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(54) **NIPPLE FOR NURSING BOTTLE.**

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JP-B- 3 927 695
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Description

Technical Field

The present invention relates to a nipple for a nursing bottle through which an infant can take milk with a chewing action, or a chewing muscle action.

Background Art

In recent years, cases of temporomandibular joint disorder, malocclusion, periodontitis and other dental diseases have increased in young people and children. It is considered that this is caused by an insufficient development of the human masticatory organ. That is, the infants of today are inferior in masticatory ability to infants of former days.

The initial development of the masticatory organ could be said to have three stages. The first stage corresponds to a period during which the infants obtain the basic muscle force of masticatory organ by taking the mother's milk, and at the same time, the pattern of chewing action is acquired.

A problem arises in this period with respect to the resent infants being fed an artificial milk. That is, the infants being fed the artificial milk are inferior in chewing and swallowing ability or masticatory ability to those of the infants being fed a mother's milk. The cause of such the inferiority is presumed from the difference acquisition in masticatory ability appeared in the first stage.

Meanwhile, artificial milk is given to an infant from a nursing bottle through a nipple made of rubber taking the external form similar to the breast. As shown in Figure 25, a conventional nipple has a hollow body portion 83 formed between a hemispherical papilla portion 80 provided with a milk sucking hole 81 and a flange-shaped connecting portion 82 connected to a neck portion of the nursing bottle. The infant can take the milk in the nursing bottle through the sucking hole 81 by sucking the papilla portion 80 in its mouth. In other words, the infant can take the milk by entirely performing the sucking operation.

As a result of the investigation, the inventor of the present application has found that infants being fed an artificial milk do not sufficiently develop the masticatory organ because a chewing operation is not required to take the artificial milk while the infants being fed a mother's milk satisfactorily develop it because the chewing action is required to take the mother's milk.

In accordance with above mentioned findings, the inventor of the present invention has proposed a nipple for a nursing bottle provided with a check valve disposed between a papilla portion and a hollow body portion so adapted to be closed upon the compression of the papilla portion for preventing the flow of drink and to be opened in the normal uncompressed state of the papilla portion (See EP-A-0 384 394).

According to the nipple for the nursing bottle, because the check valve permits the flow of the drink when the compressing force to the papilla portion is being released, a drink such as milk in the nursing bottle can be introduced through the check valve to the papilla portion. In this state, when the papilla portion is compressed by the chewing action, the check valve prevents the flow of the drink thereby enables the drink introduced to the papilla portion to dispense through a dispensing hole in the papilla portion into the cavitas oris of the infant. Thus, the infant can take the drink in the nursing bottle successively by repeatedly chewing the nipple. Accordingly, because the above mentioned nipple is adapted to allow an infant to take a drink such as milk not by a sucking operation but by a chewing action, the inventor has fulfilled a nipple which can ensure the sufficient development of the masticatory organ of an infant who grows up with being fed an artificial milk.

Meanwhile, generally, in a situation where the infant is taking a drink successively, the inside of the nursing bottle or the nipple tends to be negative pressure. Therefore, when the negative pressure progresses in the nipple with check valve for a nursing bottle, the compressed papilla portion remains in the deformed state thereby the check valve also remains in the closed state. Such the closed state of the check valve particularly tends to happen in a nipple which has a dispensing hole in the papilla portion formed so adapted to be closed except when the drink is dispensed for preventing the flow back of the air therethrough into the papilla portion when the compressed papilla portion restores the original shape thereof. The above mentioned closed state of the check valve causes to prevent the drink from flowing from the body portion of the nipple to the papilla portion, thereby the papilla portion can not restore its shape and unable to dispense the drink from the nipple.

Accordingly, it is an object of the present invention to provide a nipple for a nursing bottle through which an infant takes a drink not by a sucking action but by a chewing action so that the masticatory organ of the infant grown up with being fed an artificial milk should be satisfactorily developed.

The another object of the present invention is to provide a nipple for a nursing bottle which prevents the poor dispensation of the drink.

Disclosure of Invention

In order to accomplish the above mentioned objects, this invention provide a nipple for a nurs-

ing bottle comprising: a connecting portion adapted to be connected to a neck portion of a nursing bottle; a hollow body portion integral with the connecting portion; a papilla portion integral with the body portion; a dispensing hole for dispensing a drink from the papilla portion; a diaphragm disposed between the body portion and the papilla portion for partitioning the inside of the nipple; a slit formed in the diaphragm and adapted to be opened in the normal uncompressed state of the nipple for permitting the flow of the drink from the body portion to the papilla portion and to be closed upon the compression of the nipple by an infant for preventing the flow of the drink from the body portion to the papilla portion; characterised in that a communicating portion is formed in the diaphragm for slightly permitting the flow of the drink from the body portion to the papilla portion in a case where the slit is closed.

With the above arrangement of the nipple for a nursing bottle, a drink such as milk in the nursing bottle can be introduced to the papilla portion through the slit opened while the nipple is not compressed by the infant. In this state, when the nipple is compressed by the infant, the slit is closed and prevents the flow of the drink from the body portion to the papilla portion, thereby the drink introduced in the papilla portion can be dispensed through a dispensing hole formed in the papilla portion into the cavitas oris of the infant. Thus, the infant can take the drink in the nursing bottle successively by repeatedly chewing the nipple.

Furthermore, even if the compressed papilla portion can not restore its shape and the slit remains in the closed state, the communicating portion allows the slight quantity of the drink to be introduced from the body portion to the papilla portion, so that the restoration of the deformed papilla portion is started to open the closed slit immediately.

Preferably, the connecting portion is provided with an air valve for introducing the air into the nursing bottle. In this aspect, because the air is introduced into the nursing bottle, the application of the excessive negative pressure onto the nursing bottle can be avoided during the infant is taking the drink in the nursing bottle. Consequently, the possibility that the slit remains in the closed state can be reduced.

