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Assembly & Analysis of Post Processing 3D Printer

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A B S T R A C T

The washing and curing machine project aims to develop an efficient system for cleaning and curing components used in manufacturing processes. This machine will streamline production by automating the cleaning and drying process, reducing manual labor and improving product quality. Incorporating advanced technology, the machine will offer adjustable settings for different component types and sizes, ensuring thorough cleaning and precise curing. Additionally, it will prioritize energy efficiency and environmental sustainability through optimized resource utilization. Overall, the project seeks to enhance manufacturing efficiency and product reliability through innovative washing and curing technology.

Keywords: Washing, Curing

1. Introduction

Post-processing in the context of curing resin 3D printing refers to the additional steps and treatments applied to 3D printed objects after the printing process is complete. These steps are essential to enhance the final appearance, mechanical properties, and overall quality of the printed parts. The post-processing of curing resin 3D prints typically involves steps such as cleaning, curing, and finishing. The history of Washing and Curing Machines dates back to the early 20th century, driven by the need for efficient and reliable methods of industrial cleaning and surface treatment. Over the decades, these machines have undergone significant evolution, incorporating advancements in technology, materials, and process automation.

Traditional methods of cleaning and curing components are often labor-intensive, time-consuming, and prone to inconsistencies, leading to inefficiencies and quality issues in production lines. In response to these challenges, this project aims to introduce a cutting-edge washing and curing machine that revolutionizes the manufacturing landscape. By integrating state-of-the-art technology, the machine promises to enhance productivity, ensure uniform cleaning and curing, and reduce operational costs.

2. Literature Review

Robbie Williams[1] Nearing 30 years since its introduction, 3D printing technology is set to revolutionize research and teaching laboratories. This feature encompasses the history of 3D printing, reviews various printing methods, and presents current applications. The authors offer an appraisal of the future direction and impact this technology will have on laboratory settings as 3D printers become more accessible.

Md Ashiqur Rahman Laskar[2] Additive Manufacturing (AM) has added a new dimension in manufacturing process by exploiting advanced technology. Utilization of AM technologies in different sectors has increased remarkably in the present days. This paper reviews the available AM techniques as well as the advantages specifically. It will also discuss several empirical applications of AM before describing the current landscape in Additive Manufacturing. Furthermore, an attempt is made to find out the challenges and opportunities for future

AM Matthew B Hoy [3] 3D printers are a new technology that creates physical objects from digital files. Uses for these printers include printing models, parts, and toys. 3D printers are also being developed for medical applications, including printed bone, skin, and even complete organs. Although medical printing lags behind other uses for 3D printing, it has the potential to radically change the practice of medicine over the next decade. Falling costs for hardware have made 3D printers an inexpensive technology that libraries can offer their patrons. Medical librarians will want to be familiar with this technology, as it is sure to have wide-reaching effects on the practice of medicine.

3. Assembly specification

1. Frame Assembly: The frame provides structural support for the entire machine. It's usually made of metal or sturdy plastic. Assembly of the frame involves connecting various frame pieces using bolts, screws, or welding, depending on the design.

2. Washing Chamber: This is the part of the machine where the washing process occurs. It typically includes a tank for holding the washing solution, spray nozzles or brushes for applying the solution to the parts being washed, and a drainage system. The washing chamber is often made of corrosion-resistant materials such as stainless steel.
3. Curing Chamber: The curing chamber is where the curing process takes place. It usually consists of a chamber with controlled temperature and humidity levels to facilitate the curing of coatings or adhesives on the parts. The chamber may include heating elements, fans for air circulation, and sensors for monitoring temperature and humidity.
4. Conveyor System: Many washing and curing machines include a conveyor system to transport parts through the washing and curing chambers. The conveyor system may consist of belts, rollers, or chains driven by motors. Assembly of the conveyor system involves installing the conveyor belts or chains, attaching them to the drive system, and ensuring proper alignment.
5. Control System: The control system of the machine includes electrical components such as switches, sensors, relays, and a programmable logic controller (PLC) or microcontroller to automate the washing and curing processes. Assembly of the control system involves wiring the electrical components according to the machine's wiring diagram and programming the PLC or microcontroller to control the sequence of operations.
6. Safety Features: Washing and curing machines typically include safety features such as emergency stop buttons, interlocks, and safety guards to protect operators from hazards such as moving parts, electrical shocks, and chemical exposure. Assembly of safety features involves installing and testing these components to ensure they function correctly.
7. Testing and Calibration: Once the machine is assembled, it undergoes testing and calibration to ensure that all components are functioning correctly and that the washing and curing processes meet the desired specifications. This may involve running test cycles with simulated parts and making adjustments to the machine's settings as needed.
8. Documentation and Training: Finally, assembly specifications should include documentation such as assembly drawings, parts lists, and operating manuals to assist with assembly, maintenance, and troubleshooting. Training may also be provided to operators and maintenance personnel to ensure safe and efficient operation of the machine.

4. Objective

The objective of a Washing and Curing Machine for resin printers is to revolutionize the post-processing workflow associated with resin-based 3D printing. These machines are designed to automate and streamline the crucial steps of cleaning, rinsing, and curing resin-printed parts, ultimately ensuring efficiency, consistency, and quality in the production process. By efficiently removing uncured resin and support materials, the washing function of these machines prepares printed parts for subsequent processing stages. Thorough rinsing then eliminates any remaining residues or contaminants, ensuring the parts are clean and ready for curing.

