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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
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(54) **Title: WEARABLE NEBULIZER**

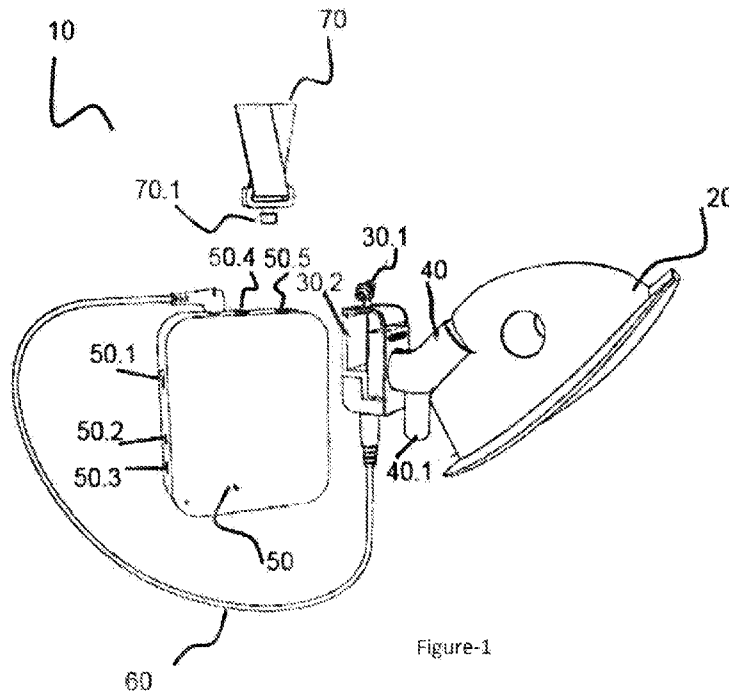


Figure-1

(57) **Abstract:** The invention particularly relates to a wearable nebulizer (10), which operates via a rechargeable power source positioned into a power unit (50), without being connected to the electrical system during its functioning. A nebulization unit (30) and the power unit (50) are separated and connected via a connection cable (60). The nebulization unit (30) can be connected to the patient via a mask (20) or a mouthpiece and the power unit (50) can be worn by the patient through wearing means (70). The invention provides, at the same time, a separation of inhalable fine particles (90) from coarse particles (80) in order to make only the fine particles (90) reaching the patient. A collection chamber (40.1) collects the coarse particles (80), which can be afterwards re-introduced into the medicine chamber (30.2) of the nebulization unit (30).

- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

DESCRIPTION

WEARABLE NEBULIZER

The Related Art

The present invention relates to easy-to-use mobile nebulizer device, which converts
5 a therapeutic dose of a liquid medicine into an aerosol vapour in the form of
respirable particles, and facilitates their intake and delivery to the lungs via respiration
as quick as possible.

More particularly, the present invention relates to a nebulizer device, which enables
10 connection of the mask or mouthpiece providing respiration with the medicine unit
where the medicine is placed, and disintegrating the liquid medicine into respirable
particles of vapour form, which is mobilized without the need for being held by hand
by means of a connection to the electronic unit required for operation of the device,
and which comprises an apparatus positioned between the units and providing
separation of coarse particles.

15 The Prior Art

Recently, use of medicine via nebulization is being preferred more and more due to
advantages such as local and quick effect, use of medicine at a lower dose, and the
scarcity of side effects compared to systemic drug use.

These are devices that provide effective administration of medicine to infants,
20 patients who can not be administered a measured dose, and patients with severe
asthma.

Nebulizer devices vaporize liquid-form medicine via sound waves, a contracting-
and-loosening plate, or pressurized air, and thus enable their intake by respiration.

3 Types of nebulizers are used in the prior art.

25 Jet nebulizers, ultrasonic nebulizers, and vibrating mesh nebulizers are used in the
prior art. Jet nebulizers continuously generate aerosol at the moments of inhalation,
exhalation, and holding breath. Ultrasonic nebulizers generate aerosol particles via

high frequency vibration of the piezoelectric crystal. The electric current reaching the piezo electric crystal form a high frequency vibration at the crystal. This vibration causes emission of high frequency sound waves, which impact on the top surface of the liquid and turn it into aerosol. Vibrating mesh nebulizers comprise a plate which contracts and loosens when in contact with electric current. Approximately 1000 perforations are found on this plate, through which aerosol medicine particles are formed by micro spraying.