Brief Description of Drawings

Figure 1 is a sectional view showing an embodiment of a nipple for a nursing bottle according to the present invention;
Figure 2 is an enlarged sectional view taken along the line 2-2 in Figure 1;
Figure 3 is a sectional view showing the state in which the slit is closed;
Figure 4 is a side view of the nipple;
Figure 5 is a perspective view of the nipple;
Figure 6 is an enlarged sectional view of the nipple;
Figure 7 is a sectional view taken along the line 7-7 in Figure 6;
Figure 8 is an enlarged sectional view showing another embodiment of the dispensing hole;
Figure 9 is a sectional view taken along the line 9-9 in Figure 8;
Figure 10 is a sectional view showing a state in which the papilla portion is deformed;
Figure 11 is a sectional view showing still another embodiment of the dispensing hole;
Figure 12 is a sectional view showing for the explanation of the size of the papilla portion;
Figure 13 is a sectional view showing an embodiment of the papilla portion in which the sidewall is provided only to one side;
Figure 14 is a sectional view taken along line 14-14 in Figure 13;
Figure 15 is a sectional view showing another embodiment of the communicating portion;
Figure 16 is a sectional view showing still another embodiment of the nipple;
Figure 17 is a sectional view taken along the line 17-17 in Figure 16;
Figures 18 and 19 are sectional views showing still another embodiment of the papilla portion;
Figure 20 is a sectional view showing another embodiment of the air valve;
Figure 21 is a sectional view showing another embodiment of the diaphragm;
Figures 22 and 23 are essential sectional views showing an embodiment of the present invention in which two check valves are disposed;
Figure 24 is a sectional view taken along line 24-24 in Figure 23;
Figure 25 is a sectional view showing an example of a conventional nipple.

Best Mode for Carrying Out the Invention

The present invention will be described in detail with reference to the accompanying drawings showing preferred embodiments of the present invention.

Figure 1 is a sectional view illustrating a nipple A for a nursing bottle according to the present invention and Figure 5 is a perspective view of the nipple A. The above nipple A is formed by integrally connecting a papilla portion 1, tip of which is in a round shape, through a substantially tapered tube-shaped body portion 2 to a flange-shaped connecting portion 3 adapted to be connected to a neck portion B1 of a nursing bottle B.

The above described nipple A is manufactured by molding a rubber material such as isoprene rubber, silicone rubber or polyurethane rubber in a predetermined shape by injection molding, blow molding, dip molding or the like. The nipple A is connected to the nursing bottle B by pinching the connected portion 3 between the cap C and a neck portion B1 of the bottle B.

The papilla portion 1 is provided with a tip in which is formed a dispensing hole 11 for dispensing the drink such as artificial milk from the inside of the nipple A into the cavitas oris of an infant. The dispensing hole 11 is of such a construction as to be closed except when the drink is dispensed, which can be obtained by adapting such a shape as a cross cut (see Figures 6 and 7), a so-called super cross cut provided with a dent 11a in the inner side of the cross cut (see Figures 8 and 9), and a Y-shaped cut. The papilla portion 1 has flat sidewalls 21 opposed to each other, which form the opposite sides of the papilla portion 1.

The above mentioned nipple A has a check valve 5 disposed therein for partitioning the inside of the nipple A between a papilla portion side A1 and connecting portion side A2. The check valve 5 takes in the form of a diaphragm 51 disposed between the papilla portion 1 and the body portion 2 and a slit 52 formed in the center of the diaphragm 51. As shown in Figure 2, the slit 52 extending in the parallel direction with the sidewalls 21. The slit 52 has two concave surfaces 52a of which both ends are opposing and gradually approaching to each other. A maximum opening width L of the slit 52 is established to approximately 0.5 to 5 mm.

The above slit 52 of the check valve 5 is closed when the peripheries of the check valve 5 is compressed in the direction of arrow X in Figure 2 (See Figure 3). The application of the compression force substantially prevents the flow of the drink from the body portion 2 to the papilla portion 1. When the compression force is released, slit is opened thereby the drink flows from the body portion 2 to the papilla portion 1.

The above diaphragm 51 has a pinhole 53 as a communicating portion for communicating between the papilla portion 1 and the body portion 2. The pinhole 53 is formed in one or plural positions of the diaphragm 51, so as to allow slight quantity of the drink to flow from the body portion 2 to the papilla portion 1 in a case where the slit 52 is closed. Preferably the diaphragm 51 has certain thickness to prevent the collapse when the slit 52 is closed.

The connecting portion 3 has circular ribs 34 adapted to be fitted to the neck portion B1 of the nursing bottle B at predetermined intervals with one or plural air valve 33 (See Figures 1 and 4) formed at predetermined positions between the ribs 34. The air valve 33 takes in the form of a short line-shaped slit 33a formed in a bottom of a cup-shaped hollow projection 35 formed between the ribs 34. The slit 33a is extending in the radial direction. This is to prevent the slit 33a, when the connecting portion 3 is tightened with the cap C, from being distorted in the tightening direction of the cap C and thereby being closed. The air valve 33, which is formed between the ribs 34, is protected from external force by these ribs 34. The hollow projection 35 has preferably a protruding height of approximately 2 mm and a thickness of 6 mm or more. It is preferable to form an air pass between the connecting portion 3 and the cap C for introducing the air into the air valve 33.

In accordance with above mentioned structure, when an infant puts the papilla portion 1 of the nipple A in its mouth, the infant instinctively tends to chew the papilla portion 1. Thus, the papilla portion 1 is compressed and at the same time, the check valve 5 is closed by a chewing action, thereby the drink introduced into the papilla portion 1 is dispensed into the cavitas oris of the infant through the dispensing hole 11. When the compression force for the nipple A is released, the papilla portion 1 is restored to its original shape by an elastic restoring force and correspondingly, the slit 52 which forms the check valve 5 is opened. Consequently, the drink is introduced again from the body portion 2 into the papilla portion 1. Therefore, the infant can take the drink in the nursing bottle B by repeatedly chewing the papilla portion 1. The above nipple A allows an infant to take a drink by the chewing action as described above, even an infant having cleft palate can easily take the drink therewith.

