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Design and Development of Extrusion Molding Machine

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Abstract: 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. The main principle is to compress the plastic material in a heating chamber (barrel) with the help of plunger and induction coil convert plastic polymer into molten (semi-solid) state. Then the plastic polymer in predetermined quantity is forced through the nozzle into the die under pressure. After completing the process, final product is obtained from the die. We can use plastics, metals or alloys for this process. In our project we are using plastics polymers for making bushes, switches, fishing hooks, mobile covers etc. This machine is a prototype for producing small plastic components. This injection moulding machine is very useful for the small scale industries because of its low manufacturing cost, low maintenance cost, no skilled worker is required. It can be recommended for small scale investors those who are willing to produce small plastic products.

The describe an injection molding machine, which is a widely used method for converting plastics into various end products. The machine operates by compressing plastic material in a heating chamber using a plunger and induction coil, transforming it into a molten state. The molten plastic is then injected under pressure through a nozzle into a die, resulting in the formation of the final product. The process can utilize plastics, metals, or alloys. The described machine is a prototype designed for producing small plastic components such as bushes, switches, fishing hooks, and mobile covers. It offers benefits such as low manufacturing and maintenance costs, as well as not requiring skilled labor. As a result, it is recommended for small-scale industries and investors looking to manufacture small plastic products.

Keywords: Injection Molding, Plastic, Extrusion Molding

I. INTRODUCTION

Plastic has many advantages in industrial level and even in day-to-day life. It is easy to manufacture, light weight, does not react to outside influences, it has good chemical resistance and durable. Plastic can be used to manufacture many items, it is used in high industries like transportation, electronics, aviation, construction, scientific equipment, as well as daily life article. Even though it has many advantages which were mentioned before there are many drawbacks to it. As per reports, our country produces 16,000 tones of plastic in a day from which 9,000 tones in a day is collected and the remaining amount of plastic remains as pollutants. Plastic pollutants produced by the human beings causes harms to other living beings and environments.

The ration of amount of plastic recycled to the amount of plastic produced is very less. This project is about the design and fabrication of plastic recycling machine. It is a small table top extruder. It consists of components like hopper, screw, barrel, die and cutter. The plastic to be recycled fed to the hopper which is moved by a rotating screw operated by a motor. The external heat is given by the band heaters which melts the plastic and after which it passed through the die. It requires adequate amount of temperature in order to get expected product and avoid the melted plastic to get pasted in the barrel. When two different types of plastics are used it may result in mixture of both. Therefore, it is very essential to maintain the temperature throughout the process.

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.

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use plastics because it is easier and cheaper to manufacture and comfortable to use. Considering this demand of plastic for various purpose, 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.

Prof. Raghu Tilak Reddy and et. al., [1] 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., [2] 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., [3] 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., [4] 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. 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.

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Gurushanth B. Vaggar and et. al., [5] 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. OBJECTIVES

Based on the knowledge gap through the existing literature the objectives of the current research work are fixed which are outlined as below:

- To develop a versatile injection moulding machine from locally available materials for plastic recycling
- Design and fabricate a table top injection moulding machine.
- To assess the effect of addition of recycled plastic to the mechanical properties of the virgin plastic.

IV. SCOPE OF THE PROJECT

- To become aware of the procedure utilized in advent of plastic merchandise.
- To examine the molecular shape and locate the soften float charge of Plastic substances.
- To layout the person pleasant device for production the plastic Products at low price four.
- To layout the die this can be used for production the toy Product.
- To layout the device for plastic recycling
- Study the electricity traits of molded plastic substances and Recycled plastic merchandise.
- To layout mild weight and compact molding device

V. METHODOLOGY

- With the help of literature we learn about previous researches, models and designs which is related to our projects.
- The designs have been made using certain software in order to initiate and prepare our project.
- The dimensions are finalized according to our requirements.
- Materials are selected after proper analysis in order to full fill the design our model and other factors like weight, ease to manufacture, etc.
- Fabrication is done according to the planned design.
- Several tests are done to evaluate the working efficiency of the model.
- The report has been prepared.

