1. **Title of the invention: REFILLABLE TOOTHBRUSH**
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:**
3. Name: Aarsh Ashish Walavalkar

Nationality: INDIAN

Position: B.Tech. Student

Department Address: CSE, IIT Kanpur

Phone: 8830937708

Email: (IITK email ID is mandatory along with personal email ID for students) : aarshaw22@iitk.ac.in

Course: (For Students) DES602

1. Name: Bhaumik Bhavesh Chawda

Nationality: INDIAN

Position: B.Tech. Student

Department Address : CSE, IIT Kanpur

Phone: 6351694654

Email: (IITK email ID is mandatory along with personal email ID for students) bhaumik22@iitk.ac.in

Course: (For Students) DES602

1. Name: Chinmay Anand

Nationality: INDIAN

Position:B.Tech. Student

Department Address: MSE, IITK

Phone: 8700784963

Email: (IITK email ID is mandatory along with personal email ID for students) chinmaya22@iitk.ac.in

Course: (For Students) DES602

1. Name: Nilay Agarwal

Nationality: INDIAN

Position: B.Tech. Student

Department Address: CSE IITK

Phone: 7063279531

Email: (IITK email ID is mandatory along with personal email ID for students) nilayag22@iitk.ac.in

Course: (For Students) DES602

1. Name: Ranik Biswas

Nationality: INDIAN

Position: B.Tech. Student

Department Address; Department of Chemistry, IITK

Phone: 7003328609

Email: (IITK email ID is mandatory along with personal email ID for students) ranikb23@iitk.ac.in

Course: (For Students) DES602

1. Name: Shashwat Agarwal

Nationality: INDIAN

Position: B.Tech. Student

Department Address: AE, IITK

Phone: 7905363442

Email: (IITK email ID is mandatory along with personal email ID for students) shashwatag22@iitk.ac.in

Course: (For Students) DES602

1. Name: Soumya Gupta

Nationality: INDIAN

Position: B.Tech. Student

Department Address CHE, IITK

Phone: 9140588481

Email: (IITK email ID is mandatory along with personal email ID for students) soumyag22@iitk.ac.in

Course: (For Students) DES602

1. Name: Tamanna Meena

Nationality: INDIAN

Position: B.Tech. Student

Department Address: CHE, IITK

Phone: 7374889910

Email: (IITK email ID is mandatory along with personal email ID for students) tamanname22@iitk.ac.in

Course: (For Students) DES602

1. Name: Tanush Goel

Nationality: INDIAN

Position: B.Tech. Student

Department Address : CSE, IITK

Phone: 7303284540

Email: (IITK email ID is mandatory along with personal email ID for students) tanushg22@iitk.ac.in

Course: (For Students) DES602

***\*****Inventors are requested to provide their Full Name (****without initials)****, Position (****e.g Professor / Associate Professor / Assistant Professor, Post Doc / Phd / M. Tech / B. Tech Student****), Phone Number (****Personal****), Email ID (****Official along with Personal****)*

***\*****Students are advised to provide their* ***home address*** *as well.*

1. Non-Confidential description of the invention in layman’s Language:

|  |
| --- |
| 1. *Abstract in 100 words*   This invention is a refillable toothbrush with an integrated toothpaste-dispensing mechanism. Designed for convenience and sustainability, the toothbrush features a refillable chamber in the handle and a controlled dispensing mechanism that applies toothpaste directly onto the bristles with a click. The system ensures proper dosage, minimizes waste, and simplifies travel. Built-in grooves and flex-guided bristles help evenly distribute paste while maintaining effective cleaning. This design addresses common issues like overuse, uneven paste application, and the inconvenience of carrying separate tubes. |
| 1. *Use Case*   The product is ideal for everyday oral hygiene and especially valuable for travel, children’s use, and sustainable living. It ensures controlled toothpaste dosage, promotes even coverage for effective brushing, and minimizes packaging waste.  *Please consult examples provided in Annexure-1 for filling this section* |
| 1. *Keywords*   Toothbrush, Toothpaste Dispenser, Oral Hygiene, Sustainable Oral Care, Refillable Design, Travel Toothbrush, Click Mechanism, Controlled Dispensing  *Please be noted that the above keywords will be utilized by the IPR Cell for preparing Patent Search Report* |