Furthermore, because the above mentioned nipple A has the diaphragm 51 in which is formed the pinhole 53, the drink can be introduced from the body portion 2 side through the pinhole 53 to the papilla portion 1 side even if where the slit 52 of the check valve 5 remains in the closed state (see Figure 10) because the compressed papilla portion 1 cannot be restored owing to the excessive negative pressure of the inside of the papilla portion 1. This allows the deformed papilla portion 1 to start being restored to its original state, causing the slit 52 to be opened earlier.

Moreover, because the air valve 33 formed in the connecting portion 3 introduces the air to the inside of the nursing bottle B, the excessive negative pressure can be avoided as far as possible. Consequently, the possibility that the slit 52 of the check valve 5 remains in the closed state can be reduced as little as possible even if the infant takes the drink successively.

In the above mentioned embodiment, because the papilla portion 1 has the flat sidewalls 21 opposed to each other and the slit 52 formed in parallel with the above flat sidewalls 21, the direction of the nipple A can be easily identified when an infant puts the nipple A in its mouth. More specifically, the slit 52 can be positioned in a suitable direction by only making the infant puts the nipple A in its mouth such that the above flat sidewalls 21 are parallel to the gums of the infant. Furthermore, because the above sidewalls 21 fit the mouth of the infant, the infant can easily chew the nipple A.

Because the dispensing hole 11 is closed except when the drink is dispensed, it prevents the air from being introduced to the papilla portion 1 through the dispensing hole 11 when the drink is introduced through the slit 52 to the papilla portion 1. This facilitates the introduction of the drink to the papilla portion 1.

The body portion 2 should have certain thickness for preventing the easily distortion because the purpose of the sufficient gnathic action can not be ensured if the body portion 2 is easily distorted when the infant puts the body portion 2 in its mouth.

As shown in Figure 11, a plurality of dispensing holes 11 may be provided in the papilla portion 1. The dispensing holes 11 shown in Figure 11 are short cut lines each having a length of approximately 0.5 to 1.5 mm, totaling approximately 2 to 10 in number. These dispensing holes 11 are formed in a direction parallel to the sidewall 21. The dispensing holes 11 thus constructed will not permit the drink to be dispensed therethrough only by sucking the nipple A. By chewing the nipple A, however, the drink will easily be dispensed. As a result, the infant is easily forced to take a drink not by the sucking action but by the chewing action.

The maximum opening width L of the slit 52 is preferably not more than one half of the shorter length L1 of the inside of the papilla portion 1 (see Figure 12). The longitudinal length M of the slit 52 is preferably not less than one half of the longer length M1 of the inside of the papilla portion 1. Further, the relation between the maximum opening width L and the longitudinal length M is preferably

$L/M = 1/20$ to $1/2$

This evaluation is based on the fact that as the longitudinal length M is set longer, the slit can be molded more easily, and as the maximum opening width L is set smaller, the check valve 5 serves more efficiently.

On the other hand, the wall thickness of the nipple A may be uniform throughout. However, it is desirable that right and left portions in Figure 2 are thinner than upper and lower portions because the slit 52 in the check valve 5 is easily closed.

As shown in Figures 13 and 14, the flat sidewall 21 may be formed at one side of the papilla portion 1.

Figure 15 shows another embodiment in which a body portion 2 is communicate with a papilla portion 1 through a small clearances 54, instead of the pinholes 53, formed at the end portions of a slit 52 being closed. In the present embodiment, the end portions of the slit 52 are provided with longitudinally extending short line portions 52b which form the clearances 54 at the opposite ends of the slit 52 being closed. Therefore, the slit 52 can be opened earlier by introducing the drink through the clearances 54, even if the papilla portion 1 is not restored in its original shape.

The papilla portion 1 may shape in a spherical cross section having a round tip as shown in Figures 16 and 17, or in an elliptical cross section as shown in Figure 18. Further, as shown in Figure 19, the whole shape of the nipple A may be caused to have predetermined directionality such that the nipple A can fit the cavitas oris of the infant.

As shown in Figure 20, the air valve 33 may be in the form of a penetrating hole which penetrating the connecting portion 3.

As shown in Figure 21, the diaphragm 51 of the check valve 5 may be smoothly integrally formed on the inner wall of the body portion 2. In this case, the strength of the diaphragm 51 can be increased, so that the collapse of the diaphragm 51 can be effectively prevented under the situation where the slit 52 is closed.

The present invention is not limited to the above-described embodiments; for example, the check valves 5 may be formed two in number apart from each other by a predetermined interval (see Figure 22), which can enhance the hermetical characteristic of the papilla portion 1. In this arrangement, also, if the slits 52 formed in the diaphragms 51 are directed so as to be perpendicular to each other (see Figures 23 and 24), the nipple A can be chewed in two directions selectively.

As described in the foregoing, in the nipple for a nursing bottle according to the present invention, because the drink can be introduced from the body portion side through the communicating portion to the papilla portion side even in the case where the slit of the check valve remains in the closed state, the deformed papilla portion can be restored to its original state, causing the slit to be opened earlier. Consequently, this embodiment prevents the disadvantage that the drink can not be dispensed from the nursing bottle.

Claims

1. A nipple (A) for a nursing bottle (B) comprising:

   a connecting portion (3) adapted to be connected to a neck portion (B1) of a nursing bottle (B);

   a hollow body portion (2) integral with said connecting portion (3);

   a papilla portion (1) integral with said body portion (2);

   a dispensing hole (11) for dispensing a drink from said papilla portion (1);

   a diaphragm (51) disposed between said body portion (2) and said papilla portion (1) for partitioning the inside of said nipple (A);

   a slit (52) formed in said diaphragm (51) and adapted to be opened in a normal uncompressed state of said nipple (1) for permitting the flow of said drink from said body portion (2) to said papilla portion (1) and to be closed upon the compression of said nipple (A) by an infant for preventing the flow of said drink from said body portion (2) to said papilla portion (1); characterised in that

   a communicating portion (53, 54) is formed in said diaphragm (51) for slightly permitting the flow of said drink from said body portion (2) to said papilla portion (1) in a case where said slit (52) is closed.

