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A Review on Design and Development of Extrusion Molding Machine

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Abstract: One of the main problems since the creation of plastic product and its large production is its useful life and waste management. In the document "Development of an extrusion machine for the production of plastic figures" the purpose is to reuse plastic and thus reduce pollution from the excessive consumption of plastic product. To fulfill this purpose, the extrusion machine must be created, where it works correctly and quickly. The desired method is from plastic granules, creating figures based on molds and thus extending the useful life and reducing waste. The design of this machine will allow the recovery, conversion and reuse of plastic waste as an input for the creation of different figures, thus reducing its environmental impact and the mismanagement of this resource. This project aims to develop an extrusion machine that is cost effective and reduces labor work due to the optimization of time. Development of an extrusion machine will produce a lot of automation, reduces cycle and manufacturing lead time.

Keywords: Injection Molding, Plastic, Extrusion Molding

I. INTRODUCTION

Plastics are essential materials with various properties and applications and have been part of our daily life for around 100 years; They have found applications in the production of packaging, the automotive industry, electricity, construction and transportation, as well as in medicine, agriculture, among many other areas. Currently, the excessive pollution caused by the mismanagement of plastic containers is a problem that grows day by day, plastic is one of the main contributors to the large amounts of garbage, whose management is a serious problem for today, as well as for the future. Our main objective is to design and build an automated extruder prototype equipment to reuse plastic material such as polyethylene terephthalate with the purpose of producing structures that will allow the recovery, conversion and reuse of plastic waste, thus reducing its environmental impact and the mismanagement of this resource.

Plastics are one of the major reasons of environmental problems. Even though plastic plays a major role in our day-to-day life, their disposal is difficult and takes up a lot of area. But the major advantage of plastic is that it can be recycled. Even though it has many demerits many industries such as automobile, packaging, medical, etc. use plastics because it is easier and cheaper to manufacture and comfortable to use. Considering this demand of plastic for various purposes, the manufacturers produce good quality products at an affordable cost in large quantities. Even though hydraulically operated machines produce products in large scale efficiently they can't be afforded by small industries and manufacturers. The project based on with the design and fabrication of screw type waste plastic recycling machine.

II. LITERATURE REVIEW

This chapter presents the background information on the issues to be considered in the present research work and to focus the significance of the current study.

Sandoya et al developed the research "Design and construction of shredder-extruder equipment for reusable plastic material such as polyethylene terephthalate for the production of filament for 3D printers". The authors state that the objective of their research was to design a reusable plastic shredder-extruder in order to reduce pollution caused by the excessive consumption of products packaged in plastic bottles.

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It was concluded that through a design process of 3 prototypes, a design with optimized characteristics was selected in the different aspects considered in the study, and it was determined that the equipment can process approximately 1 kg of plastic in 30 minutes. The final contribution of the work was a machine capable of converting PET plastic into filament for 3D printers, thus giving a new use to plastic that could have been part of the planet's contamination. Gardner et al present a paper that provides an overview of extrusion of wood-plastic composites. Included in this paper is a brief introduction to wood-plastic composites, the equipment and processing unit operations required to manufacture wood-plastic composites, and the basic material properties of wood-plastic composites. Finally it intends to be an introductory pedagogical tool to discuss the basic concepts of the extrusion of wood and plastic composites. Limón et al in the article entitled "Recycling of PET bottles for additive manufacturing", the authors state that the objective of their research was to study the possibility of using PET bottles in Additive Manufacturing. Finally, the contribution of this research was to make filament with PET bottles through a traditional process and use it as raw material in the 3D printer lactic extrusion is a process used to manufacture a wide variety of plastic products, from pipes and profiles to films and sheets. However, as with any manufacturing process, issues and antecedents can arise that affect the quality and efficiency of the process.

Ashraf, Hossain, & Hossain, Development of an automated plastic recycling system using machine learning techniques: This project proposes the use of machine learning techniques to develop an automated plastic recycling system that allows the automatic classification of plastic waste and the identification of materials to be recycled. Soltani, Khodaei, & Gharavi, Design and Implementation of a Smart Plastics Recycling System: This project describes the development of a smart plastics recycling system that uses a combination of computer vision and machine learning technologies to sort and separate plastic waste. Chua and Rasul, Automated plastic recycling system using computer vision and robotic arm: This project presents the design and implementation of an automated plastic recycling system that uses a combination of computer vision and a robotic arm. robotic system for sorting and handling waste. Riaz and Anwar, Design and development of an automated plastic recycling machine: This project describes the design and construction of an automated plastic recycling machine that allows the processing of different types of plastic materials. Prof. Raghu Tilak Reddy and et. al., presented the project based on with the design and fabrication of screw type waste plastic recycling machine. The machine which is operated by hand is modified into motor driven machine by modifying the design and procedures. This plastic recycling machine includes assembly of mechanically components like hopper frame, heating coil, DC motor, battery power cooler unit, etc. Ashwin Umanabadimath and et. al., presented the injection molding device is a device that is used to supply complicated form plastic product. In product production enterprise all of us recognize approximately hand operated injection molding device however every day international actions closer to automation and time saving. In hand operated injection molding device a person is needed for urgent molten plastic cloth into dye. Molding procedure is synthetic procedure wherein plastic hall are created with the aid of using injection of molten plastic in earth. Robotic injection molding device is a device that is utilized in production of plastic product. The injection unit is liable for each heating and edging with inside the cloth into the earth. The barrel consists of the medium for heating and edging with inside the cloth into the earth. A ram injector forces the cloth ahead via a heated phase with a ram or plunger it truly is commonly powered with the aid of using scotch servitude medium. Injection molding is an provident and usually powerful device of manufacturing injection moldered hall.