Nebulizers are used with a mouthpiece or a mask.

Nowadays, nebulizers are used as plugged in or their power demands are met by means of batteries.

Jet nebulizers are based on the idea of passage of a gas, which is pushed strongly via an electrical compressor, or which is pre-compressed (via oxygen or air), through a small hole called a, and converting the liquid found around this hole into vapor-mist form by suction via negative pressure while passing through the hole. The electrical compressor is required to be plugged in continuously.

In this case, the device is required to be used in close position to a plug-socket or via an interconnecting cable. Besides, these devices are quite noisy and heavy, since they also use compressor for compressing air.

With recent improvements, ultrasonic and mesh nebulizers are developed, which can be used with the help of a battery and thus without being plugged in. They can be used externally with rechargeable power sources.

Ultrasonic and mesh nebulizers are smaller and quieter, and they provide faster nebulization, while not changing the concentration of the remaining medicine. They are particularly suitable for children and home-treatment purposes.

During use of these devices, mask and mouthpiece are used, and especially in mesh nebulizers, the unit ensuring nebulization is required to be used in connection with a mask or mouthpiece.

In this case, the whole device is required to be hold manually together with the mask and kept in a fixed position during the treatment.

Since the medicine is required to be taken by respiration, during the nebulization process, the device is required to be held properly at the mouth region in order to provide proper intake of the medicine, and in some medicine types, to prevent harm on the face region.

5 In the prior art systems, the nebulization unit disintegrating the medicine and ensuring respiration, and comprising the power and medicine chambers is found as a single body, where the mask or mouthpiece is used by being connected to this body. This situation necessitates the whole device being held by the patient or somebody else during the treatment. Use of the device together with its main body does not permit
10 holding the mask by putting it on the head.

Considering that these kind of devices are used for 10-25 minutes for treatment purposes according to the type of the medicine, the course of treatment, and the type of disease, and considering the weakness and fatigue of the patient, and use of the device on children, maintaining the device in fixed position around the mouth region
15 together with the whole device body within the set time period would be difficult, and thus improvement is necessitated in the relevant technical field.

Moreover, since the nebulization devices used in the prior art disintegrate the medicine by various methods, particles of different sizes occur in each case. Standard and uniform-size particles can not be formed.

20 During respiration, particles of different sizes may stick on different parts of the mouth, throat, and trachea of the patient due to the difference in their sizes and weights. Especially coarse particles have limited mobility due to their weight, and thus they might stick on the mouth and trachea of the patient before they reach the lungs.

Among the particles of various sizes obtained with the prior art nebulization devices,
25 while finer particles reach the depths of the lungs, the coarser particles stick especially on the throat of the patient with the impact of the centrifugal force.

This may lead to situations where non-negligible amounts of the medicine are not delivered and the medicine is used below the required dosages, and thus has negative effect on the relief and recovery of the patient.

Moreover, since this situation can not be controlled and the actual amount of medicine delivered can not be determined, it may have negative effects on the use of the medicine and the situation of the patient. Since the patient can not take the adequate dose and can not feel relief, he/she may tend to use the medicine again, and thus consumption of the medicine increases, and furthermore, other kinds of illnesses may occur as a result of the residue medicine stuck on the throat or that would reach the stomach as a result of swallowing.

When the prior art embodiments and the relevant applications are examined, complicated and high-cost systems and nebulizer systems where transmission is ensured to the mask via an interconnection cable fixed on the power unit are encountered.

Moreover, when the prior art embodiments and relevant applications are examined, systems for disintegrating the medicine into particles and facilitating its respiration via various means are encountered.

The crucial points in the nebulization devices that are especially manufactured for use at home are to provide intake of medicine effectively via respiration, and at the same time ensure ease of use and facilitate control of the dosage of medicine taken. It is desired to provide ease of operation for the user and simple and light components to be used in the mechanism for complete grasp on the device during use.

When the intended purposes of nebulizer devices are considered, another point of great importance is to ensure delivery of effective dose to the lungs.

At this point, the mechanism of the present invention is a mobile nebulization device, which is easy to use to meet all the demands, measures the amount of medicine taken, and provides respiration of suitable particles by separating particles of different sizes and weights.

