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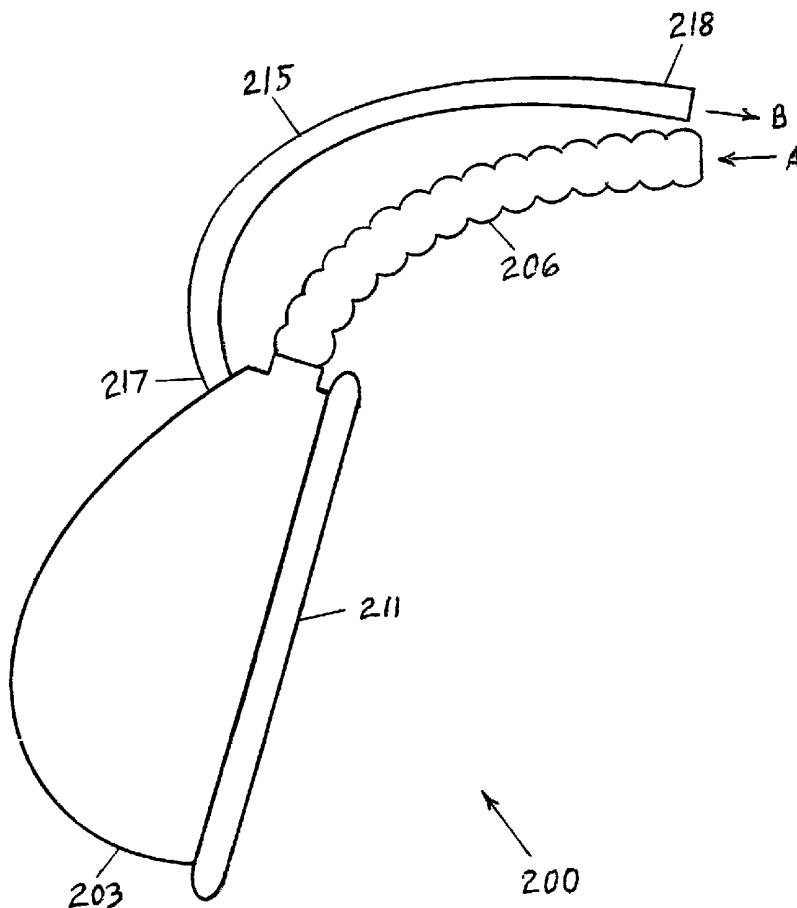
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(54) Title: REMOTE VENTING FOR A RESPIRATORY MASK



(57) **Abstract:** A respiratory mask having a remote venting is provided according to the invention, including a gas supply hose, a mask shell adapted to output a gas to a respiratory system of a person, the mask shell adapted to be connected to the gas supply hose, and a remote venting device having proximal and distal ends, the remote venting device remotely venting a gas out of the respiratory mask to substantially reduce or eliminate rebreathing of expired carbon dioxide.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

REMOTE VENTING FOR A RESPIRATORY MASK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to the field of respiratory masks.

5 2. Description of the Background Art

A respiratory mask is a device used to deliver a gas or gases to a person. FIG. 1 shows a respiratory mask 100 of the related art. The related art respiratory mask 100 includes a mask shell 103, a gas supply hose 106, a vent aperture 108, and an optional gasket 111. The mask shell 103 is fitted over a face of the person in order to supply a gas to a respiratory system of the
10 person.

The respiratory mask 100 may be used to deliver any variety of gases, including air or oxygen, and a variety of medicines or treatments. Preferably, the mask 100 does not allow a supplied gas to escape. A strap or other attaching means (not shown) may be affixed to the mask shell 103 and may be fitted over the head of the person. Constant pressure gas is therefore
15 delivered, with the vent aperture 108 maintaining a substantially constant pressure in the mask. This is referred to as a continuous positive airway pressure (CPAP) mask. The vent aperture 108 allows the exhaust of expired carbon dioxide from the mask 100. It is important that the vent aperture 108 be of a sufficient size to exhaust all exhaled air under normal conditions of use. In the related art, the need for venting has meant simply an aperture on the mask shell 103, whereby
20 exhaled air is flushed out of the respiratory mask 100 by the positive pressure generated by the gas supply hose 106. This is taught by Rapaport U.S. Patent Re. 35,339.

