

1. **Title of the invention: Antibacterial Nano breathing Nasal Filter**
2. **Innovator(s) who have contributed or conceived an essential element of the invention, either independently or jointly with others during evolution of the technology concept or reduction to practice:**

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(*Students are requested to give their home address and email other than squirrel mail as well)

3. **Non-Confidential description of the invention in layman's Language:**

A. Abstract in 100 words

A nanotechnology based nasal air filter for breathing, the said filter comprising a base body (a) and at least two concha cartridges (b, b'). A nano-pad adapted to be fit inside a body vessel (a3) of the base body (a). Each of the concha cartridges (b, b') is adapted to receive a plurality of antibacterial layers (m1, m2, m3). The nasal filter as per the present invention comprises of micro-nano pillars, to remove all the undesirable matter from inhaled air. The herein disclosed nasal filter is capable of mimicking the natural breathing process, is compact in structure and is comfortable for the user to use.

B. Use Case

The present subject matter described herein relates to a nasal air filter, and more particularly, the invention relates to a nasal air filter based on nanotechnology for breathing by human beings that has antibacterial feature, which can mimic the natural breathing process and is comfortable to use. The Nasal filter will be useful for people living in polluted cities as well persons having allergy and suffering from Asthama & Bronchitis.

Take reference from Annexure-A for filling this section

C. Keywords

Breathing filter+ Nose filter+ Micro Breathing Filter+ Nano Breathing Filter+ Micropillars+ Nano Mats+ Antibacterial+ Flow rate+face mask+ nose filters

Please be noted that the above keywords will be utilized by the IPR Cell for preparing Patent Search Report

Note: The above Information will be circulated to several agencies for Commercialization purposes.

4. How does this invention relate to new processes, machines, compositions of matter, etc.? Please cover the following points:

(a) Describe the invention in detail for technical evaluation. Please use additional sheets for sketches, drawing, photographs and other materials that help to illustrate the description. (Annexure-II Attached)

(b) What is Novel in the invention?

The current invention overcomes the requirement of bulky breathing filters embedded with face strap, the current invention has capability to filter at Nano-scale & also has the ability to kill microorganisms through the internal cavity applied with anti-bacterial agent. The earlier nasal filters come without the feature of sanitization of internal cavity of the filter, but the current Nasal filter overcomes the drawbacks and has a feature of sanitization for the micro-organisms.

The Novel feature of the nasal filter is that it doesn't minimize the suction capacity of breathing process & the air flow suction remains the same to that of natural breathing process, mimicking the natural breathing process, hence this Nasal filter can be used during walking and running due to its lightweight and the clipping capacity of the silicone body parts at the top of the nasal filter.

(c) What is the "inventive" step in your invention? Is the step non-obvious to a person from related fields?

The current invention has several inventive steps & the steps involved in the development of this invention is non-obvious to a person skilled in related fields. The current invention has several parts with abbreviations & functionality given below

a- Body a1- exhale valve a2 – septum a3- body vessel b- concha cartridge b1- concha body b2- nozzle cap ce- concha exhale i- inhale port m-micro pad n-nano pad NAF- Nasal Air Filter

"a"-Base body made up of silicone material to provide adhesion capacity with the nose, so that the Nasal filter doesn't drop while running and walking, the base body also has a clipping ability to hold the nose properly and doesn't allow any air to pass through the distance between the nose and nasal filter.

"m"-Micro Pad contains adhesion strips having micro-Nano-pillars, these micro-Nanopillars trap the PM 2.5 particle mimicking the natural nasal property. The PM 2.5 particles get entrapped in the micro-Nano-Pillars, thereby allowing only clean air.

"n1", "n2"- Nano Mats are placed at n1 & n2 for the adhesion of pathogenic bacteria's & other Nano particles, allowing only air to pass through it. The micro-nano pad also

entraps the moisture present in the air allowing only dry air to pass through, which will be beneficial for the patients of Asthma & Bronchitis.

“m1”, “m2”, “m3”- Antibacterial gel layered over the surface to sanitize the area free from any bacterial germination in the nasal filter cavity.