Purpose and Brief Description of the Invention

Purpose of the invention is to provide use of nebulizers, which operate via rechargeable internal or external power sources positioned on a main body, without being plugged in, such that the nebulization unit and the body would be separated

during use, and to provide effective use of medicine by separating respirable and coarse particles and providing re-use thereof.

Another purpose of the invention is to provide use of the mask and the nebulization unit together without being held manually and by being fixed without the need for
5 holding during use.

Another purpose of the invention is to provide separation of the medicine particles of different sizes and weights formed in the nebulization device.

Another purpose of the invention is to provide recovery and re-use of coarse particles.

Another purpose of the invention is to provide delivery of the required dosage to the
10 lungs of the patient with the least possible loss.

Another purpose of the invention is to eliminate the loss and other sickness effects to be caused by coarse particles during use.

With the present invention, in the nebulizers which can be used via internal or external power sources without being plugged in, the use of the nebulization unit in connection
15 with the mask and without being held manually is facilitated by means of forming a connection between the unit that provides the required power for nebulization and the unit that provides nebulization, the hands of the user are freed and thus intake of medicine is facilitated, and moreover, separation of the medicine particles of different
20 sizes and weights formed in the nebulization device and recovery and re-use of coarse particles are provided, and delivery of the required dosage to the lungs of the patient with the least possible loss is also provided while eliminating the loss and other sickness effects to be caused by coarse particles during use.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 gives the mounted view of all parts of the nebulizer device.

15 Figure 2 gives the mounting details of the mask and the nebulization unit.

Figure 3 gives the side view of the mounted state of the mask and the nebulization unit.

Figure 4 gives the perspective view of the adaptor.

Figure 5 gives the side view of the adaptor.

Figure 6 gives the representative view of the adaptor particle direction.

Figure 7 gives the view of the adaptor mounting pieces.

REFERENCE NUMBERS

- 5 10. Wearable Nebulizer device
- 20. Mask
- 30. Nebulization unit
- 30.1. Plug
- 30.2. Medicine chamber
- 10 40. Adaptor
- 40.1. Collection chamber
- 40.1.1. Housing
- 40.3. Inlet direction
- 40.4. Receiving surface
- 15 50. Power unit
- 50.1 On/Off button
- 50.2. Charge indicator
- 50.3 USB connection port
- 50.4. Hanger connection
- 20 50.5. Warning lamp
- 60. Connection cable
- 70. Hanger
- 70.1 Lock
- 80. Coarse particle
- 25 90. Fine particle

DETAILED DESCRIPTION OF THE INVENTION

The present invention particularly relates to providing use of a nebulization unit (30) and a power unit (50) in nebulizers that can operate via a rechargeable internal or external power source positioned in the power unit (50), without being plugged in, and
5 at the same time, ensuring effective use of medicine by separating respirable fine particles (90) and coarse particles (80) and then re-use thereof.

The invention has the same operating principle with the ultrasonic and mesh nebulizer devices described in the prior art as comprising internal and external power source and usable without being plugged in, so that it provides ease of carrying and use in
10 addition to ensuring effective use of and saving from medicine.

The wearable nebulizer device (10) is formed of the pieces, general views of which are given in Figure 1.

The power unit (50) meets the energy demand of the device. It operates with a battery or a rechargeable battery.

15 The power unit (50) comprises an on/off button (50.1) that enables turning the device on and off, a charge indicator (50.2) that is off when the device is fully charged and on while the device is being charged, a micro USB connection port (50.3) that enables charging of the device easily through a computer or a plug, a hanger connection (50.4) where the lock (70.1) of the hanger (70), which facilitates being wearable and mobile
20 and facilitates wearing on the user's neck, is mounted, and a warning lamp (50.5) showing the operating status of the product.

The power unit (50) is carried by being positioned on the neck of the user via the hanger (70).

Moreover, it is made of a long-life and light battery. It provides the required energy for
25 the nebulization unit (30). Following placement of the power unit on the neck of the user, energy is transmitted via the connection cable (60).

In this way, the nebulization unit (30) and the power unit (50) can be separated from each other, so that ease of carrying and usage is obtained.

Differing from the prior art devices, the nebulization unit (30) is not connected directly

to the power unit (50), and energy is transmitted through a connection cable (60), so that use of the nebulization unit (50) by being connected to the mask (20) is provided.

In this way, the power unit (50), which forms most of the weight of the device required to be held during use could be made mobile and easy to handle.

