

DESIGN & MANUFACTURING AUTOMATIC SMALL BOTTLE CLEANING MACHINE

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Abstract

This project presents an automatic PET bottle cleaning machine designed to improve the efficiency and hygiene of bottle cleaning processes in small-scale industries. The machine integrates manual loading with automated washing cycles including rinsing, brushing, and drying, reducing labour while ensuring thorough sanitation. Its compact design, cost-effectiveness, and ease of use make it suitable for beverage, recycling, and packaging sectors aiming for sustainable and hygienic operations.

Keywords: Automatic, PET bottle cleaning, hygiene, recycling, automation, cost-effective, small-scale industry.

INTRODUCTION

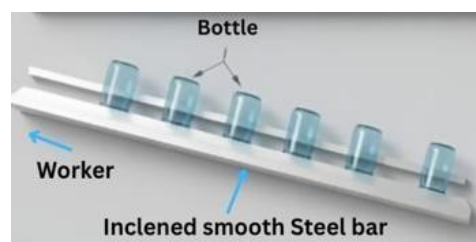
The Automatic PET bottle cleaning machine is developed to address the need for efficient, hygienic, and cost-effective cleaning of used PET bottles in small to medium-scale operations. With increasing awareness of recycling and sustainability, the reuse of PET bottles has become more common, especially in industries like beverages, packaging, and waste management. Manual cleaning is labour-intensive, time-consuming, and often inconsistent, while fully automatic systems can be expensive and complex. This automatic machine offers a balanced solution by combining manual handling with automated washing, rinsing, and drying functions. It enhances cleaning efficiency, reduces human effort, and ensures better sanitation, making it an ideal choice for businesses looking to streamline their bottle cleaning process without high capital investment. The Automatic PET bottle cleaning machine is designed to efficiently clean used PET bottles by combining manual loading with automated washing, rinsing, and drying processes. It offers an affordable, easy-to-use solution for small and medium-sized businesses to ensure hygienic bottle reuse and recycling. This machine reduces labour, saves time, and improves cleaning quality compared to manual methods, making it ideal for beverage, packaging, and recycling industries focused on sustainability.

Working

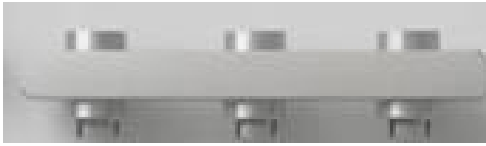


- The bottle is placed inclined on the inclined road. The bottles move downward.
- The motor is started, and it moves the Geneva mechanism that is connected to the bottle.
- The Geneva mechanism is mounted on the bottle collecting wheel.
- The Geneva mechanism is fixed between the table and the bottle collecting wheel.
- The bottles are fixed in the rotating wheel.
- At point A, the bottles are fixed in the rotating wheel.
- The wheel moves to point B, where washing or cleaning of the bottle takes place.
- Water is sprayed from the nozzle. The nozzle is connected to the pump and the tank.
- At point C, the bottle is pushed to the tank basket.

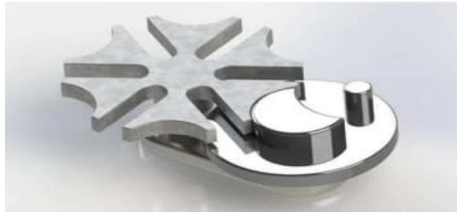
1. **Operator Action:** Manually load the dirty PET bottles onto the machine's feeding system.
2. **Feeding system:** The operator places the bottles upside down on the steel bar. This system is positioned at a sufficient height from the rotating wheel and set at an inclined angle. The motor transmits vibrations to the inclined steel bar, causing the bottles to slide down from the steel bar onto the rotating wheel. As a result, the bottles are placed or attached to the bottle collecting wheel.



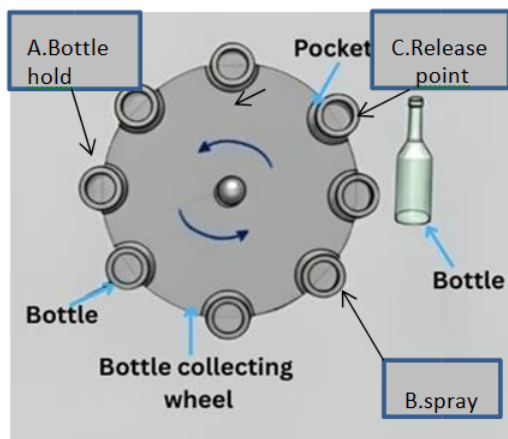
3. **Bottle holding:** After the feeding process, the bottle gets locked in the socket of the rotating wheel in an upside-down position, with the neck of the bottle fitting securely because the socket is shaped to match the shape of the bottle's neck.