2. A nipple for a nursing bottle as set forth in claim 1, wherein said communicating portion (53, 54) is a pinhole (53).

3. A nipple for a nursing bottle as set forth in claim 1, wherein said communicating portion (53, 54) is clearances (54) formed at the opposite ends of said slit (52) being closed.

4. A nipple for a nursing bottle as set forth in claim 1, wherein said connecting portion (3) is provided with an air valve (33) for introducing the air into said nursing bottle (B).

5. A nipple for a nursing bottle as set forth in claim 4, wherein said air valve (33) is a hollow projection having a linear slit (33a) formed therein.

6. A nipple for a nursing bottle as set forth in claim 5, wherein said liner slit (33a) extends in a radial direction.

7. A nipple for a nursing bottle as set forth in claim 1, wherein said papilla portion (1) is provided with a flat sidewall (21) with which said slit (52) extends in a parallel direction.

8. A nipple for a nursing bottle as set forth in claim 7, wherein said flat sidewall (21) is formed at two portions which oppose to each other.

Patentansprüche

1. Sauger (A) für eine Säuglingsflasche (B), umfassend:

   einen zum Verbinden mit einem Haisteil (B1) einer Säuglingsflasche (B) angepaßten Anschlußteil (3);

   einen als Einehit mit dem besagten Anschlußteil (3) ausgebildeten hohlen Hauptteil (2);

   einen als Einheit mit dem besagten Hauptteil (2) ausgebildeten Warzenteil (1);

   eine Abgabeöffnung (11) zur Abgabe eines Getränks aus dem besagten Warzenteil (1);

   eine zwischen dem besagten Hauptteil (2) und dem besagten Warzenteil (1) angeordnete Membran (51) zum Unterteilen des Inneren des besagten Saugers (A);

   einen Schlitz (52), der in der besagten Membran (51) ausgebildet und so angepaßt ist, daß er in einem normalen, nicht zusammengedrückten Zustand des besagten Saugers (A) geöffnet ist, um das Fließen des besagten Getränks aus dem besagten Hauptteil (2) in den besagten Warzenteil (1) zu gestatten, und nach dem Zusammendrücken des besagten Saugers (A) durch ein Kleinkind geschlossen ist, um das Fließen des besagten Getränks aus dem besagten Hauptteil (2) in den besagten Warzenteil (1) zu verhindern;

   dadurch gekennzeichnet, daß

   ein Verbindungsteil (53,54) in der besagten Membran (51) ausgebildet ist, um in einem Fall, wo der besagte Schlitz (52) geschlossen ist, das Fließen des besagten Getränks aus dem besagten Körperteil (2) in den besagten Warzenteil (1) in geringem Umfang zu gestatten.

2. Sauger für eine Säuglingsflasche nach Anspruch 1, dadurch gekennzeichnet, daß der besagte Verbindungsteil (53,54) ein kleines Loch (53) ist.

3. Sauger für eine Säuglingsflasche nach Anspruch 1, dadurch gekennzeichnet, daß der besagte Verbindungsteil (53,54) von Zwischenräumen (54) gebildet wird, die an entgegengesetzten Enden des besagten geschlossenen Schlitzes (52) ausgebildet sind.

4. Sauger für eine Säuglingsflasche nach Anspruch 1, dadurch gekennzeichnet, daß der

besagte Anschlußteil (3) mit einem Luftventil (33) zum Einleiten der Luft in die besagte Säuglingsflasche (B) versehen ist.

5. Sauger für eine Säuglingsflasche nach Anspruch 4, dadurch gekennzeichnet, daß das besagte Luftventil (33) ein hohler Vorsprung mit einem darin ausgebildeten geradlinigen Schlitz (33a) ist.

6. Sauger für eine Säuglingsflasche nach Anspruch 5, dadurch gekennzeichnet, daß der besagte geradlinige Schlitz (33a) in einer radialen Richtung verläuft.

7. Sauger für eine Säuglingsflasche nach Anspruch 1, dadurch gekennzeichnet, daß der besagte Warzenteil (1) mit einer flachen Seitenwand (21) versehen ist, zu welcher der besagte Schlitz (52) parallel verläuft.

8. Sauger für eine Säuglingsflasche nach Anspruch 7, dadurch gekennzeichnet, daß die besagte flache Seitenwand (21) an zwei einander gegenüberliegenden Stellen ausgebildet ist.

Revendications

1. Tétine (A) destinée à un biberon (B) comprenant :

une partie de liaison (3) conçue pour être reliée à une partie de col (B1) d'un biberon (B),

une partie de corps creuse (2) solidaire de ladite partie de liaison (3),

une partie de papille (1) solidaire de ladite partie de corps (2),

un orifice de distribution (11) destiné à distribuer une boisson à partir de ladite partie de papille (1),

un diaphragme (51) disposé entre ladite partie de corps (2) et ladite partie de papille (1) pour diviser l'intérieur de ladite tétine (A),

une fente (52) formée dans ledit diaphragme (51) et conçue pour être ouverte dans un état normal non comprimé de ladite tétine (1) en vue de permettre l'écoulement de ladite boisson hors de ladite partie de corps (2) vers ladite partie de papille (1) et pour être fermée lors de la compression de ladite tétine (A) par un nourrisson afin d'empêcher l'écoulement de ladite boisson hors de ladite partie de corps (2) vers ladite partie de papille (1),

caractérisée en ce que

une partie de communication (53, 54) est formée dans ledit diaphragme (51) pour permettre un faible écoulement de ladite boisson hors de ladite partie de corps (2) vers ladite partie de papille (1) dans le cas où ladite fente (52) est fermée.

2. Tétine pour biberon selon la revendication 1, dans laquelle ladite partie de communication (53, 54) est un trou d'épingle (53).

3. Tétine pour biberon selon la revendication 1, dans laquelle ladite partie de communication (53, 54) est constituée d'espaces vides (54) formés aux extrémités opposées de ladite fente (52) qui est fermée.