- 5 The nebulization unit (30), which is actually light, and which provides conversion of the liquid into particles and respiration thereof, is separated and directly connected to the mask (20). In this way, treatment can be made without the requirement for the patient to hold anything by hand.

10 Medicine to be used in treatment is placed into the medicine chamber (30.2) found on the nebulization unit (30). The plug (30.1) is placed and the device is made ready for use. Aerosol medicine particles are formed by means of micro spraying via contraction and loosening of the plate having 1000 perforations, when electric current is transmitted to the nebulization unit (30) through the connection cable (60).

15 In order to deliver the particles to the lungs quickly and in proper amounts, the nebulization unit (30) needs to be found at the closest distance from the mask (20).

The particles formed are delivered to the lungs during respiration by means connecting the mask (20) to the nebulization unit (30) front part or being transmitted via the adaptor (40).

20 Masks (20) are standard in the market and they can be connected by using an appropriate adaptor (40) or a mouthpiece for providing ease of use, since they are disposable and required to be replaced all the time.

25 The crucial point in the wearable nebulization device (10) of the invention is providing the use of the power unit (50) supplying energy and the nebulization unit (30) separate from each other. In order to provide delivery of the particles to the lungs quickly and in proper amounts, the nebulization unit (30) is directly connected to the mask (20) and worn on the face of the user together with the mask (20) in a light form, so that it does not need to be held by hand.

In this case, the required energy is transmitted through the connection cable (60), and the nebulization unit (30) is connected to the mask (20) directly and/or via an adaptor

(40). The connection cable (60) can be set in desired length.

In this way, the power unit (50) is worn on the neck externally and the mask is worn on the face (20), so that the whole system can be used without any requirement for holding by hand.

- 5 The adaptor (40) connected between the mask (20) and the nebulization unit (30) enables use with any brand of standard mask (20) and at the same time provides particle separation.

However, the device can also be used by being connected directly to the mask (20) without using the adaptor (40).

- 10 The adaptor (40) also performs the task of a separator.

The collection chamber (40.1) found on the adaptor (40) catches the coarse particles (80) coming out of the device (10) and enables their re-use.

- 15 Among the particles of various sizes obtained with the prior art nebulization devices, while finer particles (90) reach the depths of the lungs, the coarser particles (80) stick especially on the throat of the patient with the impact of the centrifugal force.

This may lead to situations where non-negligible amounts of the medicine are not delivered and the medicine is used below the required dosages, and thus has negative effect on the relief and recovery of the patient.

- 20 The adaptor (40) is designed with a gradient with the purpose of eliminating this drawback, and a receiving surface (40.4) is formed for coarse (80) and fine (90) particles following the inlet part.

The aerosol medicine particles (80, 90) formed by micro spraying are transmitted from the nebulization unit (30) to the adaptor (40) at a specific angle at the inlet direction (40.3) seen in Figure-6.

- 25 The lighter fine particles (90) coming close to the receiving surface (40.4) are directed towards the outlet with the pressure effect formed before them, and thus reach the mask.

Meanwhile, coarse particles (80) can not change their direction with the impact of the momentum they gained at the moment of exit, and thus hit on the receiving surface (40.4) and start to accumulate as a result of compacting.

5 Coarse particles (80) accumulating on the surface flow downwards with the impact of the gravity, and then reach the collection chamber (40.1) due to the design of the adaptor (40).

Afterwards, the collection chamber (40) shown in Figure 6 is taken out of its housing (40.1.1) and discharged into the medicine chamber (30.2).

10 In this way, the whole dose of required medicine would be used and respired in the form of fine particles (90).

This both ensures dose control and prevents loss of medicine and at the same time other possible diseases would be avoided by preventing accumulation at the throat of the user.

15 The invention provides use of the nebulization unit (30) and the power unit (50) separately, and eliminates the need for holding the power unit by means of wearing it on user's neck or placing it on a surface, and the nebulization unit is positioned on the mask in order to enable delivery of particles to the lungs in a quicker manner and in proper amounts, and at the same time, provides effective use of medicine by means of separating the respirable fine particles (90) and the coarse particles (80) by an
20 adaptor (40), and then providing re-use of the coarse particles.