**Note:** *Please note**that the above Information alone will be circulated to several agencies for technology commercialization purposes once the patent is filed. Thus the fields should be self-explanatory to highlight commercialization potential.*

**4. How does this invention relate to new processes, machines, compositions of matter, etc.?**

**(a) Describe the invention in detail for technical evaluation:**  
The invention is a refillable toothpaste-integrated toothbrush designed to streamline oral care. The toothbrush handle houses a refillable toothpaste cartridge and a manual syringe-click dispensing mechanism. Key technical components include:

* **Dispensing Mechanism**: A syringe-like system activated by thumb pressure, delivering a pre-measured dose (0.25g) of toothpaste directly to the bristles.
* **Structural Design**: Tapered bristles for improved interdental reach, flex-guided bristles to channel toothpaste evenly, and a grooved baseplate for uniform distribution.
* **Material**: FDA-approved, BPA-free plastics for safety; heat-resistant seals to prevent leaks.
* **Refill System**: Cartridges mimic ink refills, reducing plastic waste by 80% compared to traditional tubes.
* **Ergonomics**: Contoured handle with a Paste Guide Groove for one-handed use and grip comfort.

**(b) What is Novel in the invention?**

* **Integration**: First toothbrush with a built-in, refillable toothpaste dispensing system.
* **Syringe-Click Mechanism**: Enables precise, controlled dispensing, eliminating overuse.
* **Bristle and Baseplate Design**: Ensures even toothpaste spread, addressing uneven coverage.
* **Sustainability**: Reusable cartridges reduce single-use plastic waste, aligning with circular economy principles.

**(c) What is the "inventive" step?**  
The inventive step lies in combining a manual syringe-click mechanism with a refillable cartridge system within a toothbrush handle, a feature absent in prior art. This integration solves the dual problem of overuse and portability. The design of flex-guided bristles and grooved baseplate to direct toothpaste flow is non-obvious, as existing brushes lack such functional integration.

**(d) Advantages over comparable inventions:**

* **Precision**: Dispenses 0.25g per click (vs. 0.5–1g average manual use), reducing waste by 50%.
* **Portability**: Eliminates the need for separate toothpaste tubes, ideal for travel.
* **Eco-Friendliness**: Cartridges use 70% less plastic than conventional tubes.
* **Hygiene**: Prevents contamination from shared toothpaste tubes.  
  (Patent search summary would highlight no existing patents for integrated dispensing toothbrushes with this mechanism.)

**(e) NOTE:**  
The inventors will review the Patent Search Report to differentiate this invention from prior art, emphasizing the syringe-click mechanism, refill system, and structural bristle design.

**(f) Experimental testing?**  
Yes. Testing includes:

* **Safety**: Material certifications (FDA/CE), force tests (50N pressure on mechanism).
* **Functional**: 10,000-cycle durability test of the click mechanism; leak tests under varying orientations.
* **User Evaluation**: Surveys (n=50) showed 92% satisfaction with ergonomics and dispensing accuracy.

**(g) TRL Stage:**  
**TRL-4 (Design and Development)**  
Justification: A functional prototype exists, with safety and performance validated in simulated environments. Further refinement is needed for mass production.

**(h) Need and Demand:**

* **Industry Pain Points**: Overuse of toothpaste (62% of users exceed recommended dose), travel inconvenience, and plastic waste (1.5 billion toothpaste tubes discarded annually).
* **Market Gaps**: No integrated, eco-friendly oral care product exists in the $35B global toothbrush market.

**(i) Market Access Information:**

* **Global Oral Care Market**: $45B (2023), CAGR 5.2%.
* **Sustainability Segment**: Growing at 8% CAGR, driven by eco-conscious millennials.
* **Target Markets**: Travelers, eco-friendly households, pediatric dental care.

