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E. LASKER

BREAST PUMP

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Fig. 1.

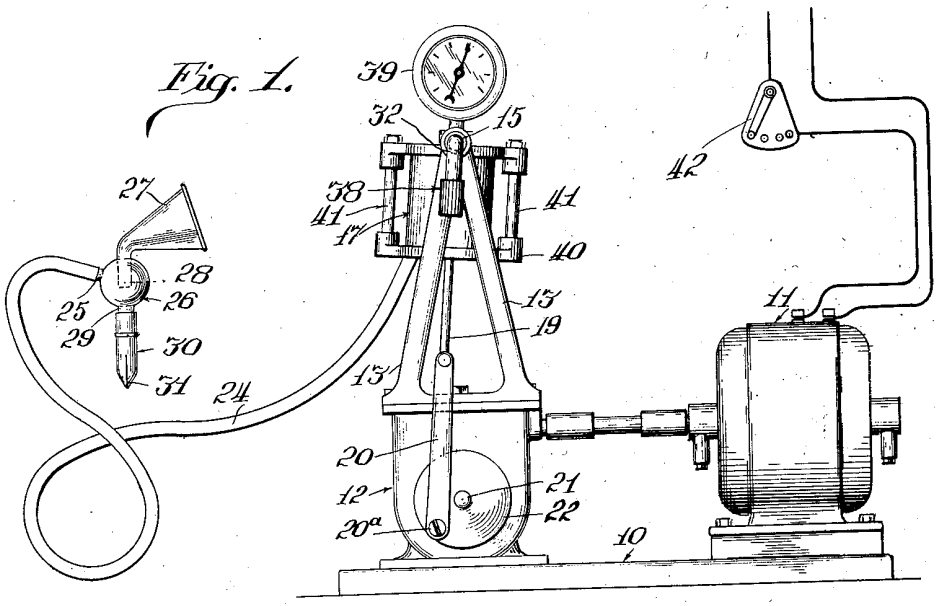
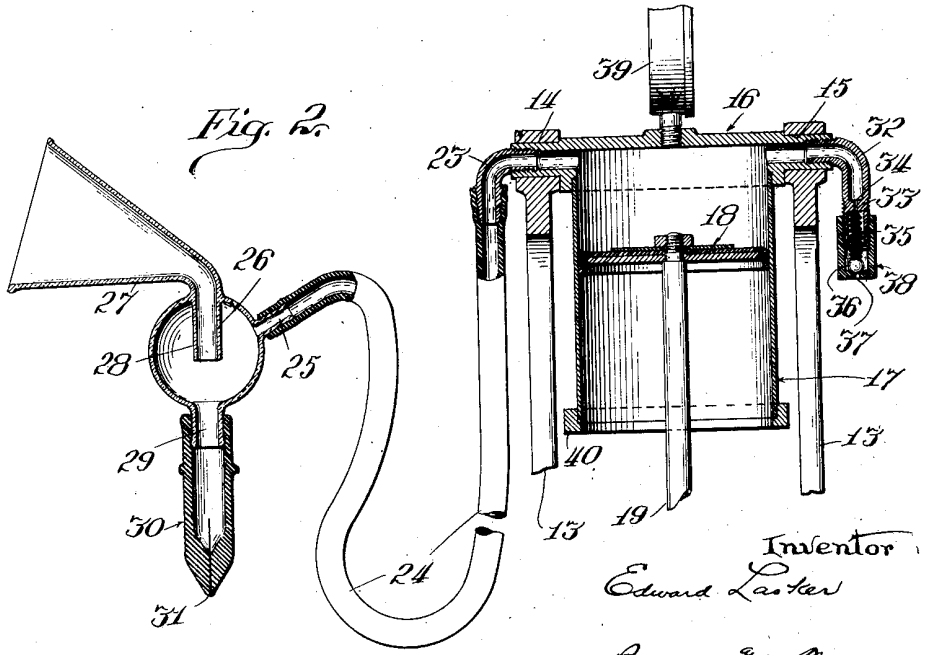


Fig. 2.



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BREAST PUMP.

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My invention relates to a breast pump for use, for example, in maternity hospitals, and the object of the invention is to provide a simple, effective, sanitary apparatus which operates automatically, imitating in its effect a sucking infant, and can be readily adjusted to give the desired degree of vacuum.

The invention is illustrated in the accompanying drawing in which

Fig. 1 is a side elevation of the apparatus, and

Fig. 2 is a view, partly in section, of the suction pump and milk receiver.