Several drawbacks exist with the venting of the related art respiratory mask 100. First, the air circulation within the mask shell 103 and vent aperture 108 may create annoying noises. Second, a jet of air from the vent aperture 108 may impinge on the wearer or on nearby persons.
25 This can be seen in FIG. 1, where the vent aperture 108 and a resulting air jet are relatively close to the face of the wearer, and will in all likelihood be in the region of persons near to or conversing with the wearer. As a result, these drawbacks may affect compliance with a therapy.

Therefore, there remains a need in the art for an improved respiratory mask.

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SUMMARY OF THE INVENTION

A respiratory mask having a remote venting is provided according to the invention, comprising a gas supply hose, a mask shell adapted to output a gas to a respiratory system of a person, the mask shell adapted to be connected to the gas supply hose, and a remote venting

device having proximal and distal ends, the remote venting device remotely venting carbon dioxide exhaled by said person out of the respiratory mask so as to substantially reduce inhalation by said person of said exhaled carbon dioxide.

The above and other features and advantages of the present invention will be further understood from the following description of the preferred embodiment thereof, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a respiratory mask of the related art;

FIG. 2 shows a first embodiment of a remotely vented respiratory mask of the present invention;

FIG. 3 shows a second embodiment of a remotely vented respiratory mask of the present invention;

FIGS. 4A and 4B show cross-sectional views of the gas supply hose and remote venting device of the second embodiment; and

FIG. 5 shows a third embodiment of a remotely vented respiratory mask of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 2 shows a first embodiment of a remotely vented respiratory mask 200 of the present invention. The remotely vented respiratory mask 200 includes a mask shell 203, a gas supply hose 206 attached to the mask shell 203, an optional gasket 211, and a remote venting device 215. The remote venting device 215 is preferably a tube having a proximal end 217 attached to the mask shell 203 and a distal end 218 that is distant from the mask shell 203. The remote venting device 215 may be formed of a soft or rigid material. The remote venting device 215 allows a gas flow out of the mask 200 in order to exhaust expired carbon dioxide. It is estimated that a minimum gas flow volume of about ten to fifteen liters per minute at a pressure of four cm H₂O air pressure may be adequate to vent the exhaled air from the mask 200. At higher CPAP pressure, higher flow rates are acceptable. Preferably, the remote venting device 215 is designed with an internal diameter such that the resulting gas flow is adequate at the lowest CPAP working pressure, which is typically a pressure of about three to four cm H₂O. In one embodiment, the remote venting device 215 is a tube having an internal diameter of about 0.2

inch and a length of about 12 inches, producing a gas flow of about 27 liters per minute, at a pressure of about 12 cm H₂O.

In use, the mask shell 203 receives a gas flow A (see arrow) from the gas supply hose 209 at an essentially constant pressure, while the remote venting device 215 allows an airflow B of exhaled air. The remote venting device 215 may be run parallel to the gas supply hose 206, and additionally may be attached to the exterior of the gas supply hose 206. As shown in the figure, it is preferred that the remote venting device 215 be run substantially parallel to the gas supply hose 206, with the distal end 218 of the remote venting device 215 being positioned as desired in order to direct the exhaled airflow B in a direction and location where it will be least offensive.

FIG. 3 shows a second embodiment of a remotely vented respiratory mask 300. The main components are identical to the mask 200, and the reference numbers of the identical components are retained. The mask 300 includes a remote venting device 315 located internal to the gas supply hose 206. The proximal end 317 of the remote venting device 315 is preferably located in the gas supply hose 206 near the mask shell 203 (solid lines), but may alternately be located inside the mask shell 203 (dashed lines). The distal end 318 may emerge from the gas supply hose 206 at a location distant from the mask shell, as shown. Alternatively, the distal end 318 may connect to a fitting (not shown), with such a fitting including an aperture for venting exhaled air.