“Ce”- Concha Exhale opens only at the time of inhaling air and gets closed during breathing the air out, the “a” portion opens up allowing the air go out while exhaling, during the process of exhaling the “Ce” gets closed.

- (d) What are the advantages of the present invention over comparable inventions available in patent literature? Please attach a summary of your patent search*.

The current invention has several advantages over existing nasal filters i.e. US2282681A, US6701924B1, US20040261798A1, US6561188B1, US20070227542A1

1. The current invention doesn't need insertion inside the nostrils.
2. The invention doesn't need any face straps for support, since it has a silicone body with clipping ability for attachment to the nose.
3. The current invention works at 2 scales i.e. Micro & Nanometer
4. The current invention has cell adhesion properties for bacterial cells, PM2.5 particle entrapment through micro-nano pillars.
5. This invention also sanitizes the internal cavity of the nasal filter through antibacterial gel, mimicking the natural process of internal nasal cavity where the mucus is produced after detecting a pathogen.
6. The person wearing the nasal filter can use it for inhaling and exhaling & if needed can also talk & eat while wearing the mask

- (e) NOTE: The inventors should go through the Patent Search report carefully and write the difference between his invention and each content of the patent search. For Patent search please contact ipr@iitk.ac.in

- (f) Has the invention been tested experimentally? Are experimental data available?

No

- (g) Technology Readiness Levels (TRL) description (mention the applicable stage of TRL given below). Please Mark as Appropriate

TRL-1

Research Idea

(Potential Application/Basic Principles observed)

TRL-2

Applied Research Idea

(Hypothesis testing and initial proof of concept is demonstrated in a limited number of trials)

TRL-3

Project Plan

(Device Characteristics documents & project proposal completed, Proof-of-concept phase)

- TRL-4**
Design and Development
(POC & Safety of device demonstrated by prototype design)
- TRL-5**
Standardization
(Validating the result of the prototype by testing in simulated environment)
- TRL-6**
Preclinical Evaluation
(Clinical trials of functional prototype)
- TRL-7**
Technology Transfer
(Technology transfer of the developed system)
- TRL-8**
Clinical Evaluation
(Evaluation of the system by clinical trials or demonstration)
- TRL-9**
Commercialization
(Commercialization & Post Market Surveillance)

(h) Base Price of the Technology: INR 14 Lakh

(i) Licensing Category:

- Material Transfer
- Prototype Transfer
- Intellectual Property Transfer
- Manufacturing Rights Transfer

(j) Technology Licensing Type:

- Exclusive
- Non-Exclusive

(k) Need and Demand

(Technology gaps addressed in domestic & international markets, pain points of Industry which are being resolved)

The degradation of the quality of air at an alarming rate has given rise to the need of filters, and protective masks for removal of unwanted matter from the air that a person breathes in. Besides, there are individuals who are allergic to certain particles and there are individuals who work in occupations that demand exposure to particulate matter such that they inhale these undesirable matters into the respiratory system of their body. The quality of air in cities has decreased due to pollution that it is advisable to use a mask to filter the air a person breathes in.

(l) Market Access Information

(Current Global & domestic Scenario, market size & CAGR)

India pollution mask market is projected to grow at a CAGR of more than 18% by 2023, on the back of growing health concerns due to deteriorating air quality in the country, especially across the urban areas. Increasing CO₂ emissions due to surging industrial activity and expanding vehicle fleet, rising sales of pollution masks through online channels and intensifying competition are some of the other factors expected to boost pollution masks market in the country over the course of next five years. Moreover, increasing per capita expenditure on healthcare and safety products and rising consumer awareness regarding respiratory diseases and benefits of antipollution products are anticipated to fuel demand for pollution masks in India in the coming years.

(m) Future Developments

(Scope of future technology development and their application)

This Nasal filter may be modified to add embedded sensors, giving real time data of the air quality being inhaled. The real time data can be obtained in a smartphone through Bluetooth data transmission.

(n) Application/s of the invention

(Please refer to appendix-I)

The present subject matter described herein relates to a nasal air filter, and more particularly, the invention relates to a nasal air filter based on nanotechnology for breathing by human beings that has antibacterial feature, which can mimic the natural breathing process and is comfortable to use. The Nasal filter will be useful for people living in polluted cities as well persons having allergy and suffering from Asthama & Bronchitis.