The molten resin will live with inside the despair for 30 seconds to at least one nanosecond or in addition till it cools down and solidify. Khan Farhan and et. al., presented the context of molds and dies production, frequent changes in design and increased competitiveness require an overall optimized manufacturing process. The finishing process is typically composed of an accurate milling stage to manage shape deviations, followed by polishing operations to reach required surface roughness. In this project we had design a new type of connector which connects the existing cap with new filter. Due to this project we save the time and money to a larger extend. Injection moulding machine is one of the most widely used method for conversion of plastics into various end products application to wide range of plastic material. Nehemiah Mengistu and et. al., presented the large quantity of plastics is wasted every day in the world and the waste accumulates polluting every place and environment. Recycling of wasted plastics would be a good alternate for fresh production of raw materials. Hence, design and development of hand operated injection molding machine for manufacturing recycled plastic articles for small scale industries and tertiary institutions were studied. In this work, recycled molten plastic materials are injected into a closed mold, where it solidifies and gives the desired shape as per the mold dimensions. The functional prototype machine was designed and developed for recycling waste plastic and to make useful products. Based on the phases of product design and development; customer need assessment, concept generation, concept selection, detail design, mold flow analyses and manufacturing were done. Design and manufacturing were done with the available materials and software. Manufacturing drawing and 3D model was prepared using Catia V5, machine fabrication and cost analysis was carried out. Finally, the performance of the injection molding machine mold flow was tested using virtual prototyping of selected plastic article with the help of solid works plastics 2014 software.

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Experimental procedure was done by preparing specimens of recycled Polypropylene plastic according to ISO 197-1 and ASTM D695-02a standard for impact and compression test respectively. The result of selected plastic article (plastic cap) obtained from simulation shows, pressure and flow front central temperature at the end fill was 0.8 MPa and 1820 c respectively. The pack time required for the plastic component was 7.5 seconds. The result obtained from experiment shows that the recycled Polypropylene manufactured using the developed machine attains average impact and low compression strength compared to the fresh raw material. Thus, the recycled material is useful to manufacture plastic articles which can reduce wastes considerably. Gurushanth B. Vaggar and et. al., presented the development of plastic extrusion machines, the structure of an extrusion machine is rather similar to that of a commercial one however it emphasizes production fundamentals as well as cost effectiveness. The purpose of this work is to create low-cost plastic extrusion devices that end-users can employ at home to prevent plastic pollution. Many producers and researchers have found plastic extrusion to be a tough procedure to use in order to make items with a variety of criteria at a reasonable cost. This review work will result in the development of a plastic extrusion machine at a low cost that can be used at home by end-users to combat plastic pollution. In addition to this, the machine is made from different modular units that can be easily assembled or disassembled including gearbox, motor units that can be utilized. The goal of this article is to give a thorough overview of the extrusion process, with a focus on the numerous defects and their impact on product quality. The machine is meant to be simple to maintain and employs locally available raw materials that are straightforward to fix. In this machine, shredding and melting of, material feed into the hopper is accomplished by conveying and heating, and it is operated by only one or two people.

III. METHODS OF EXTRUSIONS

Extrusion can be defined as a process which is basically used to make objects of fixed profile. It mainly involves pushing of a material through a die of desired shape, through this process many complex shapes can formed with minimum amount of waste. It can also be defined as deformation process in which a billet of metal or any other material is squeezed through a die opening in order to obtain a desired geometry.

The materials which are difficult to form such as stainless can be easily deformed through this process. The advantage of this process is that it results in better grain structure and higher accuracy.

Types of Extrusion

There are mainly four types of extrusion:

- ❖ Hydrostatic Extrusion
- ❖ Direct Extrusion
- ❖ Indirect Extrusion
- ❖ Impact Extrusion

3.1 Hydrostatic Extrusion:

In this type of extrusion, the container is filled with fluid and the force required or extrusion pressure is transmitted by fluid to the block. In this type of extrusion, the friction force can be neglected as there is no direct contact between the billet and the container wall. As the pressure which can be attained is about 1700 MPa greater reduction of highly brittle materials can be made through this process. This type of extrusion can be used for extrusion of ceramics or making of aluminum or copper wires. Very high-pressure ratios can be achieved by the help of this process. One of the main disadvantages is uncontrollable speed of extrusion.

3.2 Direct Extrusion:

It is also known as forward direction, is a process in which the direction of movement of billet is same as of ram and punch. Friction between the block and the container is very high which results in the requirement of greater forces to extrude the block. This method can be used to extrude hollow sections like tubes. Extrusion pressure varies with the length of the billet as the latter is increased the pressure is also varied as the friction forces between the container wall and billet is increased. It can be employed for the extrusion of solid circular or non-circular sections

3.3 Indirect Extrusion:

It is also known as backward extrusion, a process in which billet and punch moves in opposite direction to each other. Due to opposite motion there is less contact between the container walls and billet which results in lesser amount of forces required as compared to direct extrusion. The drawback of this type of extrusion is that longer lengths of extrudes cannot be obtained with this

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3.4 Impact Extrusion:
Impact extrusion is basically a variant of indirect extrusion which is mostly used to extrude toothpaste containers, hollow sections etc. The slug is stroked at high speed by punch by a sudden impact load.

IV. CONCLUSION

Due to its low price, this operating version may be efficaciously instated in small scale molding devices and may be used to fabricate small plastic detail at an first rate cycle charge inside an powerful price detail. The Injection molding Machine is usually easy, presto, correct and smooth to use.

All electric powered is frequently supposed for the smallest electricity price, severe reproducibility, slim processing window for skinny walled detail in engineering polymers, dragged delicacy and immediate repetition, excessive uptime, decrease shot length application, low emigration, water saving, quiet terrain want, smooth room necessity.

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