Referring to the drawing, 10 designates a base on which the apparatus is preferably mounted. 11 is an electric motor and 12 a casing containing a reduction gearing of any suitable construction. Supported on the casing are a pair of upright spaced supports 13 having bearings at the top for gudgeons 14, 15 formed on the head 16 of a pump cylinder 17 which is thus pivotally supported on the gear casing 12. The cylinder 17 contains a piston 18 having a rod 19 connected by a pitman 20 to a wrist pin 20^a eccentrically arranged on a disc 21 on the outside of casing 12, the shaft 22 of which disc is rotated at a relatively slow speed by motor 11 through reducing gearing (not shown) of any suitable type in casing 12. The gudgeons 14, 15 are tubular and communicate with the interior of the pump cylinder and into the gudgeon 14 is fitted a nipple 23 for a flexible tube 24, the other end of which is attached to a nipple 25 on a preferably globular vacuum chamber 26. The chamber 26 is provided with a flaring mouth piece or breast appliance 27 to fit over the breast. The mouth piece has a tubular extension 28 projecting preferably within the chamber to a point below the air exit nipple 25. From the bottom of the vacuum chamber projects a milk outlet nipple 29 on which is arranged a tapered valve tube 30 of flexible material such as rubber, the lower end of which is slit at 31.

Preferably the vacuum chamber and its mouth piece and nipples are made of glass, the mouth piece being fused into the chamber so as to form therewith a single integral structure which obviously may be very easily cleaned and sterilized. The valve tube may be removed and cleaned, and also tube 24, when necessary, so that all parts subject to contamination may be kept in sanitary condition. The invention is not, however, limited to the exact structure of the milk receiver which may be modified as to form.

Fixed in the other hollow gudgeon 15 is an elbow fitting 32 formed with a partition 33 having a small orifice 34 therethrough and beyond the partition is a coiled spring 35 bearing on a ball valve 36 seating over an orifice 37 in the end of a bonnet 38 which is threaded on the end of fitting 32 for the purpose of adjusting the pressure of the spring on the valve.

Preferably a vacuum gauge 39 is arranged on the head of the pump cylinder to indicate the vacuum developed in the apparatus by the pump. The pump cylinder 17 is clamped between the head 16 and a lower open head on ring 40 by means of bolts 41. The pump structure may be readily disassembled, as will be seen, and the parts cleaned when necessary.

The operation of the apparatus is as follows: The pump at its down strokes creates suction impulses which are transmitted to the breast through tube 24 and the vacuum chamber. The intensity of these impulses may be varied while the machine is in operation, by turning the bonnet 38 so as to adjust the compression of spring 35. In practice the valve is set at first to produce a very low vacuum, say one or two inches of mercury, in order to avoid shock to the patient likely to cause inhibition of milk flow. The vacuum is then gradually increased to a maximum of from five to nine inches, the normal suck of healthy infants. The number of such strokes per minute may be varied by changing the speed of the motor through a suitable rheostat indicated diagrammatically at 42. Ordinarily the suction impulses to imitate the sucking of an infant will vary from 40 to 80 per minute. The milk is drawn through the mouth piece 27 which has an air-tight fit around the breast and into the chamber 26 below the air exit nipple 25, so that no milk will enter the air line, the milk passing downwardly into the valve tube 30. The capacity of the pump cylinder 17 is considerably greater than would be required simply to provide the desired suction on the breast, and the valve 36 will be so adjusted that a certain amount of air is drawn into the cylinder on the suction stroke of piston 18. On the return stroke of the piston, the ball valve 36 will close, and this air must be expelled through tube 24 to vacuum chamber 26, thus

creating a positive back pressure in the breast appliance, and, together with the weight of the milk, bringing about the discharge of the milk through slit 31 into some suitable vessel in which it may be collected. The valve 30 acts not only to discharge the milk (in the embodiment of the invention shown) but as an automatic vent to limit the amount of back pressure. The breast appliance 27 has a smooth conical inner surface against which the breast is drawn on the vacuum pulsation preventing undue distension and bringing about a compression like the action of an infant's lips, the breast being repelled from the conical surface by the pressure pulsation. The pulsating action has therefore a massaging effect on the breast which is often beneficial. The course of the milk through the apparatus is short so that the possibility of contamination is minimized. Between each suction impulse there is a period of rest at substantially atmospheric pressure or at a pressure which may be increased slightly above atmospheric pressure. It will be understood, however, that the invention is not limited to the particular means shown for producing the intermittent suction impulses. In fact, the invention includes all modifications within the scope of the appended claims.