5. IPR Ownership

(a) Was the intellectual property created with the significant use of funds or facilities of IITK?

Yes

(b) Please describe any source of funding for the invention (Name of the funding agency and copy of agreement, letter of intent if any, must be enclosed with this form)

IITK

(c) What is the source of Salary/Remuneration of inventor/Co-inventor?

IITK

(d) Have you presented in any conference, seminar, etc., if yes, please give details?

No

(e) Have you published full/part of this invention, if yes, please give copy of publications?

No

(f) Was the intellectual property created in the course of or pursuant to a sponsored/consultancy research agreement with IITK? If yes, please enclose a copy of MOU with concerned project.

*Submission of IPDF soft copy is Mandatory at the time of Patent document submission.

No

- (g) Was the intellectual property created as a part of academic research leading towards a degree or otherwise?

No

- (h) **REVENUE SHARING AMONG INVENTORS:** Please disclose the extent of contribution of each inventor in the invention in percentage terms for revenue sharing.

	NAME OF THE INVENTOR	% SHARE*	SIGNATURE
1.	Santosh Pramanik	70%	
2.	XYZ	30%	

* If this column is not filled and signed then it will be assumed that all inventor(s) have equal contribution

6. **Commercial potential**

Give brief description of potential commercialization by specifying

- (i) Who (individual(s)/organization) is a potential buyer of this innovation?

The Nasal filter will be useful for people living in polluted cities as well persons having allergy and suffering from Asthama & Bronchitis, Companies involved in manufacturing breathing air filter like Dettol, 3M and Nasofilters.

- (ii) Why should the individual(s)/organization may consider procuring this innovation?

The current invention is the only solution of its kind, in the category of breathing filter, that solves the problem of reduction in breathing flow rate along with efficient filtration. None of the existing products offer a combination of natural breathing flow rate along with efficient filtration capacity.

- (iii) These question are related to the question (i) above:

- a. In your opinion what are the steps/processes must be undertaken by the procurer to commercialize the use of this innovation?

The procurer needs to modify the aesthetics, the procurer will also need regulatory license for the manufacturing of the nasal filter i.e. Manufacturing License to State Drugs Control Organisation (or maybe register in CDSCO Head Quarters and say that it is equivalent to CLENARE and NASOFILTERS (made in India) and obtain Marketing Authorisation.

- b. How long may it take to reach the commercial stage by the procurer? 6 months

- (iv) Please give specific list of companies and contact details of concerned person who can be contacted for initiating Technology Licensing

S. No.	Name of Companies	Name of the contact person	Contact no.

*PCT/ International filing is subject to support from the Project funds of the Inventor.

1.	3M		1-800-425-3030
2.	Nasal Medical		
3.	Nasofilters		(+91)-(11)-45656700
4.	SANISPIRA		

(*Unsigned & Incomplete IPDF forms will not be accepted).

(v) Do you want to file Patent under PCT Route in other countries?

Yes

No

***The institute shall file patent under PCT route only in those cases wherein industry/company has exhibited interest for commercialization.**

Disclaimer: *I/We declare that before the submission of this disclosure form or/and during the process of filing this invention as an IPR prospect, I/We will not publish the above information in public domain.*

I/We also give consent to IIT Kanpur being the applicant of this IPR prospect, that they may use this disclosure upon their discretion, which will not be limited to publication on e-auction website, Industry meets & different portals for promotional & licensing purpose.

Signature of Inventor with date

Signature of Inventor with date

Annexure- I
Illustrated examples for mentioning use case of Product/ Process

1. “Classification of Hard and Soft Taps on Capacitive Touch Screen” having application in below mentioned use case:

We all use capacitive touch screens, on a series of devices starting with smart watches, smartphones tablets laptops and desktops. The only thing you can do on the present touch screens is to indicate a location, by touching it there. It doesn't matter whether you touch it hard or lightly - the touch is definitely not 3D. iPhone X has attempted to introduce this feature (force touch) by including expensive special pressure-sensitive hardware. We adopt a different approach, that requires you to only install an app on the existing device. With this the same touch screen that you have been using now becomes sensitive to at least two levels of pressure, light and heavy. Every other app developer can now exploit this feature and provide more sophisticated user interfaces which can distinguish levels of touch. The possibilities are limited only by the imagination. As the technology matures, a larger number of levels of touch is likely to be supported.