FIGS. 4A and 4B show cross-sectional views of the gas supply hose 206 and the remote venting device 315 at the section line C-C of FIG. 3. In FIG. 4A, the remote venting device 315 extends adjacent to an inner surface of the gas supply hose 206. The remote venting device 315 may be attached to an interior surface of the gas supply hose 206. In FIG. 4B, the remote venting device 315 is substantially coaxial with the gas supply hose 206.

FIG. 5 shows a third embodiment of a variable aperture vented respiratory mask 500. The main components are identical to the mask 200, and the reference numbers of the identical components are retained. The mask 500 includes a remote venting device 515 which does not run parallel to or near the gas supply hose 206, but instead is located away from the gas supply hose 206, and may be positioned as desired.

It should be understood that the gas supply hose 206 may run up and over the head of the respiratory mask wearer, may hang down below the respiratory mask, or may be in any other conceivable configuration. The various embodiments of the present invention include a remote venting device which may run with or away from the gas supply hose 206, and likewise may run

up and over the head of the wearer, may hang down below the respiratory mask, or may depart from the respiratory mask in any desired direction.

The present invention results in several benefits to the wearer of the mask. The benefits include a noise reduction, a conversion of the noise into a lower region of the sound spectrum, an improved air jet direction through the placement of the remaining noise farther away from the face of the wearer, and in some embodiments the ability of the wearer to put the distal end of the remote venting device in any desired position.

While the invention has been described in detail above, the invention is not intended to be limited to the specific embodiments as described. It is evident that those skilled in the art may now make numerous uses and modifications of and departures from the specific embodiments described herein without departing from the inventive concepts.

CLAIMS

1. A respiratory mask having a remote venting, comprising:

a gas supply hose;

5 a mask shell adapted to output a gas to a respiratory system of a person, said mask shell adapted to be connected to said gas supply hose; and

a remote venting device having a proximal end operably connected to an internal area of said mask shell to vent carbon dioxide exhaled by said person from said mask, and a distal end, said remote venting device remotely venting a gas out of said respiratory mask so as to substantially reduce inhalation by said person of the exhaled carbon dioxide.

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2. The respiratory mask of claim 1, wherein said proximal end of said remote venting device is attached to said mask shell.

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3. The respiratory mask of claim 1, wherein said distal end of said remote device is distant from said mask shell.

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4. The respiratory mask of claim 1, wherein said remote venting device maintains a gas flow volume of about fifteen liters per minute at a continuous positive airway pressure of about 3-4 cm H₂O.

5. The respiratory mask of claim 1, wherein said remote venting device is a tube.

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6. The respiratory mask of claim 1, wherein said remote venting device is internal to said gas supply hose.

7. The respiratory mask of claim 6, wherein said remote venting device is attached to an inner surface of said gas supply hose.

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8. The respiratory mask of claim 6, wherein said proximal end of said remote venting device is located in said gas supply hose.