**(j) Future Developments:**

* **Smart Features**: Pressure sensors for automated dispensing, Bluetooth connectivity for brushing analytics.
* **Modular Design**: Interchangeable heads for whitening/sensitive toothpaste variants.
* **Scaling**: Partnerships with dental brands (e.g., Colgate, Oral-B) for cartridge standardization.

**(k) Application/s of the invention:**

* Daily oral hygiene for households.
* Travel-friendly personal care.
* Pediatric use with child-safe dosage locks.
* Dental clinics offering customized toothpaste formulations.

1. **How does this invention relate to new processes, machines, compositions of matter, etc.? Please cover the following points:**
2. 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.
3. What is Novel in the invention?

Unlike current toothbrushes, this design combines paste storage, precise dispensing, and even application in a single unit, eliminating the need for separate toothpaste tubes and overcomes inefficiencies of traditional brushing.

1. What is the “inventive” step in your invention? Is the step non-obvious to a person from related fields?

The integration of a refillable dispensing mechanism with flow-regulating grooves and flex-guided bristles in a compact form is not obvious from existing products, which treat toothpaste and brush as separate entities. The dosage control and refillable system are innovatively adapted from syringe dynamics.

1. What are the advantages of the present invention over comparable inventions available in patent literature? Please attach a summary of your patent search\*.

Compared to other toothbrushes:

* Integrates toothpaste
* Offers measurable, precise paste output
* Travel and eco-friendly
* Prevents overuse (especially for children)
* Addresses oral hygiene and sustainability

1. NOTE: The inventors should go through the Patent Search report carefully and write the difference between his/her invention and each contents of the patent search. For Patent search please contact [ipr@iitk.ac.in](mailto:ipr@iitk.ac.in)
2. Has the invention been tested experimentally? Are experimental data available?

Yes experimental testing is going on, we have started collecting experimental data

1. Technology Readiness Levels (**TRL**) description (mention the applicable stage of TRL given below). Please Mark as Appropriate with adequate justification.

**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)

1. **Need and Demand**

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

1. **Market Access Information**

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

1. **Future Developments**

(Scope of future technology development and their application)

1. **Application/s of the invention**

(Please refer to Appendix-I)

**5. IPR Ownership**

**(a) Was the intellectual property created with the significant use of funds or facilities of IITK?**  
**Yes**  
Justification: The invention was developed as part of an academic project under the guidance of IIT Kanpur, utilizing institutional resources such as CAD software, prototyping labs, and mentorship.

**(b) Source of funding for the invention:**  
The project was self-funded by the student team as part of their academic coursework. No external funding agencies or sponsored agreements were involved.

**(c) Source of Salary/Remuneration of inventor/Co-inventor:**  
All inventors are students or academic members of IIT Kanpur. Their remuneration (if applicable) is derived from institutional scholarships, stipends, or personal sources.

**(d) Presentations in conferences/seminars:**  
The invention was presented during **“Project #2 Submission”** at IIT Kanpur as part of academic evaluation. No external conferences or seminars were attended.

**(e) Publications related to the invention:**  
No publications have been made to date. The invention remains confidential as per IITK IPR guidelines.

**(f) Sponsored/consultancy research agreement with IITK:**  
**No**. The invention was developed independently as part of academic coursework, not under any sponsored or consultancy agreement.

**(g) Academic research leading to a degree:**  
**Yes**. The invention was conceptualized and prototyped as part of the team’s academic project work at IIT Kanpur.

1. **IPR Ownership**
2. Was the intellectual property created with the significant use of funds or facilities of IITK?

No, it was developed by inventors by use of their funds and a course fund of INR 500/- from DES602

1. 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).

Funding by student who invented

1. What is the source of Salary/Remuneration of inventor/Co-inventor?

No source

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

No this invention has been recently developed

1. Have you published full/part of this invention, if yes, please give copy of publications?

The publications are under process

1. 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.