Geneva wheel mechanism: The DC motor is connected to one wheel(driver), and another wheel(Driven) is mounted on the shaft. The DC motor rotates the driver wheel, and the driven wheel gets rotated and also rotates the collecting wheel.

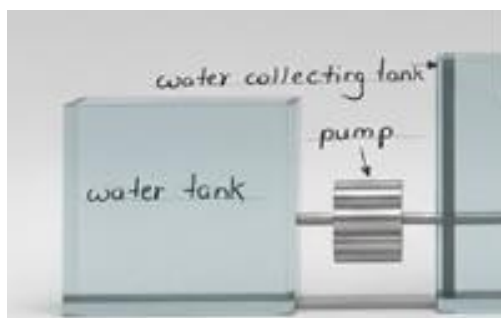


4. A bottle cleaning system: After the bottle holding process, the wheel rotates continuously in an anticlockwise direction with the help of a motor. During this process, the bottles are held at point 'A'. As the wheel rotates, the bottles move to point 'B', where the nozzle continuously sprays water. After passing points 'A' and 'B', the wheel continues to rotate to point 'C', where the bottles are released.



During the rotation of the wheel, the nozzle continuously sprays water inside the bottle. When the water jet impacts the inside of the bottle, it tends to push the bottle upward. To prevent this upward motion, a thin steel plate is positioned above the bottles, allowing only a small movement due to the slight clearance between the plate and the bottles.

The water pump is located near the water collecting tank. This pump draws water from the water tank and transfers it to the nozzle, where it is then sprayed into the bottles.



ADVANTAGES

Reduces Manual Labour

The automatic system minimises human involvement in the cleaning process. **Increases Production Rate:** Continuous and automated operation allows large numbers of bottles to be cleaned in a shorter time.

Saves Water

Recirculation systems is also be integrated to reuse water, reducing overall water consumption.

Provides Uniform Cleaning

Use the proper spring nozzle Which jet will impact inside the bottle properly and remove all unwanted dust

Future scope:

- 1. Used in Small Industries:** The automatic small bottle cleaning machine can be used in water plants, juice factories, dairy units, and other small-scale industries to clean bottles quickly and efficiently.
- 2. Reduces Manual Work:**It reduces human effort and saves time by automatically cleaning bottles, which increases productivity in industries.
- 3. Integration with Other Machines:** In the future, the machine can be connected with bottle filling, capping, and labelling machines to form a complete automatic bottling system.
- 4. Scope for Automation:** The machine can be upgraded by adding sensors, PLC control, and smart monitoring systems to improve accuracy and efficiency.
- 5. Eco-Friendly and Efficient:** Future improvements can help reduce water and energy consumption, making the machine more economical and environmentally friendly.

LIMITATIONS:

1. Needs Continuous Power Supply
2. Limited Bottle Size Compatibility
3. Water Consumption

Beverage Industries: Used for cleaning PET bottles and plastic bottles before filling soft drinks, juices, and packaged water.

Pharmaceutical Industries: Ensures sterile cleaning of medicine bottles, syrups, and injection containers.

Dairy Plants: Cleans milk bottles and flavored milk containers to maintain hygiene and prevent contamination.

Chemical Industries: Used for cleaning containers that store chemicals, solvents, and industrial liquids.

Food Processing Industries: Cleaning of sauce bottles, oil containers, and packaged food jars before filling. This reduces water consumption, lowers operational costs, and supports sustainable industrial practices while maintaining effective cleaning performance.

Conclusion

The automatic Bottke Cleaning Machine is used to wash the small bottles. It is mostly use in Small and medium scale industries. increasing awareness of recycling and sustainability. It is used in beverages, packaging, and waste management Industries. It balances both Manual working And Automatic process.

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REFERENCES

Ankur G. Gajjar- Research Scholar, Control & Automation Institute of Technology, Nirma University, Ahmedabad, India. https://youtube.com/shorts/gw5TTL9xYk0?si=ut4j43_NXJ8fxNP7