4. Description of Components

- Washing Container
- Curing Platform
- Transparent closing lid
- Power adaper and cable
- Cleaning basket
- Control System
- UV Lamps

4.1 Washing Container

The washing chamber within a resin printer's washing and curing machine plays a pivotal role in the post-printing process, acting as a dedicated space for the thorough cleansing of 3D printed objects. This specialized chamber, typically constructed from robust materials like stainless steel or durable plastics, is designed to submerge the prints completely in a cleaning solution, usually isopropyl alcohol (IPA). Its primary function is to remove any uncured resin residues and impurities from the printed objects, ensuring they are pristine and ready for the next stage of curing. The chamber features removable baskets or holders that securely hold the prints in place during the washing cycle, preventing them from floating or shifting. This ensures a uniform and comprehensive cleaning process, reaching even the most intricate details and recesses of the prints.

4.2 Curing Platform

The curing platform within a resin printer's washing and curing machine is a critical component designed to ensure thorough and uniform curing of 3D printed objects. This specialized platform serves as the stage where the prints are exposed to UV light, transforming the liquid resin into a solid, hardened form. One of the key features of the curing platform is its ability to rotate, providing even exposure of all sides of the prints to the UV light. This rotational motion ensures that every part of the print receives equal and consistent UV exposure, critical for achieving uniform curing.

a b

Fig-1 (a) Washing Container ,(b) Curing Platform

4.3 Transparent Closing Lid

The transparent closing lid of a washing and curing machine for resin printers serves as a crucial safety and operational feature, offering users visibility into the chamber while also providing protection from UV light and fumes. Made of transparent materials such as glass or durable plastics, the closing lid allows operators to monitor the progress of the washing and curing processes without the need to open the chamber. This visibility enables users to observe the prints as they undergo cleaning or curing, ensuring that the process is proceeding as expected and allowing for quick visual checks of the print quality

4.4 Cleaning Basket

The cleaning basket and cable are essential components of the washing and curing machine for resin printers, contributing to the efficient and effective post-processing of 3D printed objects. The cleaning basket serves as a dedicated holder for the printed objects during the washing stage, ensuring they remain securely in place throughout the cleaning process. Typically made from durable and chemical-resistant materials such as stainless steel or tough plastics, the basket provides a stable and enclosed environment for the prints to undergo thorough cleaning. Its design often includes openings or perforations to allow the cleaning solution, usually isopropyl alcohol (IPA), to circulate around the prints, ensuring all surfaces are properly cleaned.

a b

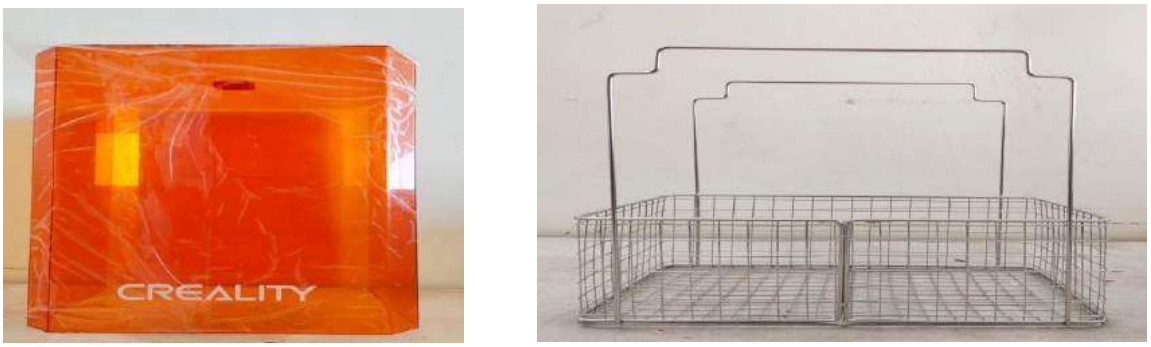

Fig-2 (a) Closing Lid, (b) Cleaning Basket

4.5 Control System With Display Unit

The control system of a washing and curing machine for resin printers serves as the central intelligence hub, orchestrating the entire post-processing workflow with precision and ease of use. This essential component provides users with a user-friendly interface, often featuring buttons or a touch screen,

making it intuitive to navigate through the machine's settings. One of the standout features of the control system is its pre-set programs tailored for different resin types.

4.6 UV Lamp:

UV (Ultraviolet) light is a critical component in the operations of washing and curing machines, particularly prevalent in the realms of printing and electronics manufacturing. In the context of washing machines, UV light serves the purpose of curing and solidifying inks and coatings on substrates such as glass, metal, or plastic. This process begins with the pre-treatment of the substrate with UV-curable materials, followed by the printing process.

a b

Fig-3 (a) Control System with display unit, (b) UV Lamp

5. Assembly

a b

c d

Fig-4 (a) Assembly of UV Lamp (b) Assembly of Curing Platform,(c) Assembly of Washing Container ,(d) Complete Assembly

6. Conclusion

The machine's washing chamber, equipped with innovative agitation mechanisms, ensures thorough cleaning of printed objects by removing uncured resin residues from even the most intricate details. This meticulous cleaning process not only enhances the cleanliness of the prints but also prepares them for the subsequent curing stage. In the curing chamber, a precise UV light source facilitates the polymerization of the resin, resulting in solidified, durable prints with the desired mechanical properties

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