2. “Antibacterial Nano breathing Nasal Filter” having application in

Many people use face mask for breathing pollution free air, but the main constraint in breathing is decrease in breathing flow rate. The innovation described herein relates to a nasal air filter, and more particularly, the invention relates to a nasal air filter based on nanotechnology for breathing by human beings that has antibacterial feature, which can mimic the natural breathing process i.e. 12-15 lpm and is comfortable to use. The nasal filter will be useful for people living in polluted cities as well persons having allergy and suffering from Asthama & Bronchitis.

3. “A method of measuring BMP signaling using BMP responsive reported cell line” having application in

Bone Morphogenetic Protein (BMP) signaling is necessary and sufficient for bone formation. It is present in several biological samples measurement of which may have diagnostic value. However, at present there is no sensitive method of detecting BMP proteins in a biological sample. In this disclosure we describe creation of a cell line based sensitive and accurate method of estimating BMP proteins in any specimen.

4. A unique device for plasma processing to simulating magnetospheres in the laboratory

The dipole plasma device would be helpful in industry for plasma processing of samples such as in the semiconductor industry, where energetic electrons (or ions) are required to impinge on a substrate and to bring about desired changes in the substrate such as plasma assisted ion doping, etching, or creation of nanostructures on metallic surfaces, the device would be helpful in understanding the physics of plasmas confined in a magnetic dipole.

5. Large area micro-texturing on free-form surfaces using flexible-electrode throughmask electrochemical machining

Surface micro-texturing deals the issues pertaining to various fields of engineering for enhancing the essential functions such as tribological, wetting, biocompatibility, sustainability, cleanliness etc. Among all the aforementioned sectors, micro-texturing of free-form large

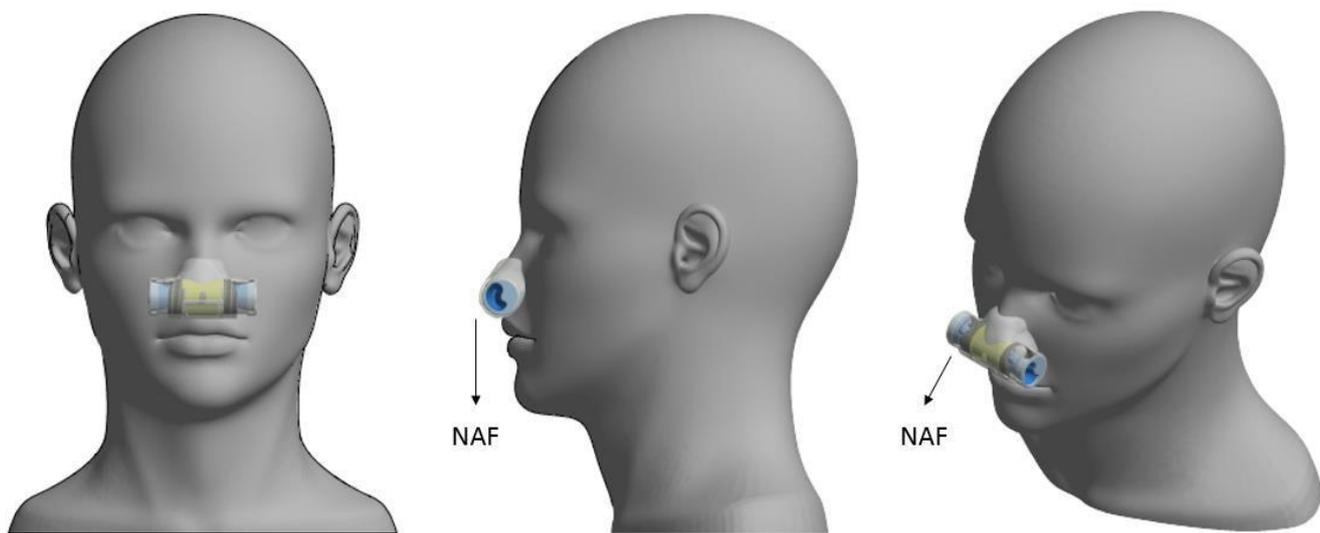
*PCT/ International filing is subject to support from the Project funds of the Inventor.

areas is getting huge attention, e.g. micro-textures on artificial biomedical implants enhances sustainability and life cycle by better implant-tissue interface, cell-adhesion and cell proliferation. Micro-textures on cylindrical surfaces (both internal and external) of bearings, piston rings, hypodermic needles assists in reducing the coefficient of friction and facilitating lubrication.