As the pump is operated by a motor the suction impulses are uniform, the maximum intensity as well as the duration and frequency of the suction impulses being the same, subject, of course, to adjustment for different patients. Between each suction impulse there is a period of rest at atmospheric pressure, or slightly above. The breast appliance is connected with the pump by flexible tubing so that it may be easily held against the breast with a slight pressure, which is not affected by the pump movement as would be the case with a hand operated device in which the breast appliance and exhauster were rigidly connected. The intermittent, regular and even suction and pressure impulses, the latter resulting from back pressure of air during the periods of discharge of milk from the vacuum chamber, have a massaging effect which has been found very beneficial in stimulating milk secretion and have even produced milk flow from breasts considered dry. The machine can be successfully used on patients having inverted nipples. The machine can be used also on engorged breasts, caked breasts and fissured or cracked nipples effectively and without pain by reducing the maximum vacuum intensity from, for example, nine inches of mercury, which is the average for normal cases, to as low as two and one-half inches if necessary.

I claim:

1. In a breast pump, the combination of a vacuum chamber having a valved milk outlet, a breast appliance unobstructedly connected with the chamber, and means for producing alternate suction and pressure impulses in the vacuum chamber and breast appliance comprising a reciprocating pump having one valveless connection with the vacuum chamber and a separate valved air inlet.

2. In a breast pump, the combination of a vacuum chamber having a valved milk outlet, a breast appliance unobstructedly connected with the chamber, and means for producing alternate suction and pressure impulses in the vacuum chamber and breast appliance comprising a pump cylinder, a piston in the cylinder, means for reciprocating the piston, a valveless tubular connection between the cylinder and the vacuum chamber, a separate air inlet to the cylinder, and a valve in said inlet permitting a restricted flow of air to enter on the suction stroke of the piston.

3. In a breast pumping apparatus, the combination of a breast appliance formed to fit over the breast, means providing a chamber to receive milk from the breast appliance and mechanism for alternately reducing the air pressure in the breast appliance below and increasing it above atmospheric pressure in recurrent pulsations.

4. In a breast pumping apparatus, the combination of a breast appliance formed to fit over the breast, means providing a chamber to receive milk from the breast appliance, and mechanism comprising a vacuum and pressure pump and motor for driving the same for alternately reducing the air pressure in the breast appliance below and increasing it above atmospheric pressure in recurrent pulsations of uniform frequency and intensity.

5. In a breast pumping apparatus, the combination of a breast appliance formed to fit over the breast, means providing a chamber to receive milk from the breast appliance, mechanism comprising a vacuum and pressure pump and motor for driving the same for alternately reducing the air pressure in the breast appliance below and increasing it above atmospheric pressure in recurrent pulsations of uniform frequency and intensity, and means for varying the intensity of the vacuum produced.

6. In a breast pumping apparatus, the combination of a breast appliance formed to fit over the breast, means providing a chamber in unobstructed communication with and arranged to receive milk from the breast appliance, air pumping mechanism operating to alternately produce a vacuum and a pressure above atmospheric pressure, and a flexible valveless tube for operatively connecting the breast appliance and chamber with said air pumping mechanism.

7. In a breast pumping apparatus, the

combination of a breast appliance formed to fit over the breast, means providing a chamber in unobstructed communication with and arranged to receive milk from the breast appliance, air pumping mechanism comprising a reciprocating vacuum and pressure pump, a motor to drive the same and means for admitting outside air to the pump on the vacuum stroke of the pump, and a flexible tube operatively connecting the chamber and breast appliance to the pump.

8. In a breast pumping apparatus, the combination of a rigid breast appliance to fit over the breast having an inner smooth conical surface, means providing a chamber to receive milk from the breast appliance, mechanism for alternately reducing the air pressure in this breast appliance below and increasing it above atmospheric pressure in recurring pulsations which draw the breast against and repel it from said conical surface, and a flexible tube by means of which the breast appliance is operatively connected with the aforesaid mechanism.

9. In a breast pumping apparatus, the combination of a rigid breast appliance to fit over the breast having an inner smooth conical surface, means providing a chamber to receive milk from the breast appliance, mechanism for alternately reducing the air pressure in this breast appliance below and increasing it above atmospheric pressure in recurring pulsations which draw the breast against and repel it from said conical surface, a flexible tube by means of which the breast appliance is operatively connected with the aforesaid mechanism, and means for varying the intensity of the vacuum produced.