4. Tétine pour biberon selon la revendication 1, dans laquelle ladite partie de liaison (3) est pourvue d'un clapet d'air (33) servant à introduire de l'air dans ledit biberon (B).

5. Tétine pour biberon selon la revendication 4, dans laquelle ledit clapet d'air (33) est une saillie en creux comportant une fente linéaire (33a) qui s'y trouve formée.

6. Tétine pour biberon selon la revendication 5, dans laquelle ladite fente linéaire (33a) s'étend dans une direction radiale.

7. Tétine pour biberon selon la revendication 1, dans laquelle ladite partie de papille (1) est pourvue d'une paroi latérale plate (21) avec laquelle ladite fente (52) s'étend dans une direction parallèle.

8. Tétine pour biberon selon la revendication 7, dans laquelle ladite paroi latérale plate (21) est formée au niveau de deux parties qui sont disposées en regard mutuel.

Fig.1

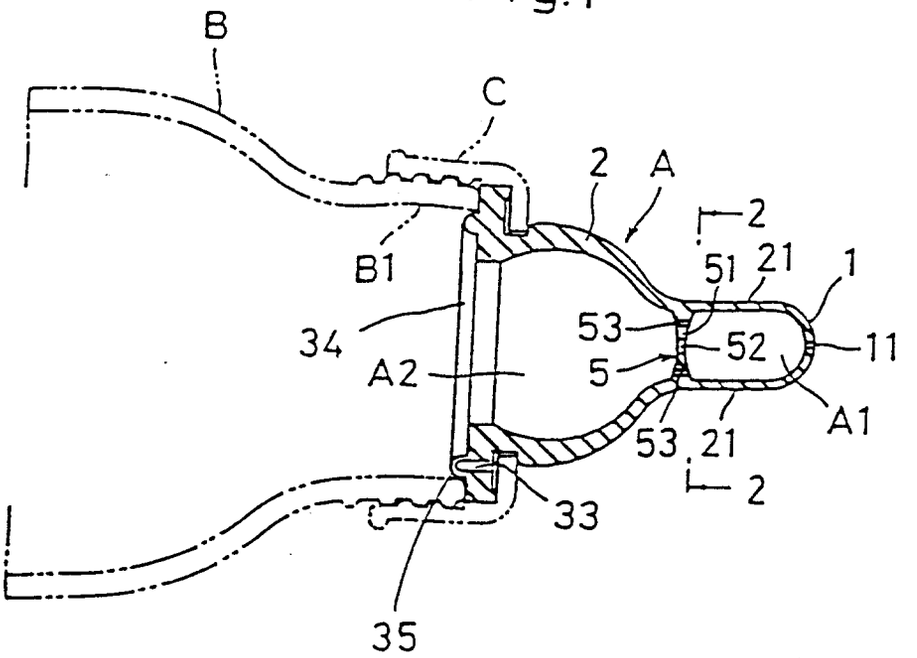
B
C
2
A
2
B1
51
21
1
34
53
52
11
A2
5
A1
53
21
2
33
35