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Anexure-II

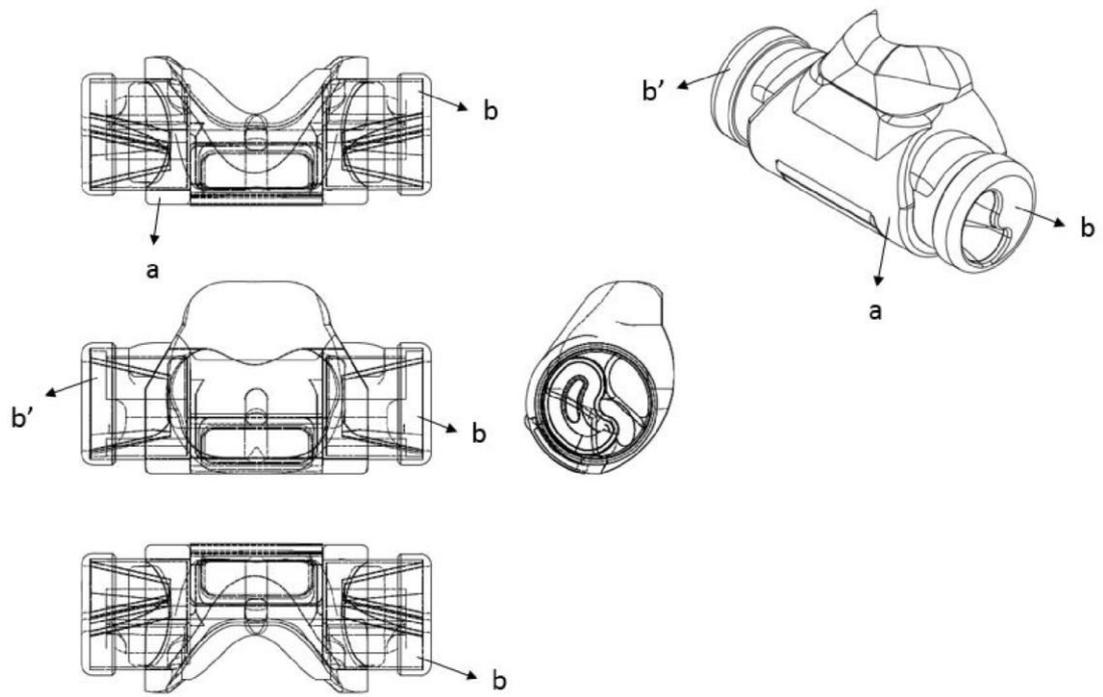
Figure: 1



NAF-Nasal Air Filter