CLAIMS

- 1- The invention is a wearable nebulizer device (10) used in treatment of respiratory tract diseases and eliminating the need for holding a power unit providing the required electrical current and a nebulization unit (30) converting medicine found in liquid form into respirable particles of vapor form, **and it is characterized in that;** it comprises transmission of electrical current required by the nebulization unit (30), which forms aerosol medicine particles via micro spraying by contraction and loosening, from the power unit (50) by means of a connection cable (60) of desired length, use of the nebulization unit (30) as a whole with a mouthpiece and/or mask (20) enabling respiration, by means of being directly connected to this mouthpiece and/or mask (20), a hanger (70) enabling wearing of the power unit (50), from which the energy required by the nebulization unit (30) is transmitted, on the neck of the user separate from said nebulization unit (30) and mask (20), a hanger connection (50.4) formed on the power unit (50), and a lock (70.1) providing connection of the hanger (70).
- 2- Wearable nebulizer device (10) according to claim 1, and it is characterized in that; it comprises a USB connection port (50.3) which enables easy charging.
- 3- Wearable nebulizer device (10) according to claim 1, and it is characterized in that; it comprises a connection cable (60), which provides transmission of current between the power unit (50) and the nebulization unit (30), and which can be extended as desired.
- 4- Wearable nebulizer device (10) according to claim 1, and it is characterized in that; it comprises an adaptor (40) separating the coarse particles (80) and the fine particles (90) formed at the nebulization unit (30), a receiving surface (40.4) formed at a specific angle within said adaptor in order to cause the coarse particles (80) hit thereon, and a collection chamber (40.1) providing collection of the coarse particles (80) that accumulate by hitting and compacting on the receiving surface (40.4) formed with said specific angle.