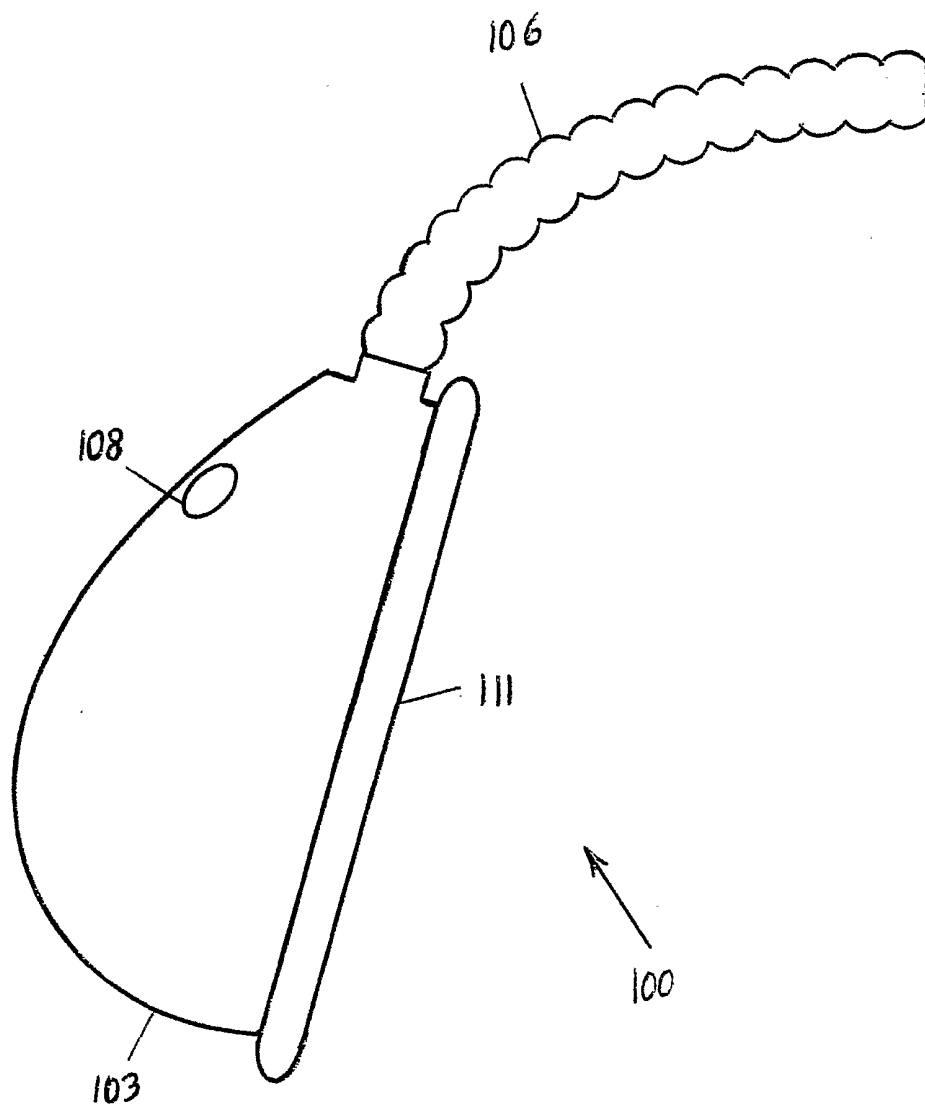
9. The respiratory mask of claim 6, wherein said proximal end of said remote venting device is located in said mask shell.

10. The respiratory mask of claim 1, wherein said remote venting device is outside of said gas supply hose.

11. The respiratory mask of claim 10, wherein said remote venting device is attached to
5 said gas supply hose.

12. The respiratory mask of claim 1, wherein said remote venting device is located entirely independent of said gas supply hose.

10 13. The respiratory mask of claim 6, wherein said proximal end of said remote venting device is located on said mask shell.