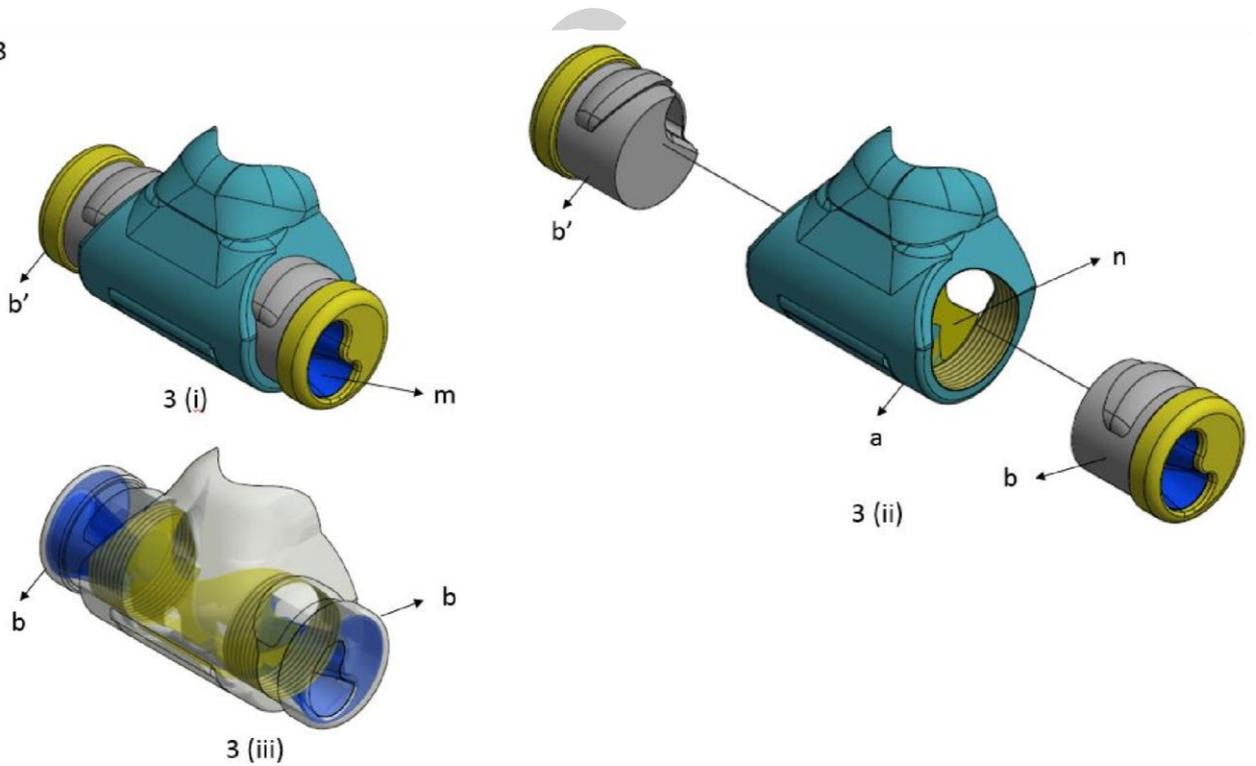
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Figure: 2



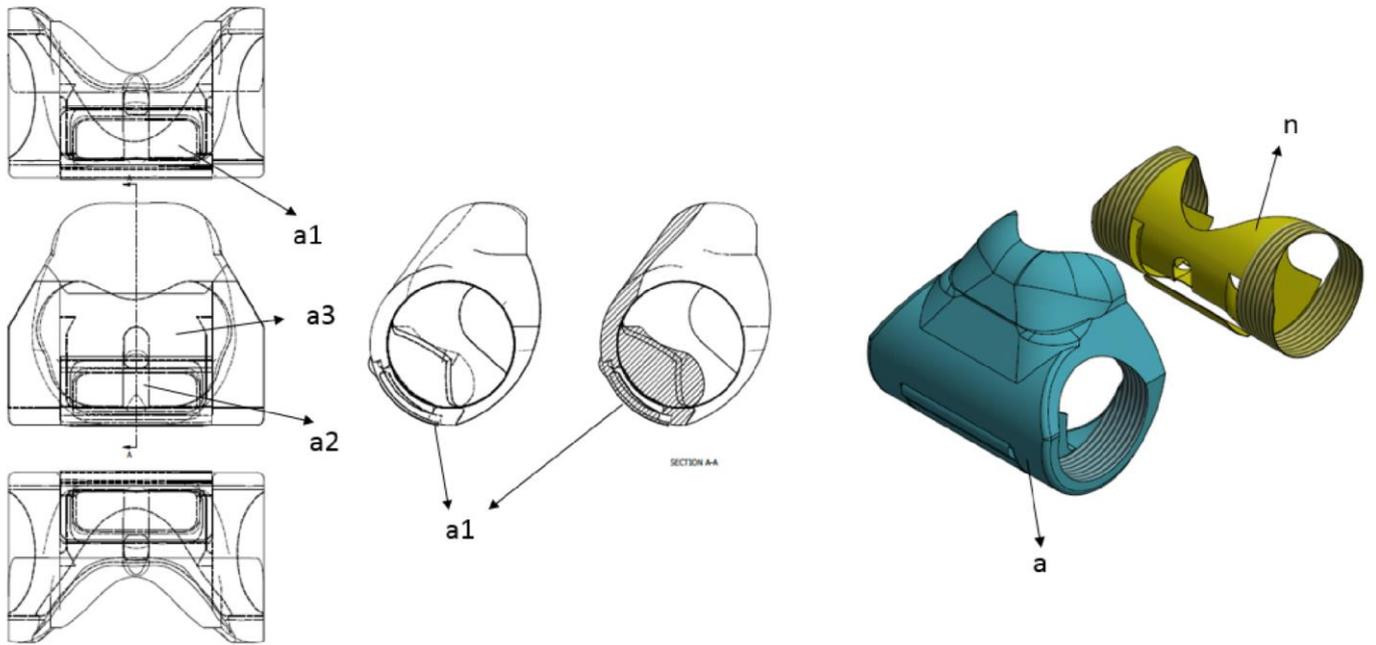
a-body; b, b'- concha cartridge.