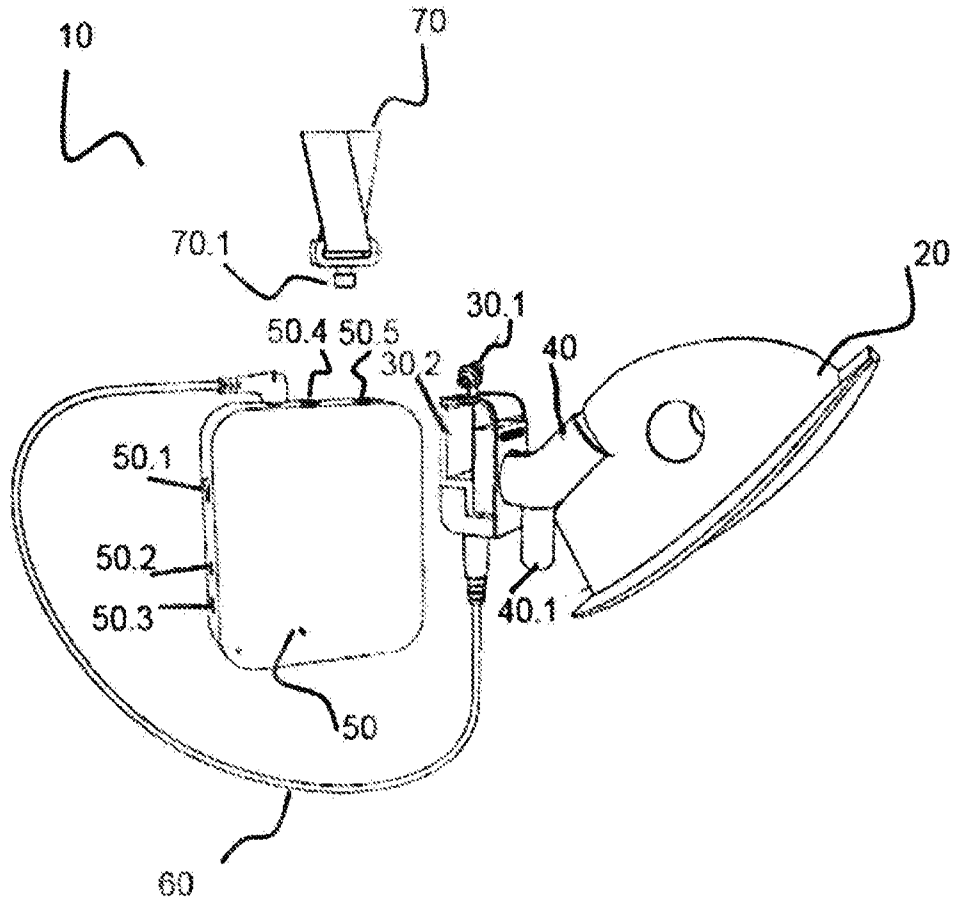


Figure-1

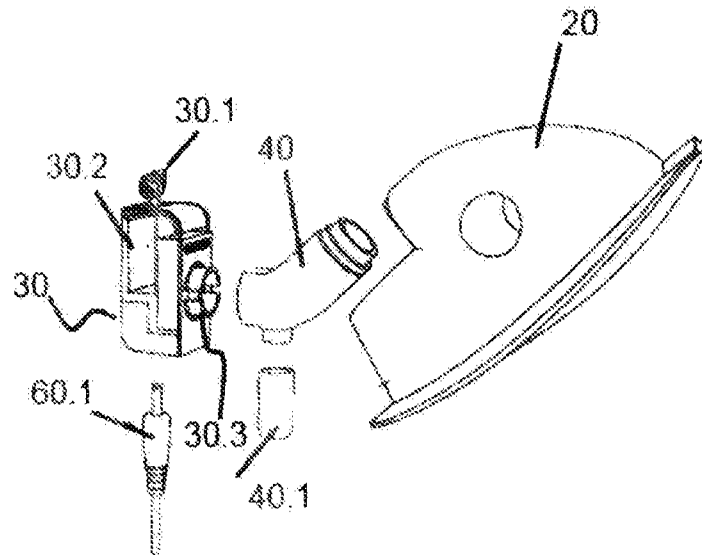


Figure-2

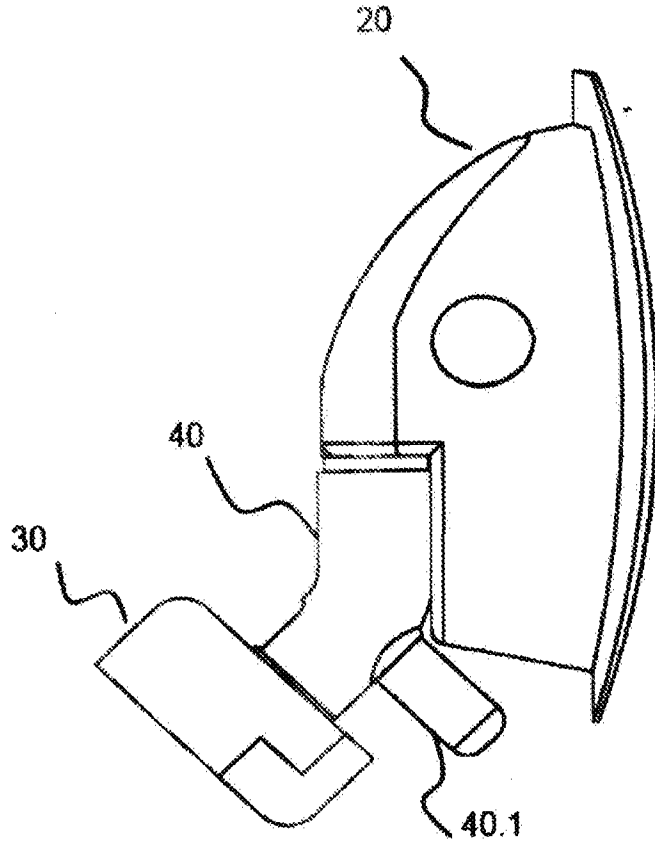


Figure -3

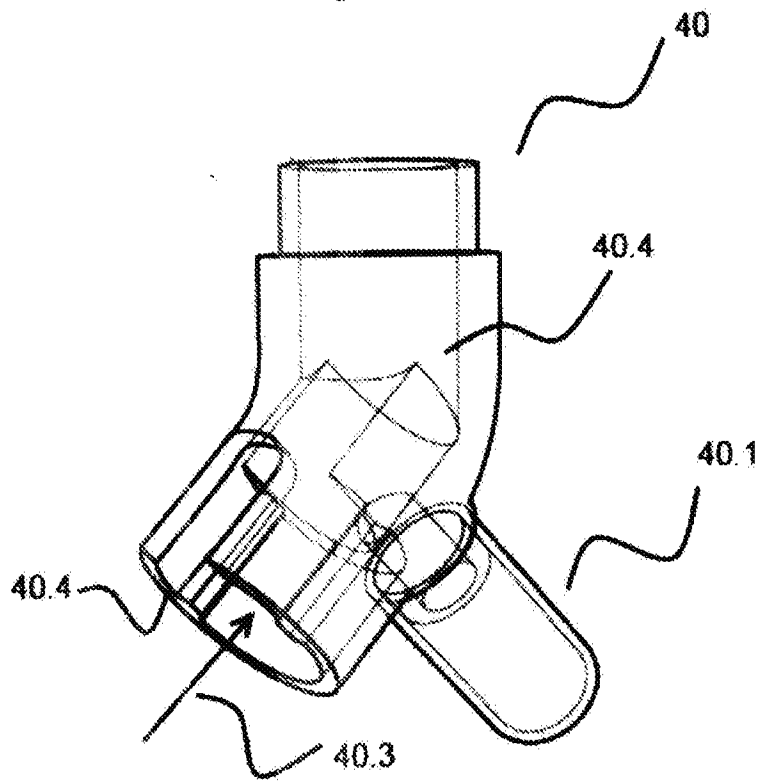


Figure -4

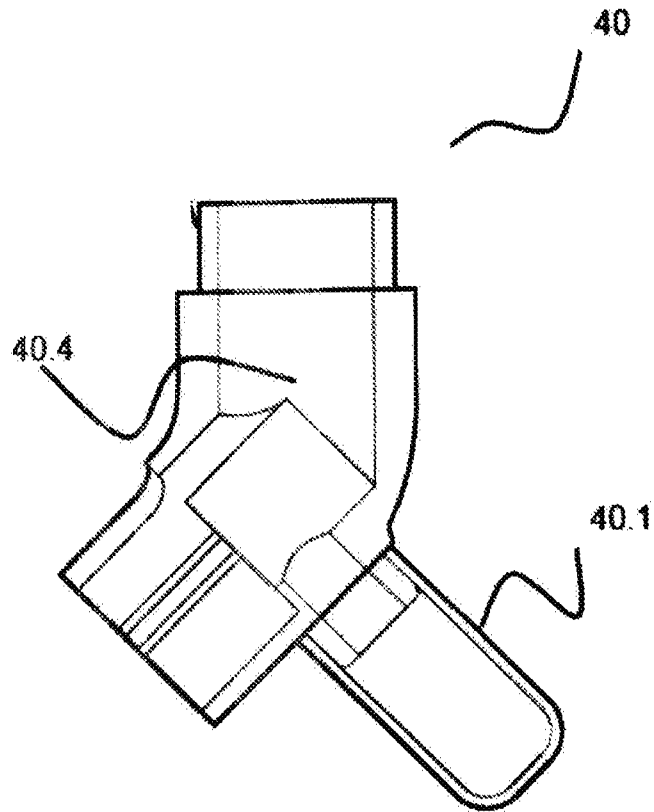


Figure -5

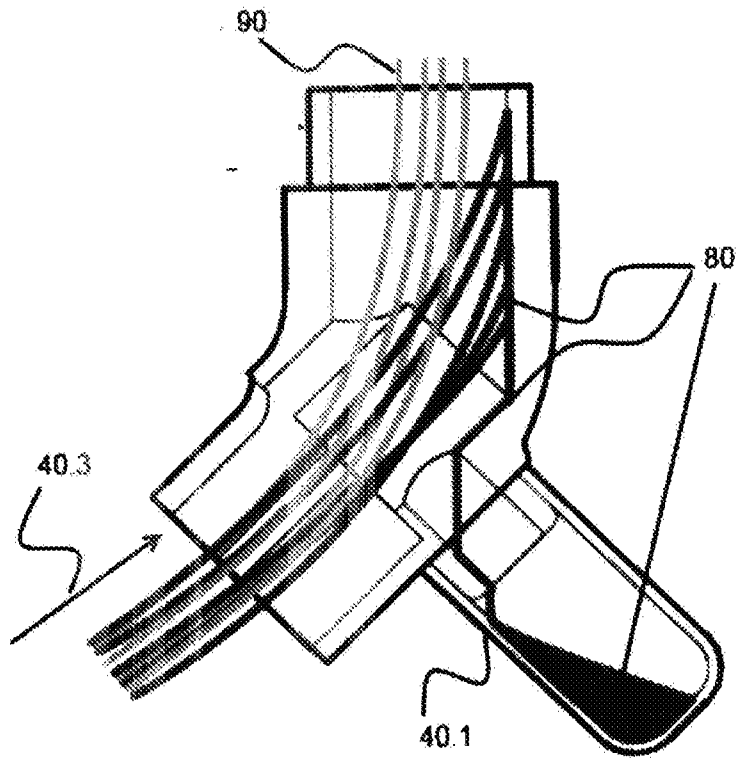


Figure -6

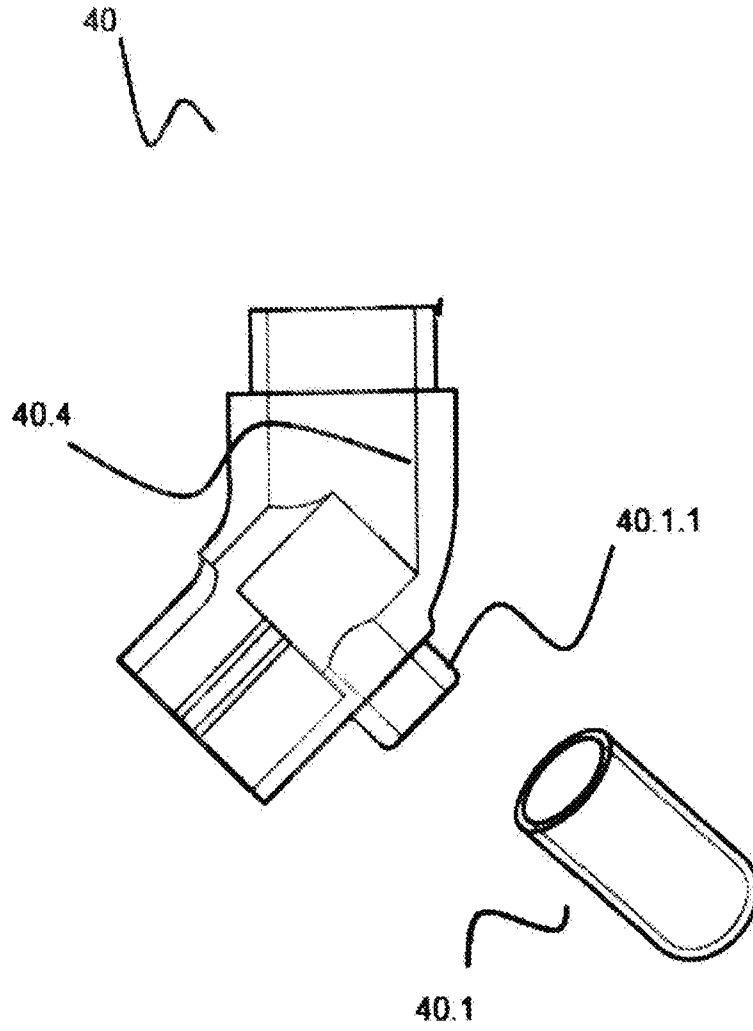


Figure -7

INTERNATIONAL SEARCH REPORT

International application No PCT/TR2015/000043
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A. CLASSIFICATION OF SUBJECT MATTER
 INV. A61M11/00 A61M15/00