RELATED ART
FIG. 1

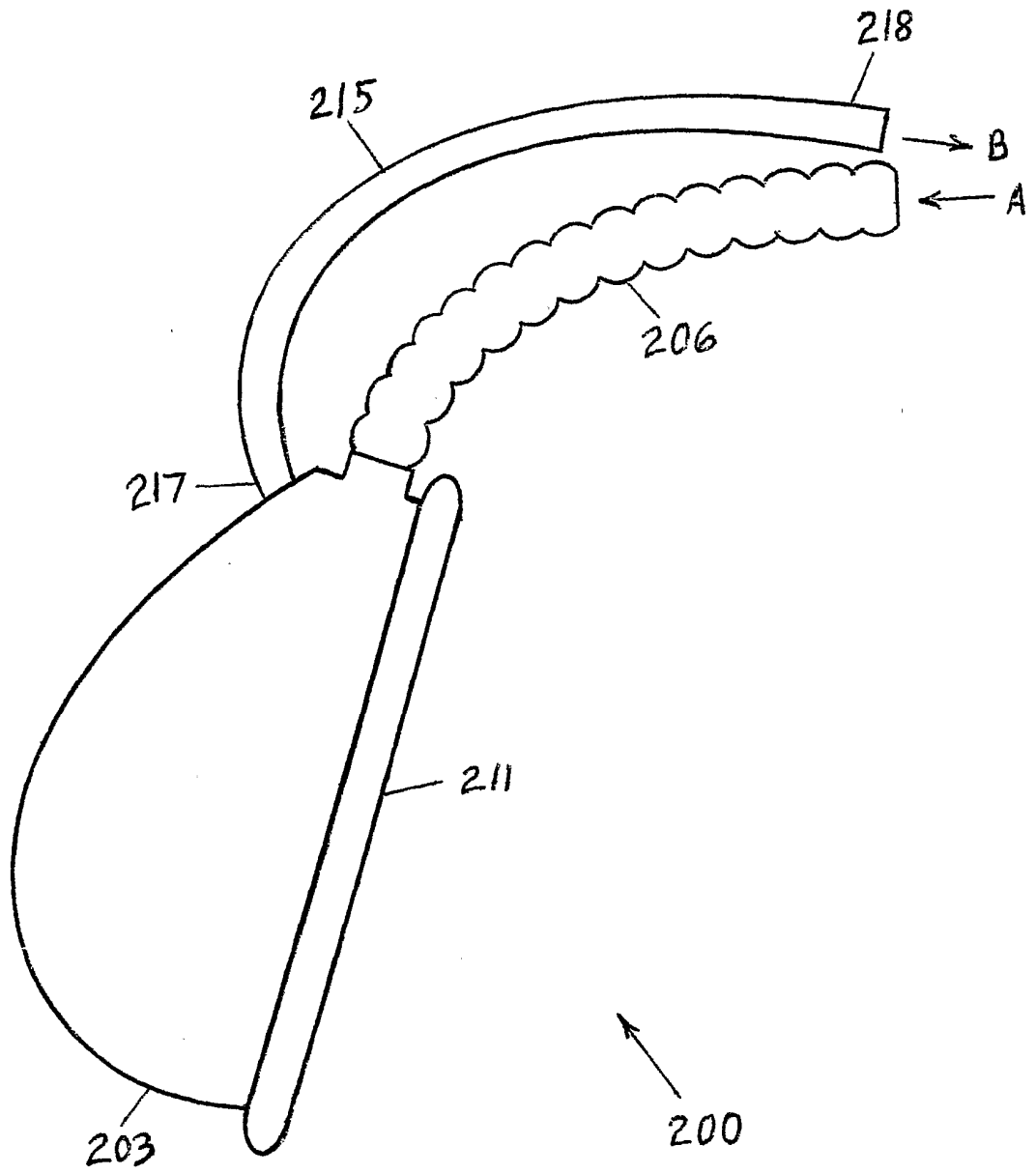


FIG. 2

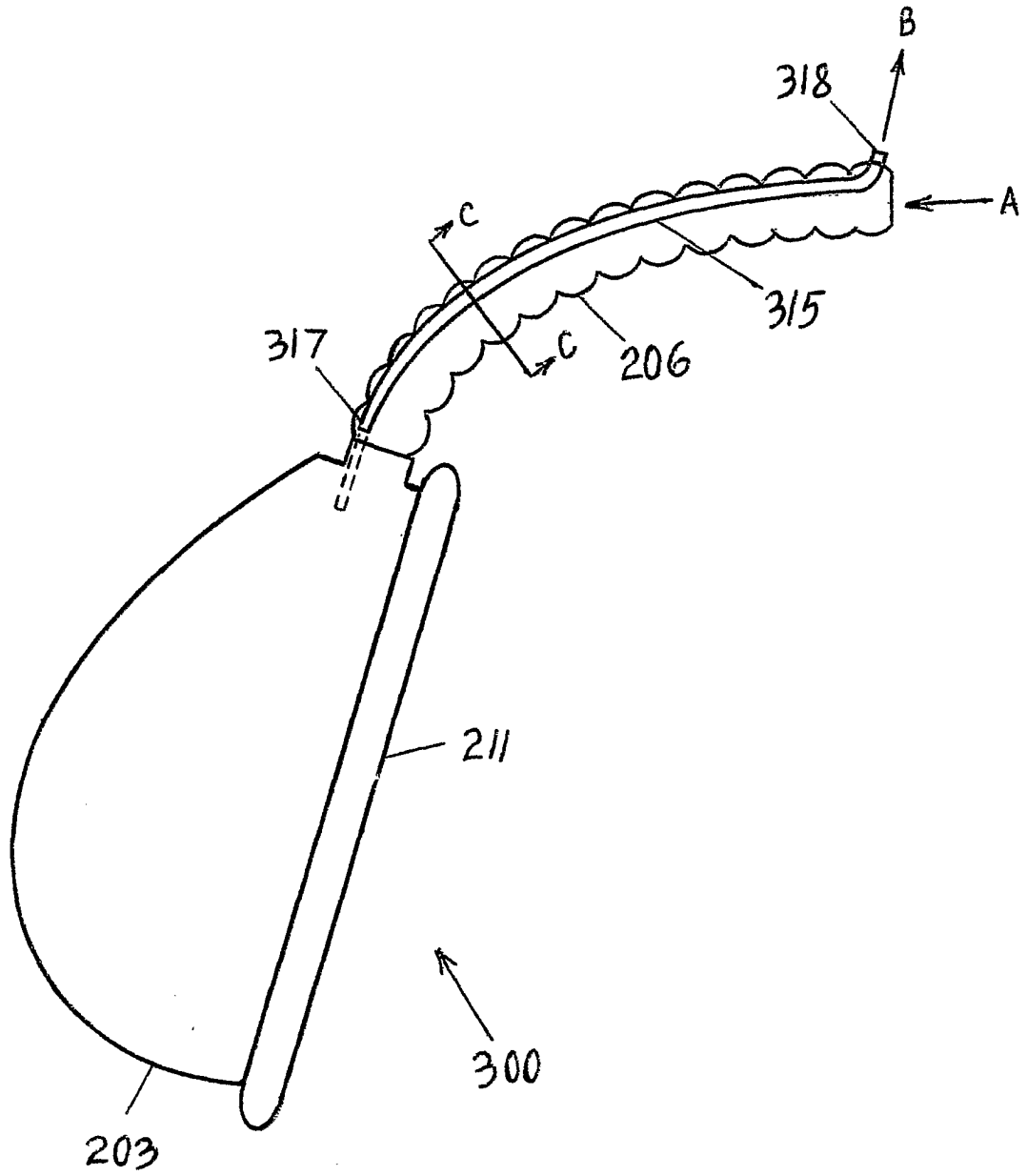