Figure: 3



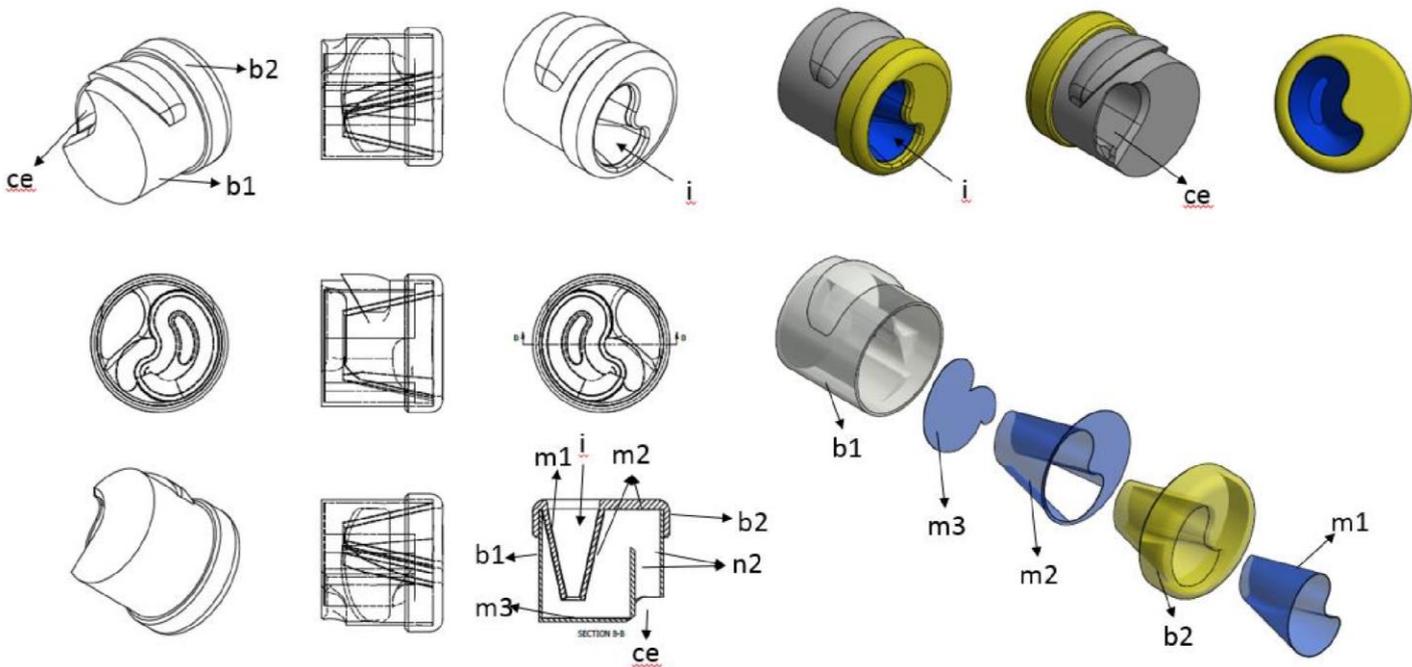
a-body; b, b'- concha cartridge; m-micro pad; n-nano pad.

