

Claims

1. A breast shield for expressing human breast milk, in which the breast shield comprises an outer housing and a flexible inner liner within the outer housing,
5 wherein in use, with the breast shield applied to a breast, the inner liner is in contact with the surface of both the areola and nipple of the breast, the breast shield further comprising an outer chamber between the outer housing and the inner liner and an inner chamber within the inner liner, in use, the inner and outer chambers being subjectable to differential pressure and the differential
10 pressure being operable to cause the inner liner to exert a massaging effect against the surface of both the areola and nipple of a breast.
2. A breast shield according to claim 1, including an entry end which in use, bears against the surface of the areola of a breast and which applies the massaging
15 effect to the areola.
3. A breast shield according to claim 1 or 2, the outer housing and the inner liner both extend to the entry end, and the outer chamber extends between the inner liner and the outer housing at the entry end.
20
4. A breast shield according to any one of claims 1 to 3, the massaging effect that is exerted against the areola being different to the massaging effect applied to the nipple.
- 25 5. A breast shield for expressing human breast milk, the breast shield comprising:
a rigid outer housing and a flexible inner liner within the outer housing,
the inner liner defining an inner chamber for receiving the nipple of a
human breast and an annular outer chamber being defined between the outer
housing and the inner liner, the inner and outer chambers being subjectable to
30 differential pressure,
the breast shield having an entry end which in use, bears against the
surface of the areola of a breast, the outer housing and the inner liner
extending to the entry end so that in use, the inner liner bears against the
surface of the areola about the nipple,

the inner liner having a compression section which is inboard of the entry end for receiving a nipple,

in use, the application of differential pressure to the inner and outer chambers is operable to cause the inner liner at the entry end to move relative to the outer housing to create a massaging effect against the surface of the areola and for the compression section of the inner liner to expand and contract relative to an inserted nipple to create a massaging effect against the surface of the nipple.

- 5 6. A breast shield according to claim 5, the entry end having a generally conical or funnel shaped portion comprising complementary funnel shaped portions of the inner liner and the outer housing whereby the funnel shaped portion of the inner liner presents for bearing engagement against the surface of the areola and the funnel shaped portion of the inner liner being movable relative to the funnel shaped portion of the outer housing for massaging the surface of the areola.
- 10 7. A breast shield according to claim 5 or 6, the massaging effect that is created against the areola being different to the massaging effect applied to the nipple.
- 15 8. A breast shield according to any one of claims 5 to 7, the massaging effect created against the nipple being by compression and expansion of the compression section of the inner liner generally perpendicular to the side surface of the nipple to press and pull the side surface.
- 20 9. A breast shield according to any one of claims 5 to 7, the massaging effect created against the areola being by compression and expansion of the inner liner at the entry end that applies both compressive and shear force or stress to the surface of the areola.
- 25 10. A breast shield according to any one of claims 5 to 9, the compression section being generally cylindrical.
- 30

11. A breast shield according to any one of claims 5 to 9, the compression section having a cylindrical cross-section and tapering from the entry end from a larger diameter to a smaller diameter.
- 5 12. A breast shield according to any one of claims 5 to 9, the compression section having a natural or relaxed state in which the inner diameter of the compression section is less than the outer diameter of the nipple that the breast shield is intended for use with.
- 10 13. A breast shield according to any one of claims 5 to 9, the compression section having a natural or relaxed state in which the inner diameter of the compression section is greater than the outer diameter of the nipple that the breast shield is intended for use with.
- 15 14. A breast shield according to any one of claims 5 to 13, the massaging effect created against the areola being as a result of movement of the inner liner in the region of the entry end of the breast shield in a direction forward and away from the surface of the areola, or laterally relative to the surface of the areola, or by back and forth movement, or by orbiting or circular movement, or by
20 lifting and pressing movement, or a combination of two or more of these types of movement.
- 25 15. A breast shield according to any one of claims 5 to 13, the massaging effect created against the areola and the nipple being as a result of inward and outward movement of the inner liner within and relative to the outer housing, as the vacuum pressure in the outer chamber oscillates relative to the vacuum pressure in the inner chamber.
16. A breast shield according to any one of claims 5 to 14, the compression section extending to an end section that is collapsible over the tip of the nipple.
- 30 17. A breast shield according to claim 16, the end section being collapsible in a three-fold collapse or a two-fold collapse.
18. A breast shield according to claim 16, the end section being formed to have a three-sided polygonal shape in a relaxed or resting state.

19. A breast shield according to any one of claims 1 to 18, the wall of the inner liner being of generally constant wall thickness.
- 5 20. A breast shield according to any one of claims 1 to 18, the wall of the inner liner having an irregular thickness or cross-section in one or more sections of the inner liner.
21. A breast shield according to claim 20, the wall of the inner liner having discrete thick sections formed in the liner wall.
- 10 22. A breast shield according to claim 21, the thick sections comprising three or four equidistantly spaced thick sections which extend longitudinally of the inner liner.
23. A breast shield according to claim 21 or 22, the discrete thick sections being formed in the compression section of the liner wall.
- 15 24. A breast shield according to any one of claims 21 to 23, the thick sections being elongate and extending in straight lines generally in the direction of the axis of the liner, or being formed in a generally spiral or helix manner about the axis of the liner, or in a random manner.
- 20 25. A breast shield according to any one of claims 20 to 24, the wall of the inner liner having uneven wall thickness that progressively increases in thickness from a minimum thickness to a maximum thickness, which is diametrically opposite the minimum thickness, and back to the minimum thickness.
26. A breast shield according to any one of claims 20 to 25 when directly or indirectly dependent on claim 5, the inner liner at the entry end being formed with recesses and/or projections.
- 25 27. A breast shield according to claim 16, the recesses and/or projections including part spherical or part elipsoidal projections and elongate recesses.
28. A breast shield according to claim 27, the recesses being operable to redistribute suction pressure at the entry end.

29. A breast shield according to claim 27, the projections being operable to apply localised increased or concentrated pressure.
30. A method for operating a breastpump unit for expression of human breastmilk using the breast shield according to any one of claims 1 to 24, the method including applying the breast shield to a breast, applying a generally constant vacuum pressure P_1 to the inner chamber, and applying a vacuum pressure in the outer chamber that oscillates about the vacuum pressure in the inner chamber so that:
- a. the compression section of the inner chamber expands and contracts relative to the nipple inserted into it, and
 - b. the inner liner at the entry end moves relative to the outer housing to create the massaging effect against the surface of the areola.
31. A method according to claim 30, the vacuum pressure in the inner chamber being approximately -70 to -350mmHg, more preferably -120 to -250mmHg, more preferably -200mmHg.
32. A method according to claim 30 or 31, the vacuum pressure in the outer chamber oscillating between atmosphere and about twice the vacuum pressure in the inner chamber.
33. A method according to any one of claims 30 to 32, including applying an initial vacuum pressure P_i to the outer chamber which is greater than the vacuum pressure P_1 of the inner chamber so that the compression section of the inner chamber expands for receiving a nipple and thereafter adjusting the vacuum pressure in the outer chamber so that the operating vacuum pressure P_o in the outer chamber oscillates about the vacuum pressure P_1 in the inner chamber.