FIG. 3

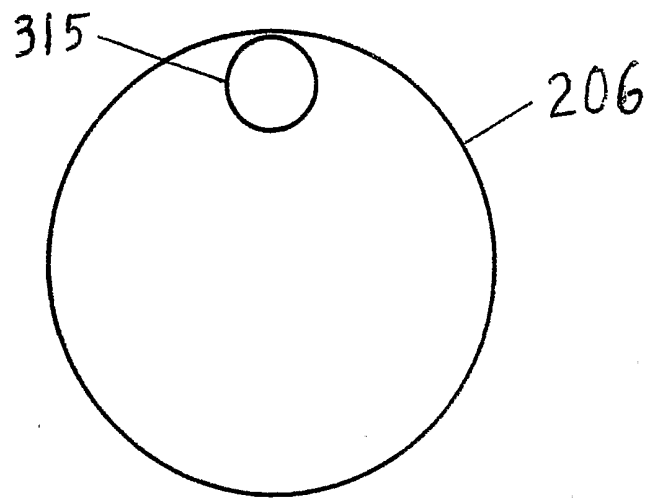


FIG. 4A

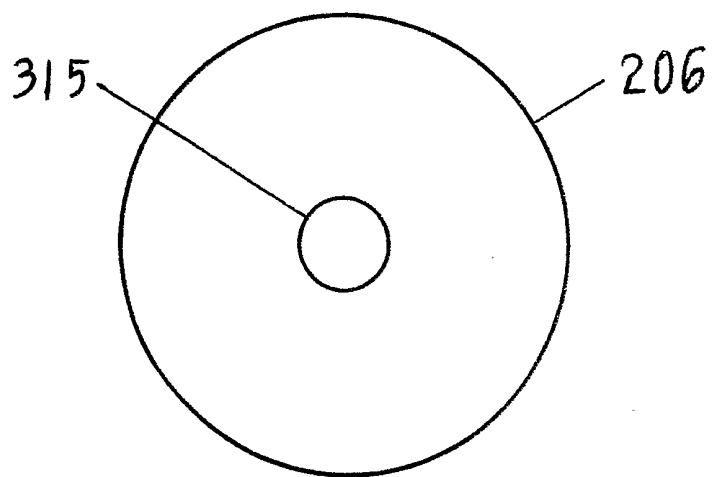


FIG. 4B

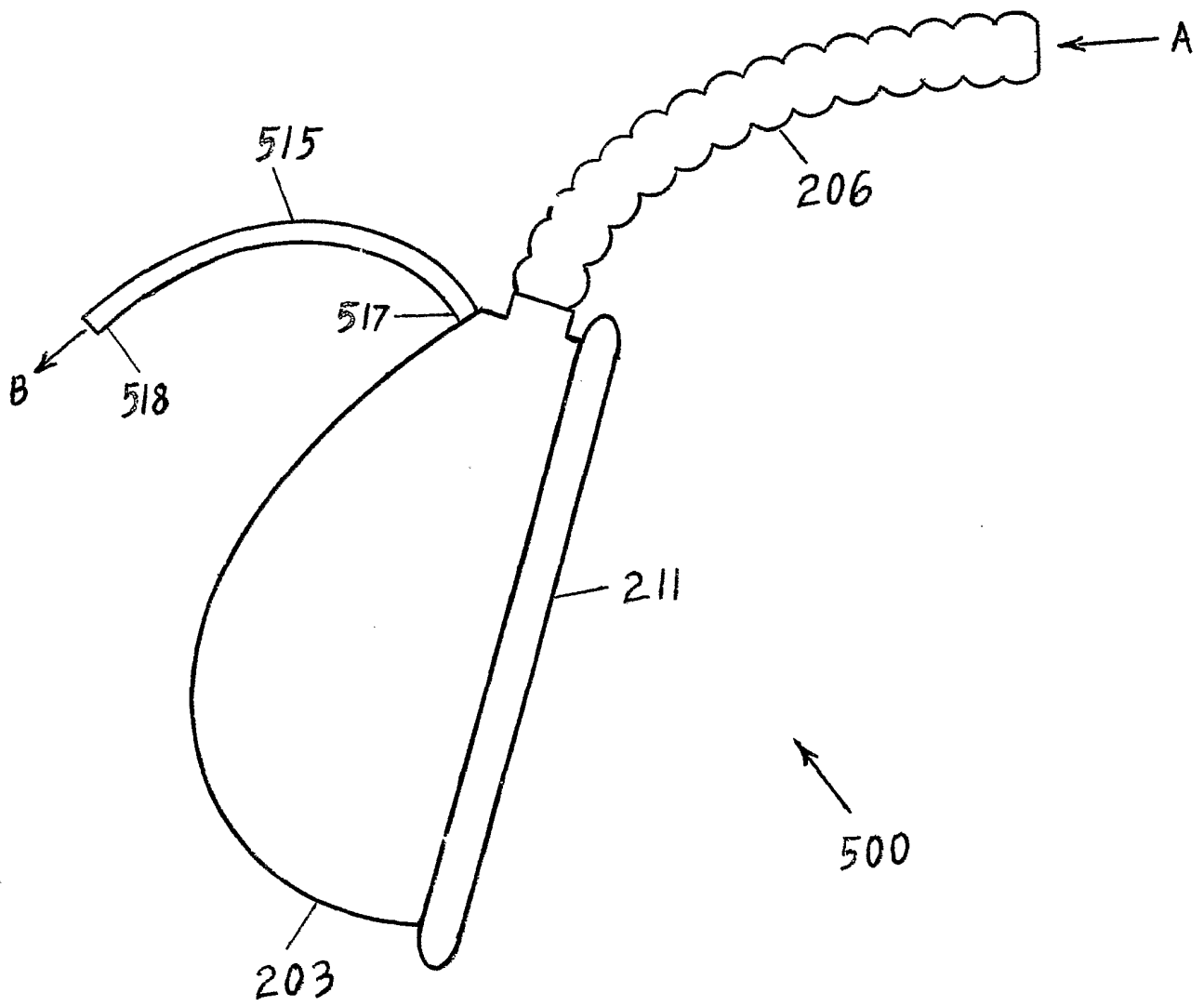


FIG. 5