Figure: 4



a-body; a1-exhale valve; a2-septum; a3-body vessel; a-body; n-nano-pad.

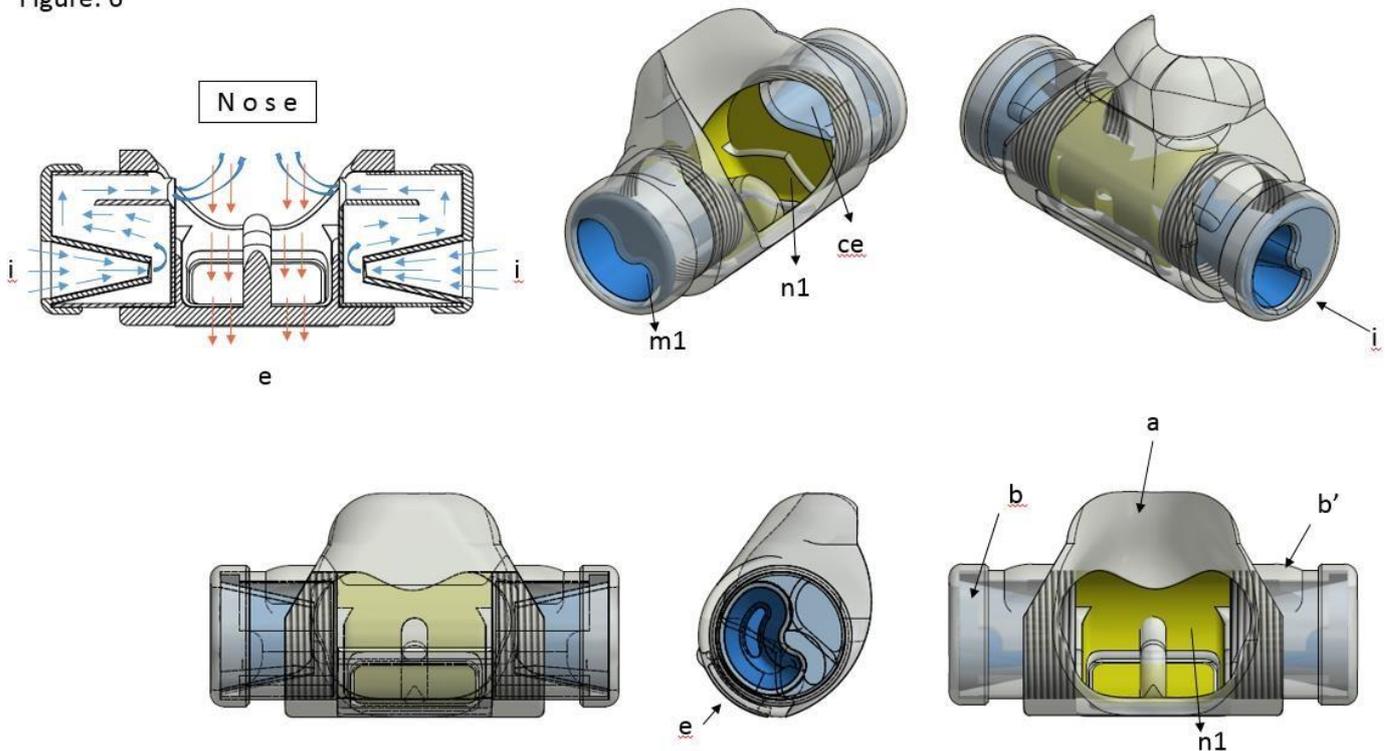
Figure: 5



i-inhale port; ce-concha exhale; b-concha cartridge; b1-concha body; b2-nozzle cap; m1,m2,m3- micro pillar pad.

*Submission of IPDF soft copy is Mandatory at the time of Patent document submission.

Figure: 6



i-inhalation; *e*-exhalation; *ce*-exhale; *a*-body; *b*,*b'*-concha cartridge; *m1*-micro pillar pad; *n1*-nano pad.