Fig.2

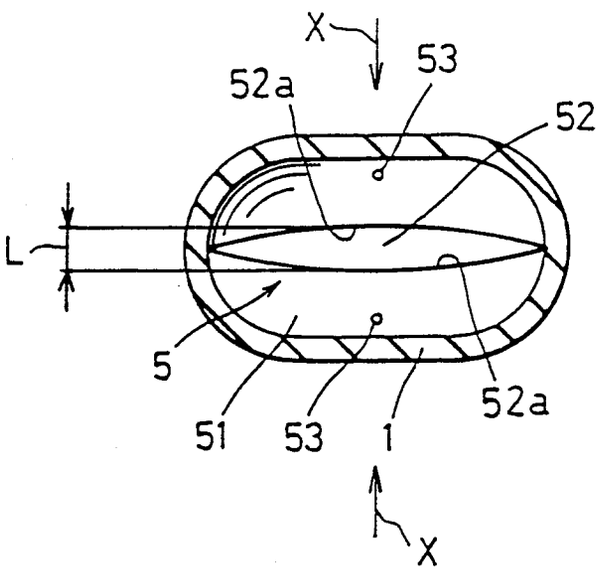
X
53
52a
52
L
5
51
53
1
52a
X

Fig. 3

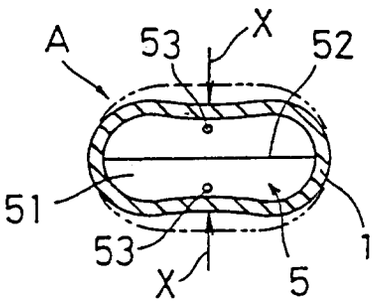

Fig. 4

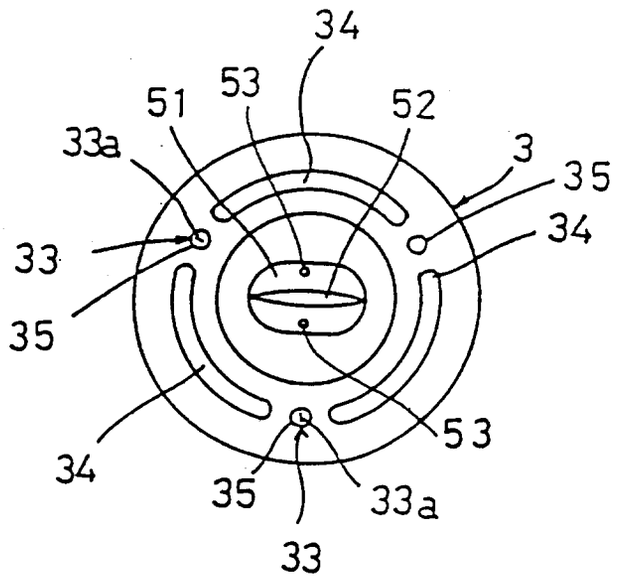

Fig. 5

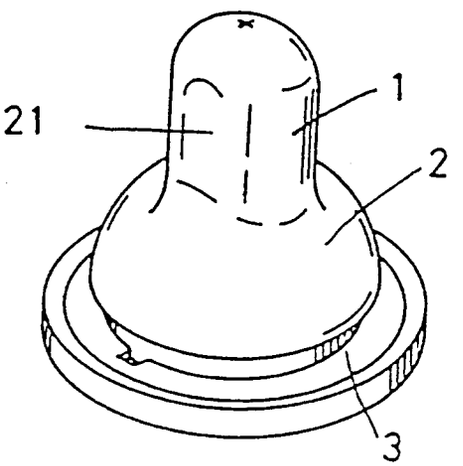

Fig.6

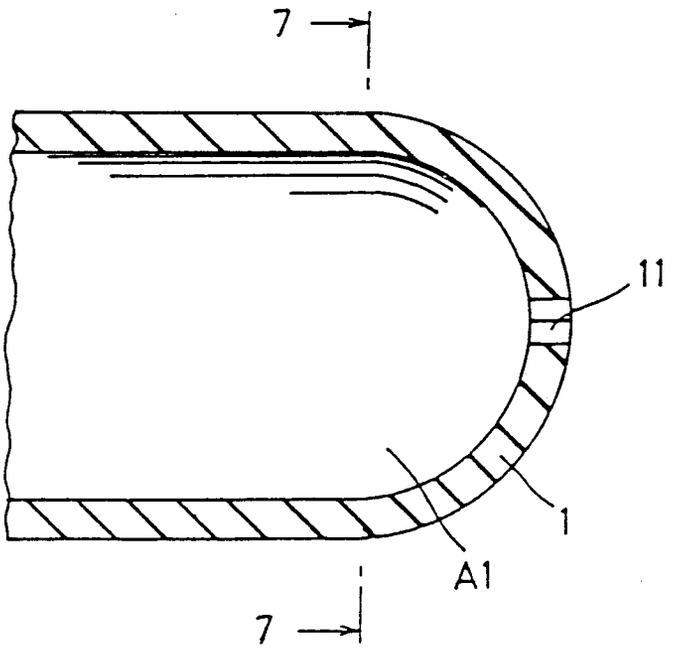

Fig.7

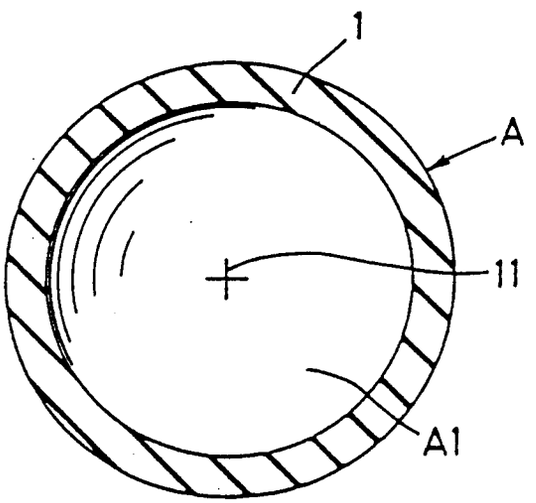

Fig.8

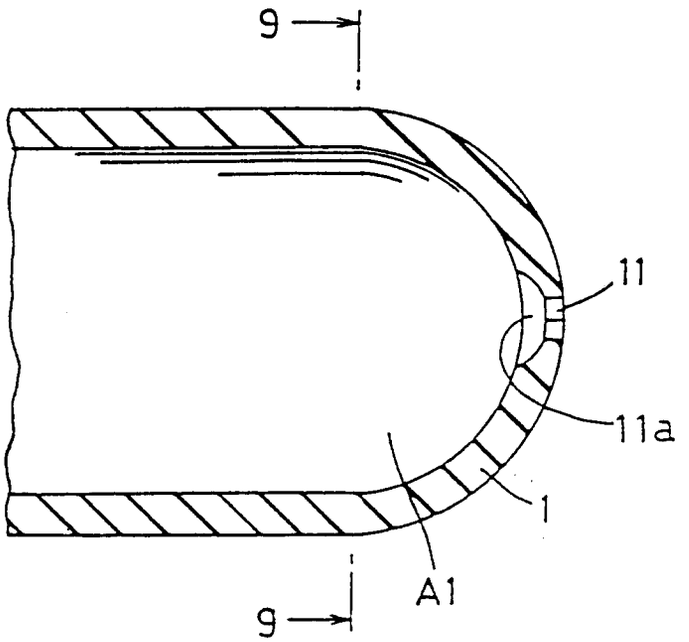

Fig.9

