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RESPIRATORY THERAPY DEVICE FOR KEEPING THE NATURAL RESPIRATORY TRACT OF A HUMAN BODY AND THE USE THEREOF IN ORDER TO PREVENT THE SOUND OF SNORING

The invention deals with a procedure in accordance with the generic term of Claim 1 and a respiratory therapy device in accordance with the generic term of Claim 2. Such devices are used for the treatment of obstructive sleep apnoea. Another application is the prevention of snoring.

Known for use in respiratory therapy are so-called CPAP devices (CPAP = **C**ontinuous **P**ositive **A**irway **P**ressure) for the generating of a positive airway pressure. These devices make air for breathing available in a facemask, with the pressure of the air being constantly higher than the atmospheric pressure by a few hPa. When a patient is breathing in this artificial atmosphere, the positive relative pressure keeps his respiratory system extended wide enough. Thus a CPAP device only effects a 'pneumatic splinting' of the respiratory system. The breathing process itself is based solely on the user's own respiration.

Snoring is an indication of a relaxed and narrow respiratory system. In the case of a high flow rate through the pharynx the air pressure will drop there, because the distance between the air molecules becomes greater with the increased speed. As a result the relaxed tissue collapses in that area and completely blocks the air path. Due to the blockage the negative pressure caused by the flow rate disappears, the respiratory system rears up again and the air will again flow until it reaches a certain speed. This will then immediately lead to the next blockage. The sound of snoring is caused by the quick sequence of the blocking and opening of the respiratory system. A CPAP device increases the air pressure in comparison with the atmospheric standard pressure (relative pressure) to the extent that the reduction in pressure caused by the flow rate can no longer effect a blockage and thus prevents the creation of the sound of snoring.

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When the mechanism that forms the basis of snoring exceeds a certain degree of severity, then the respiratory drive may fail. This constitutes the disease 'Obstructive Sleep Apnoea', which requires treatment and which affects at least 1% of the population. The disease is mainly treated with CPAP devices. Mechanical aids or surgical treatment are further possible therapies, but these are of less importance.

A disadvantage of known CPAP devices is that they have an internal flow resistance, which the patient has to overcome with his respiratory muscles. This results in additional work, because the internal resistance of the device is added to the resistance of the respiratory system of the patient.

Another disadvantage is that the air is warmed when passing through the device and that therefore its relative humidity is reduced. Consequently the air dehydrates the mucous membranes. As dry mucous membranes are not only uncomfortable, but also loose their defensive function, it becomes necessary to humidify the air in connection with respiratory therapy. Therefore CPAP devices are equipped with an integrated air humidifier or the air humidifier is installed as additional device between the CPAP device and the patient.
Further disadvantages of CPAP devices are operating noises, impediments due to the facemask, hygienic risks and high energy consumption.

Therefore the invention is based on the task to create a generic procedure and a corresponding respiratory therapy device, which allows breathing in free atmosphere. Further tasks are the abolition of the facemask, the reduction of the operating noise, the improvement of hygiene and the reduction of the energy consumption.

On the side of the process this task is solved by the characterising features of Claim 1 and on the side of the device by the characterising features of Claim 2.
Advantageous design possibilities of the respiratory therapy device can be found in the Dependent Claims 3 - 6.
The invention removes the disadvantages of the state of technology.
By bringing the entire body or preferably only parts of the body, for example the soft front region of the neck, into a chamber, which has a reduced relative pressure, the collapse of the respiratory system is the area of the pharynx is prevented, because in

that case the higher static pressure of the standard atmosphere is the splinting the respiratory system. In the physical sense this process is a reversal of the CPAP principle that is known from the state of technology. In that way the patient is able to breath in standard atmosphere and has the advantage that the troublesome breathing mask is no longer necessary.
As the inhaled air does not have to flow through technical components, there is no additional respiratory resistance and the respiratory muscles are not subjected to an additional load. The inhaling of standard atmosphere also makes the additional humidifying of the air unnecessary and the expense and work of the air humidifier is no longer necessary.

As the respiratory therapy device in accordance with the invention no longer has to supply the air for breathing, but only has to maintain the negative relative pressure in a chamber, the breathing tube can be replaced by a thin suction tube. However, the air suction ventilator doe not have to move large quantities of air, but only the quantity, which flows into the negative pressure space due to leakages. The required output of the suction ventilator can thus be small and can also be supplied by a battery. In addition, the overall device can be kept quite small, which makes good sound insulation possible.

There are also advantages in the area of safety. A failure of the ventilator does not automatically lead to the rebreathing of CO_2. In a case like that the symptoms of obstructive sleep apnoea would occur again, but that is all that could happen. There are advantages with regard to hygiene, because the inhaled air does not flow through accessory parts such as tube and mask and thus there is no formation of condensation water. That means that the cleaning cycle can be extended significantly. The utilisation of the device by different patients is safe.