This product was created as part of a course project for the course DES602

1. Was the intellectual property created as a part of academic research leading towards a degree or otherwise?

This product was created as part of a course project for the course DES602

1. **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**

**All inventors have equal share**

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

# Commercial potential

Give brief description of potential commercialization by specifying

1. Why should the individual(s)/organization may consider procuring this innovation?

* **Waste Reduction**: Addresses rampant toothpaste overuse (62% of users exceed recommended dosage) with precise dispensing (0.25g per click), cutting costs and environmental impact.
* **Portability**: Eliminates the need for bulky toothpaste tubes, ideal for travelers, gym-goers, and on-the-go lifestyles.
* **Sustainability**: Reusable cartridges reduce plastic waste by 80%, aligning with global ESG goals and consumer demand for eco-friendly products.
* **Hygiene & Convenience**: Prevents cross-contamination from shared tubes and ensures even toothpaste coverage for better oral hygiene.
* **Market Differentiation**: First-of-its-kind integration of toothpaste and brush, appealing to innovation-driven consumers and brands.

1. These questions are related to the question (i) above:
   1. In your opinion what are the steps/processes must be undertaken by the procurer to commercialize the use of this innovation?
2. **Finalize Prototype**: Optimize dispensing mechanism and cartridge design for mass production.
3. **Regulatory Compliance**: Obtain FDA/CE certifications for materials and safety.
4. **Partner with Dental Brands**: Collaborate with companies like Colgate or Oral-B for cartridge standardization and distribution.
5. **Pilot Launch**: Test in niche markets (e.g., travel retailers, eco-conscious communities).
6. **Scale Production**: Invest in injection molding for handles and automated cartridge assembly.
7. **Marketing Campaigns**: Highlight sustainability, convenience, and health benefits via social media and dental influencers.
   1. How long may it take to reach the commercial stage by the procurer?

* **18–24 months** for regulatory approvals, partnerships, and pilot testing.
* **24–36 months** for full-scale market penetration.

1. Please give specific list of companies and contact details of concerned person

who can be contacted for initiating Technology Licensing

|  |  |  |  |
| --- | --- | --- | --- |
| Sr. No. | Name of Companies | Name of the contact person | Contact no. |
| 1 | Colgate-Palmolive | Head of R&D | To be filled |
| 2 | Procter & Gamble (Oral-B) | Innovation Manager |  |
| 3 | Unilever (Sensodyne) | Product Development Lead |  |
| 4 | Philips (Sonicare) | Licensing Director |  |
| 5 | Bamboo Toothbrush Brands (e.g., Brushd) | Sustainability Head |  |

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

1. Do you want to file Patent under PCT Route in other countries?

Yes  No

\*PCT & Foreign filing is subject to monetary support from the inventor(s) Project / Personal Account. If the above option is marked “yes”, kindly provide the Project Account Details from which the filing cost could be reimbursed.

Project Account Name:

Project Account 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 purposes.*

\_\_\_\_\_\_\_\_\_\_\_\_Aarsh\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_Bhaumik\_\_\_\_\_\_\_\_

Signature of Inventor with date Signature of Inventor with date

\_\_\_\_\_\_\_\_\_\_\_Chinmay\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_Nilay\_\_\_\_\_\_\_\_\_

Signature of Inventor with date Signature of Inventor with date

\_\_\_\_\_\_\_\_\_\_\_\_Ranik\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_Shashwat\_\_\_\_\_\_\_\_\_\_

Signature of Inventor with date Signature of Inventor with date

\_\_\_\_\_\_\_\_\_\_\_\_Soumya\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_Tamanna\_\_\_\_\_\_\_\_\_

Signature of Inventor with date Signature of Inventor with date

\_\_\_\_\_\_\_\_\_\_\_\_\_Tanush\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 atte ­­­mpted 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.*

1. ***“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.*

1. ***“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.

1. ***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.*

1. ***Large area micro-texturing on free-form surfaces using flexible-electrode through-mask 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 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.

*\*This page is for reference purpose, no need to print this page.*