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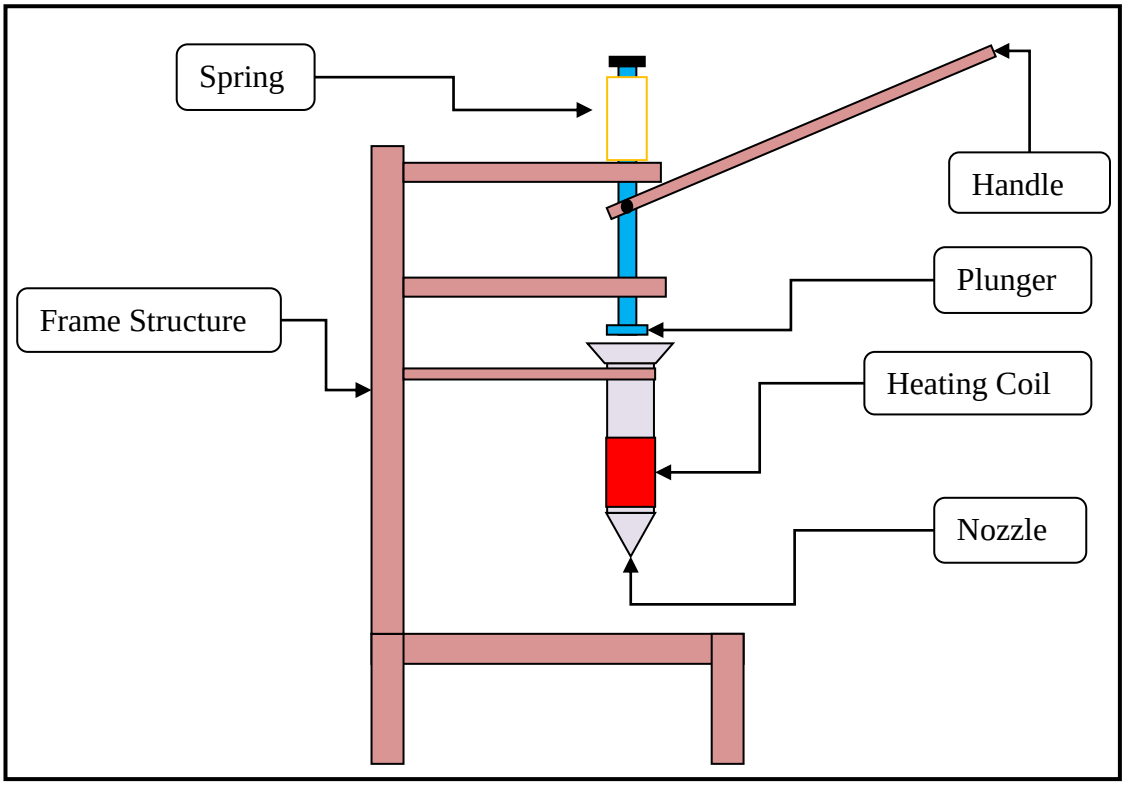
VI. DIAGRAM



VII. WORKING PRINCIPLE

The injection unit is liable for each heating and edging within side the cloth into the earth. The first a part of this unit is the hopper, a huge vessel into which the uncooked plastic is poured. The hopper has an open backside, which permits the cloth to feed into the barrel. The barrel consists of the medium for heating and edging within side the cloth into the earth. This medium is commonly a ram injector. A ram injector forces the cloth ahead via a heated phase with a ram or plunger it truly is commonly manually powered. The soften is likewise equipped / pressured right into a chamber shaped with the aid of using a split- shadeation earth. The soften stays within side the earth and is both stupefied right all the way down to solidify(thermoplastics) or hotted as much as cure(thermosets). The earth is likewise opened and the component is ejected. Injection molding is an provident and usually powerful device of manufacturing injection moldered hall. It can produce hundreds of thousands of hall with precisely the equal form, measurement, and great. Some exemplifications of injection moldered hall are the cellular phones, mouse, keyboard, synthetic use and severa elements installation within side the device.)

Procedure Step:

1: Feeding: Granulated or pulverized thermoplastic is fed from a hopper in to the injection molding device.

2: Heating: The injection molding device includes a concave sword barrel, containing a plunger. The plunger contains the plastic alongside the barrel to the earth. Heaters compass the barrel softens the plastic because it travels alongside the barrel.

3: Injecting: The plunger is pressured returned because the melted plastic collects on the stop of the barrel. Previously sufficient plastic has amassed a ram pushes the ahead edging within side the plastic via a sprue in to a earth despair. The earth is warmed earlier than edging in and the plastic is equipped snappily to assist it from hardening earlier than the earth is full.

4: Ejecting: Pressure is maintained for a brief time (stay time) to assist the cloth creeping returned at some point of setting. This prevents loss and hollows, consequently giving a higher great product. The molding is left to chill earlier than removing (ejected) from the earth. The molding is takes at the form of the earth despair

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VIII. ADVANTAGES, DISADVANTAGES & APPLICATIONS

8.1 Advantages:

1. Indispensable for plastic mugs and plates.
2. Cheaper and fluently to be had cloth used.
3. Quick response.
4. No hearth place chance hassle because of over lading.
5. Nonstop operation is feasible without stopping.
6. High product charge.
7. High forbearance.
8. Occupies decrease backside space.
9. Minimum scraps losses.

8.2. Disadvantages:

1. Difficulty in designing molds.
2. Problem with required heating and cooling plastic cloth.
3. Shrinkage. Simple shapes only.
4. Slow molding cycles.

8.3 Applications:

Injection molding is used to supply several outcomes comparable as line spools, bottle caps, car hall and elements, toys.

IX. 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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