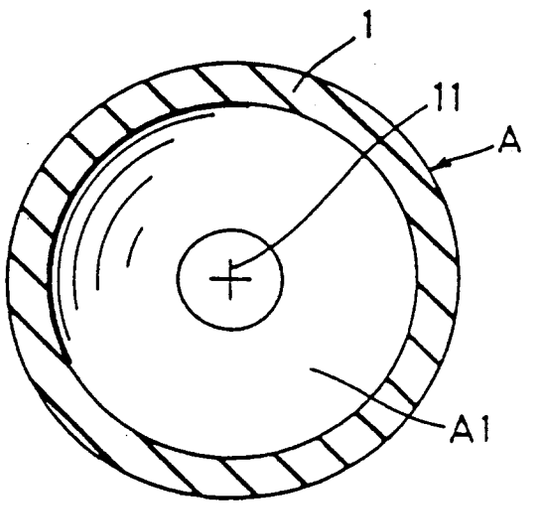

Fig.10

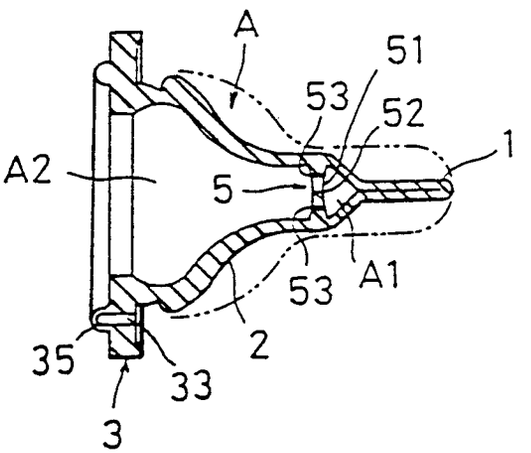

Fig.11

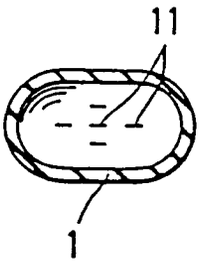

Fig.12

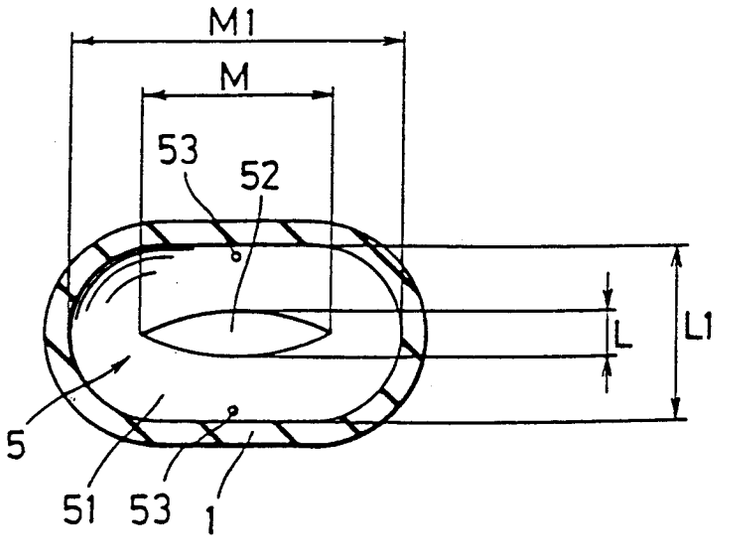

Fig.13

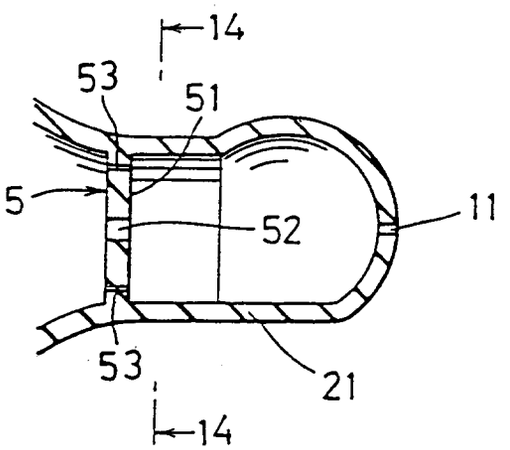

Fig.14

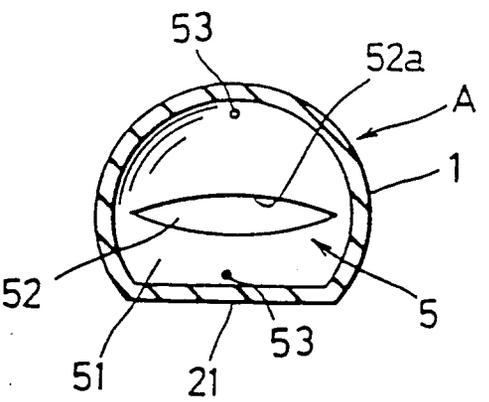

Fig.15

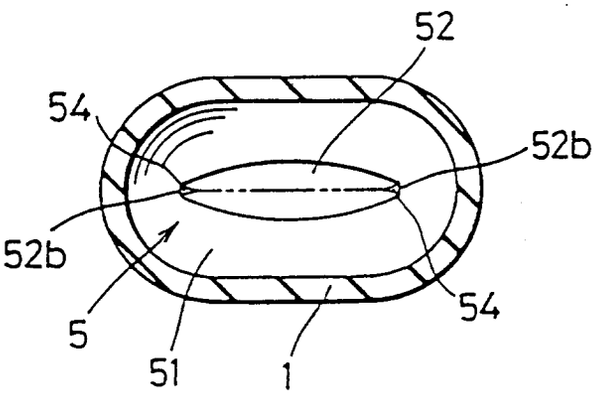

Fig.16

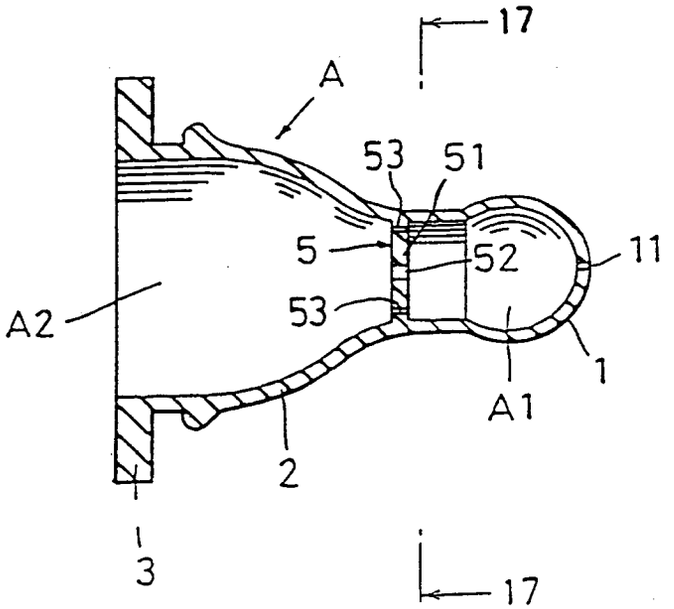

Fig.17