As the design of the device is simple and its production inexpensive and because there is no risk involved in its use, it also can be used without a doctor's prescription, e.g. in order to prevent snoring. Devices known for that consist mostly of an object that has to be carried in the mouth or on the teeth. This can easily lead to accidents, for example, when the anti-snoring clasp used comes loose and is swallowed.

The invention is to be explained in greater detail using the application example in the following. The related figure shows the structure of an easily realised possibility.
The sample device consists of a Neck Mask 1, a Suction Tube 2 and a Suction Pump 3. The Neck Mask 1 is a half-open chamber, which spans the front (ventral) neck region like a copula. The edge of the Neck Mask 1 runs around the region, starting from the chin, along both sides of the lower jaw to the sides of the neck and from there continues to the front downwards to the upper end of the sternum. Along the edge a Sealing Device 6 is arranged, which lies on the skin when in use. In this way the open side of the Neck Mask 1 is closed off by the skin of the patient and a closed Chamber Volume 7 is created.
The surface of the neck mask is designed in such way that it is rigid in perpendicular direction to its surface, but flexible in the expansion direction of the surface. Due to this feature the surface of the mask is able to expand and contract during nodding movements of the head and deform sideways in the case of turning movements of the head. In this example this characteristic is achieved by the fact that the covering of the Neck Mask 1 consists of an Elastic Shin 5, for example rubber or another elastomer, over a sub-structure of stabilising Skeleton Stays 4.

At a suitable point, preferably in the lower region of the Neck Mask 1, the Air Outlet 8 is arranged in the form of a connection piece, which leads from the outside through the covering of the Neck Mask 1 into the closed Chamber Volume 7 and via the Suction Tube 2 is connected to the suction side of the Suction Pump 3.
A Neck Band 9 is provided for the wearing and stabilisation of the correct fit of the Neck Mask 1, which could also be equipped with a closing device, preferably with a Velcro closing band.

Via the Suction Tube 2, which is connected to the Air Outlet 8, the Suction Pump 3 creates a constant negative pressure of a few hPa in the closed Chamber Volume 7 during use. This is achieved by a pressure-regulated suction pump or by setting a particular rpm on the suction ventilator. When leakages occur between the skin of the patient and the Sealing Device 6, the leakage volume entering the closed Chamber Volume 7 is sucked off. Neither do head movements cause a change in the negative pressure of the closed Chamber Volume 7, if the Suction Pump 3 or the used suction ventilator have a device for regulating the pressure.

As the Neck Mask 1 covers the entire ventral neck region and at this point is creating an artificial negative pressure atmosphere using the closed Chamber Volume 7, the respiratory system of the patient is splinted by the pressure of the standard atmosphere. A drop in pressure that is caused by the flow in the pharynx of the patient do no longer lead to a collapse of the respiratory system. Snoring noise can no longer be generated. Patients with obstructive sleep apnoea can breath freely and again enjoy a healthy sleep.

List of the Used Reference Signs

1 Pressure-resistant Cap
2 Suction Tube
3 Suction Pump
4 Skeleton Stays
5 Surface of the Chamber
6 Sealing Device
7 Negative Pressure Chamber
8 Air Outlet
9 Neck Band

Patent Claims

1. Procedure for keeping the upper respiratory system of a human being open via an air pressure splint,
characterised by the fact that the respiratory system is exposed to the pressure of the atmosphere and that the extra-corporeal area of the respiratory system is exposed to an artificial negative pressure, whereby the difference between the internal atmospheric pressure and the external negative pressure is kept constant.

2. Respiratory therapy device, **characterised by** a pressure-resistant hollow body, which surrounds the human body while keeping the natural breathing opening free and which at least in the extra-corporeal region of the respiratory system forms a Negative Pressure Chamber (7), whereby the Negative Pressure Chamber (7) is connected to a Suction Pump (3) via a Suction Tube (2).

3. Respiratory therapy device in accordance with Claim 2,
characterised by the fact that the pressure resistant hollow body is designed as a Cap (1), the edge of which runs around the frontal neck region, starting from the chin, along both sides of the lower jaw, the sides of the neck and the region of the collarbone to the upper end of the sternum and is designed in such way it covers the area of skin surrounded by its edge like a copula, while maintaining a distance to the skin.

4. Respiratory therapy device in accordance with Claim 3,
characterised by the fact that the Pressure-resistant Cap (1) is made of a material, which is stable in perpendicular direction to the body surface and in the direction of the surface is so flexible that it allows movements of the head.

5. Respiratory therapy device in accordance with Claim 4,
characterised by the fact that the Pressure-resistant Cap (1) is constructed of a preferably integrated sub-structure made of stabilising Skeleton Stays (4) and an elastic Skin 5 lying on top of it, for example made of rubber or another elastomer.

6. Respiratory therapy device in accordance with Claim 1,
characterised by the fact that the Suction Pump (3) is equipped with a pressure-regulating device for generating and maintaining a negative pressure that can be pre-selected.