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7 600 511 B2 (POWER JOHN [IE] ET AL) 13 October 2009 (2009-10-13) Title abstract figure 1 and 2 ref 1 figures 7 ref 50,52 figures 10 and 11 ref 50-52 figures 23-25 ref 250,253,260,261 column 1, line 22 - line 25 column 2, line 3 - line 11 column 3, line 25 - line 27 column 4, line 23 - line 26 column 4, line 38 - line 67 column 4, line 65 - line 67 column 5, line 4 - line 10 column 8, line 44 - line 59 column 9, line 48 - line 67 column 10, line 1 - line 4 column 11, line 3 - line 10 <div style="text-align: right;">-/--</div>	1-4

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

18 June 2015

Date of mailing of the international search report

30/06/2015

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Cecchini, Stefano

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2015/000043

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	column 11, line 59 - line 65 column 12, line 1 - line 7 column 15, line 1 - line 3 column 15, line 9 - line 37 claim 1 claim 17 claim 25	
Y	----- WO 2011/107860 A1 (TRUDELL MEDICAL INT [CA]; UNIV WESTERN ONTARIO [CA]) 9 September 2011 (2011-09-09) figures 1 ref 120,142 figure 3 ref 180 figure 9 ref 120 paragraph [0031] - paragraph [0032] paragraph [0035]	1-4
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/TR2015/000043

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