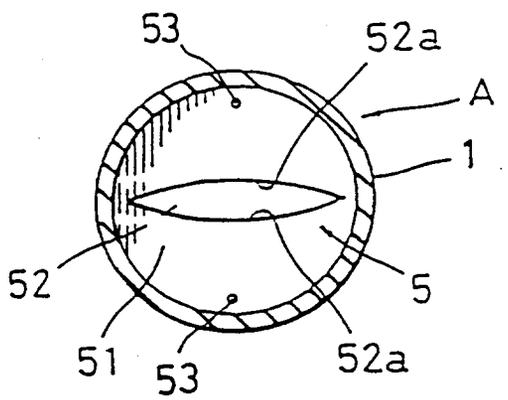

Fig.18

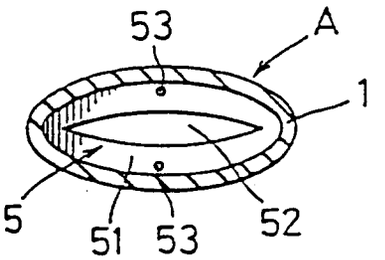

Fig.19

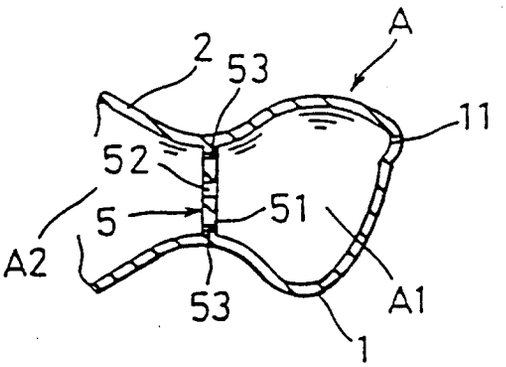

Fig.20

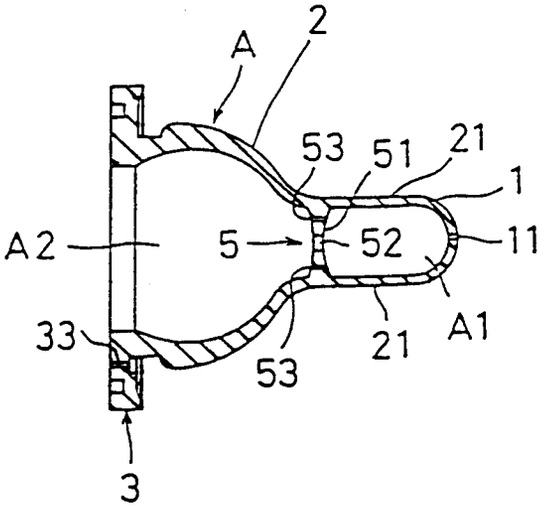

Fig.21

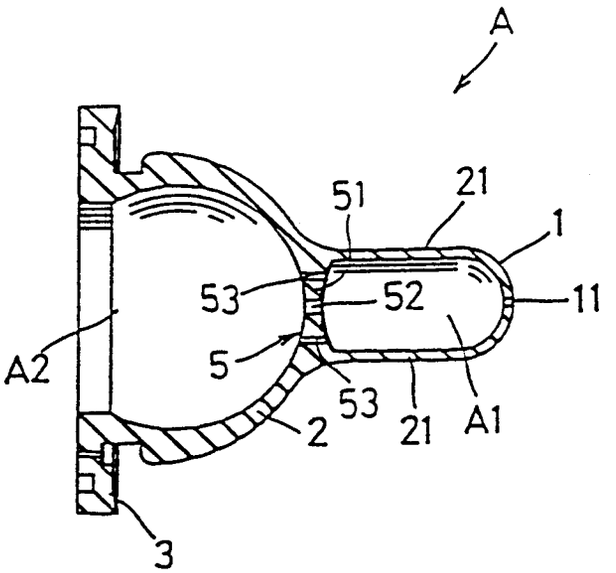

Fig.22

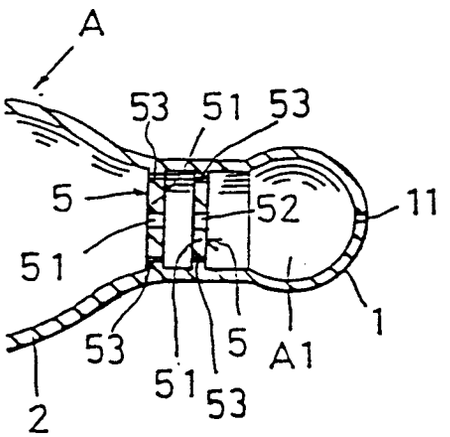

Fig.23

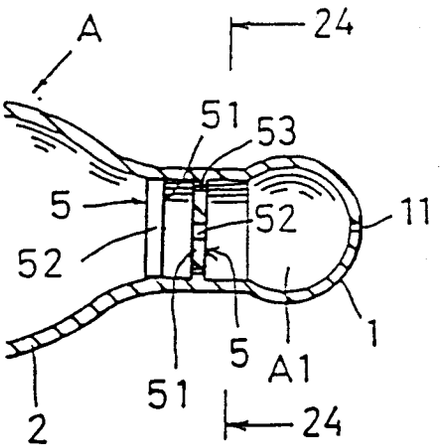

Fig.24

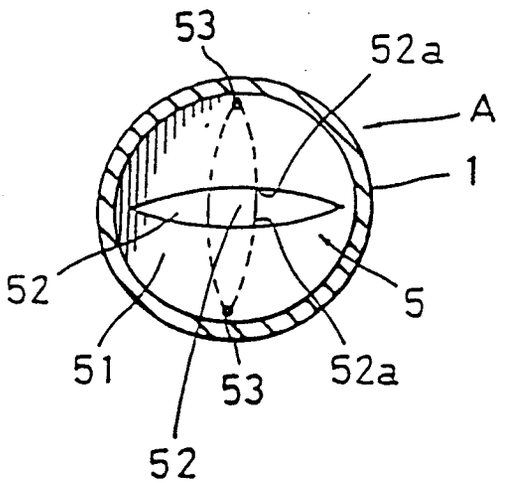

Fig.25