a mother's breast, wherein the funnel widens with a first opening angle toward a free side thereof which faces away from the connector, and wherein there is a passage for the expressed human breast milk, the passage extending continuously from a breast-side end of the funnel as far as a pump-side end, being opposite said breast-side end, of the connector and serving to apply a vacuum to the mother's breast, wherein the funnel is of more flexible design than the connector, wherein the funnel has a length, wherein the funnel has a main region extending over a substantial part of said length with the first opening angle of the passage, and a breast-side end region with a second opening angle of the passage, wherein, when the breast shield is not in use, the first opening angle is smaller than the second opening angle, and wherein, when the breast shield is in the use state, at least the first opening angle can be enlarged by axial pressure on the breast shield.

2. The breast shield as claimed in claim 1, wherein the funnel has a breast-side diameter of 5 mm to 40 mm and wherein said length is 10 mm to 40 mm, and therefore, in the use state, the nipple, and at maximum the areola, is surrounded by the breast shield.

3. The breast shield as claimed in either one of claims 1 and 2, wherein there is a transition region between the connector and funnel, with a third opening angle of the passage, wherein, when not in use, the third opening angle is greater than the first opening angle.

4. The breast shield as claimed in any one of claims 1 to 3, wherein the main region directly adjoins the transition region and/or wherein the end region directly adjoins the main region.

5. The breast shield as claimed in any one of claims 1 to 4, wherein the connector has

a much greater wall thickness than the wall thickness of the funnel.

6 The breast shield as claimed in any one of claims 1 to 5, wherein there is an outer stop, which protrudes over the outer circumference of the connector, in the transition region between the connector and funnel.

7. The breast shield as claimed in any one of claims 1 to 6, wherein the outer circumference of the connector is designed such that it widens conically toward the funnel.

8. The breast shield as claimed in any one of claims 1 to 7, wherein it is manufactured from silicone.

9. The breast shield as claimed in any one of claims 1 to 8, wherein the funnel has a Shore-A hardness of about 50 and the connector has a Shore-A hardness of about 70.

10. A breast shield set with a breast shield as claimed in any one of claims 1 to 9 and a coupling part for receiving the connector of the breast shield in a sealing manner, wherein the coupling part is of cylindrical design and is closed on one side by a base such that a blind hole for receiving the connector is formed, and wherein there is at least one port opening which is connected in terms of fluid communication to the passage of the breast shield.

11. The breast shield set as claimed in claim 10, wherein, in the assembled state, a breast-shield-remote front end of the connector ends at a distance from the base of the coupling part.

12. The breast shield set as claimed in either one of claims 10 and 11, wherein the at least one port opening is arranged eccentrically in the coupling part.

13. The breast shield set as claimed in claim 12, wherein the at least one port opening is arranged in an upper region of the coupling part, and wherein the coupling part has

a marking which defines "this side up".

14. The breast shield set as claimed in any one of claims 10 to 13, wherein the blind hole of the coupling part tapers in diameter toward the base.

15. The breast shield set as claimed in any one of claims 10 to 14, wherein the coupling part is of stiff design.