10. In a breast pumping apparatus, the combination of a rigid breast appliance to fit over the breast having an inner smooth conical surface, means providing a chamber to receive milk from the breast appliance, mechanism for alternately reducing the air pressure in this breast appliance below and increasing it above atmospheric pressure in recurring pulsations which draw the breast against and repel it from said conical surface, a flexible tube by means of which the breast appliance is operatively connected with the aforesaid mechanism, and means providing a vent for excess air during the pressure pulsations.

11. In a breast pumping apparatus, the combination of a rigid breast appliance formed to fit over the breast for a substantial distance beyond the nipple and support the same against distension, said appliance having an inner smooth conical surface, means providing a chamber to receive milk from the breast appliance, motor driven mechanism for alternately reducing below atmospheric pressure and increasing the air pressure in the breast appliance in recurring pulsations which draw the breast against and release it from said conical surface, means whereby the patient may vary the intensity of the vacuum to suit the condition of the breast during the operation of the apparatus, and a flexible tube by means of which the breast appliance is operatively connected with the aforesaid mechanism.

12. In a breast pumping apparatus, the combination of a rigid breast appliance to fit over the breast having an inner smooth conical surface, means providing a chamber to receive milk from the breast appliance, mechanism comprising a vacuum and pressure pump, and a motor for driving the same for alternately reducing the air pressure in the breast appliance below and increasing it above atmospheric pressure in recurring pulsations of uniform frequency and intensity, which draw the breast against and repel it from said conical surface, a flexible tube by means of which the breast appliance is operatively connected with the aforesaid mechanism, and means whereby the intensity of the vacuum may be adjusted.

13. In a breast pumping apparatus, the combination of a rigid breast appliance to fit over the breast having an inner smooth conical surface, means providing a chamber to receive milk from the breast appliance, mechanism comprising a vacuum and pressure pump, and a motor for driving the same for alternately reducing the air pressure in the breast appliance below and increasing it above atmospheric pressure in recurring pulsations of uniform frequency and intensity, which draw the breast against and repel it from said conical surface, a flexible tube by means of which the breast appliance is operatively connected with the aforesaid mechanism, means whereby the intensity of the vacuum may be adjusted, and means providing a vent for excess air during pressure pulsations.

14. In a breast pumping apparatus, the combination of a milk receiver having a breast appliance thereon, mechanism comprising an air pump and motor for driving the same for exhausting the air from said milk receiver and breast appliance in recurring pulsations of uniform frequency and intensity, a valve for admitting regulatable amounts of air into the apparatus during the suction pulsations, and a flexible tube operatively connecting said receiver and breast appliance with the pump.

15. In a breast pumping apparatus, the combination of a milk receiver having a substantially conical breast appliance thereon formed to fit over the breast for a substantial distance beyond the nipple and support the same against distension, mechanism comprising an air pump and motor for

driving the same for exhausting the air from said milk receiver and breast appliance in recurring pulsations of uniform frequency and intensity, a flexible tube operatively connecting said receiver and breast appliance with the pump, and means on a stationary part of the apparatus whereby the patient may vary the intensity of the vacuum to suit the condition of the breast while the apparatus is in operation.

16. In a breast pumping apparatus, the combination of a breast appliance formed to fit over the breast, means providing a chamber to receive milk from the breast appliance, a reciprocating vacuum and pressure pump operatively connected with said breast appliance and chamber, and means for admitting air in regulatable quantities into the pump on the vacuum stroke, so that pressure above atmosphere is created in the breast appliance on the alternate strokes of the pump.

17. In a breast pumping apparatus, the combination of means to fit over the breast and receive milk drawn therefrom provided with an automatically opened outlet to reduce pressure in said means, and mechanism for alternately evacuating and creating a pressure above atmospheric pressure in the aforesaid means.

18. In a breast pumping apparatus, the combination of a breast appliance formed to fit over the breast, pumping mechanism with which the breast appliance is flexibly connected for producing intermittent suction impulses in the breast appliance of substantially uniform intensity with alternate intervals of pressure above atmospheric pressure, means for permitting the escape of air from the apparatus during said intervals of higher pressure to limit such pressure, and means for varying the intensity of such suction impulses.

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