

Design and Fabrication of Pneumatic Operated Injection Moulding Machine

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Abstract— This paper presents a spotlight on the design process and fabrication of pneumatic operated molding machines and their applications in various fields. While the use of plastic products is increasing day by day, the use of molding machines is increasing in small and medium enterprises. In this project, the authors intend to create a molding machine that can operate using air to reduce human effort and achieve improved productivity. The molding machine in this project is a vertical molding machine and is specially designed for small industries. There are different components of molding machine like direction control valve, double acting pneumatic cylinder, check valve, heating chamber, nozzle, die. Let's take a look at the operation and construction as well as the features of the components in this paper.

Keywords: Pneumatic, 5/2 DCV, Molding Machine, fabrication

I. INTRODUCTION

Injection molding machine is a method used to convert a large number of plastics into a variety of plastic products. The main principle is to compress the plastic material in the heating chamber (barrel) with the help of plunger and induction coil to convert the plastic polymer to molten (semi-solid) state. A predefined amount of plastic polymer is then forced to pass through the nozzle under pressure. After the process is completed, the final product is obtained from the die. We can use plastic, metal or alloy for this process. In our project we are using plastic polymers for shrubs, switches, fishing hooks, mobile covers etc. This machine is a model for making small plastic components. This injection molding machine is suitable for small industries because its production cost is low, maintenance is low, skilled labor is not required. It can be recommended to small investors who are ready for small plastic products.

II. LITERATURE REVIEW

Tsai, Hsieh, & Kao, 2009, in this work, practical techniques for Mechatronics design and injection speed control of ultra-speed plastic injection molding machines. The PI controller and the obscure PI controller are used, compared, and then applied to a digital signal processor (DSP) using standard C programming techniques (1). William Liu, 2014, Examination of the failure of the nozzle unit in a plastic injection molding machine revealed cavities rather than rust. Three types of erosion pits have been found in different sizes. The incense in the cavity succeeds by replacing the stainless steel with aluminum (2). This paper introduces two methods of doubling time and energy consumption in the plastic injection molding process, said Ejon Mueller of Rainer Schilling. Improvement concepts are brought forward based on dual process analysis. The value stream mapping method

can thus be extended to the energy value stream mapping method (EVSM) while maintaining internal logic (3). A. G. Gerber, R. Dubey, A. Haley said a unique method of adding computational fluid dynamics (CFD) model productive control (MPC) to control melting temperatures. Generating CFD through open-loop test, temperature, and input based system model for multi-variable control of three heater barrels on injection molding machine. CFDs can be used to dramatically reduce the time associated with open-loop testing through physical experiments (4). S. J. Bull, R. Davidson, E. H. Fisher, A. R. McCabe, a. M. Jones Presented in the paper, glass-filled polymers create significant wear on the screws and barrels of injection molding machines, and many coatings and surface treatments have been used. They have developed a novel wear tester to simulate the wear conditions occurring in the barrel of an injection molding machine. The tester concept is similar to the ASTM rubber wheel friction test (5).

C. Sasikumar, S. Srikanth, S. K. Das inquired about the premature breakdown of a 150 tonne plastic injection molding machine in AISI 4140 steel tie bar. The nominal stress acting on the tie bar (95.5 MPa) is much lower than the production capacity of this material (750-900 MPa). The solution is a hydraulic clamping mechanism instead the toggle clamp mechanism for the mold will reduce the cyclic stress on the tie rods (6). G. Luchetta, p. F. Beriani, W. A Knight has investigated that virgin polymers are generally mixed to get the best trade between cost and low melt viscosity. This last limit is necessary to avoid short shots and to reduce the clamp force and final processing costs of the required injection molding machine. A new approach to reducing total production costs (7).

III. METHODOLOGY

A. Objectives

- To have increased reliability, productivity, and uptime for injection moulding machine.
- To achieve optimal utilization of plastic injection moulding machine.
- Determine the most suitable plastic material to conduct this process and the time duration.
- To provide an Injection Moulding Machine to reduce human fatigue.
- To provide an Injection Moulding Machine to operate easily.
- To provide an Injection Moulding Machine which can be manipulates easily.
- To provide an Injection Moulding Machine at low cost.
- To provide variable height adjuster for various size of dies.
- Smooth repeatable operation.

- No skilled labor is required.
- To reduce wastage of raw material.

B. Working Principle

The injection-molding process is best for the manufacture of materials made from both thermosetting and thermoplastic materials. Here, the cost of the equipment is relatively high but the main attraction is to facilitate the injection-molding process at a high production rate. In the process of injection molding, a small amount of compressed thermoplastic material is pressed into a relatively cold mold where it hardens into the shape of the mold.

The injection molding machine process shows that the compound plastic material is delivered as a grain, pellet, or powder at regular intervals through a hopper in a hot horizontal or vertical cylinder where it becomes soft. The air is pressurized by a piston driven by air to press into the mold fitted to the end of the cylinder. While passing through the hot zone of the cylinder, a device called a torpedo helps to spread the plastic material evenly around the inner wall of the hot cylinder and which ensures uniform distribution of heat. The molten plastic material from the cylinder is then injected through the nozzle material from the cylinder and then through the nozzle into the mold cavity. The template used, in its simplest form, is a two-part system.

IV. MODELING AND ANALYSIS

A. Components:

1) Double Acting Pneumatic Cylinder:

Specifications:

Title: Double Acting Mini Cylinder
Make: Techno MAL Series
Bore Size: 32 mm
Stroke Length: 160 mm

2) 5/2 Way Hand Lever Valve Spring Return

Specifications:

Title: Double Acting Mini Cylinder
Make: Airmax
Body: Aluminium
Seals: Nitrile
Design: Spool type external operated Spring Loaded

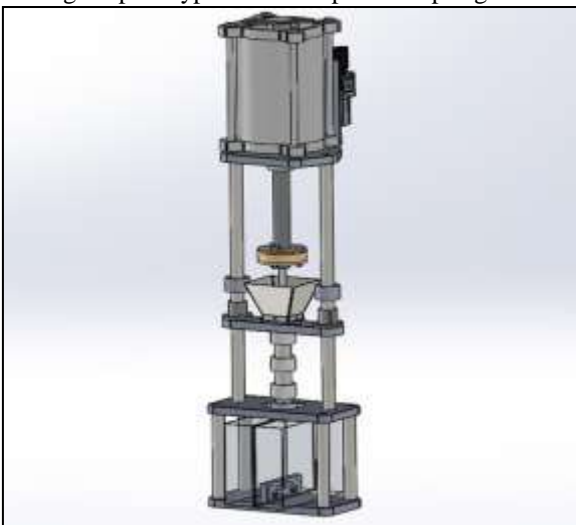


Fig. 1: Design of Pneumatic Operated Injection Moulding Machine.

V. CONCLUSION

- Due to its low cost, this working model can be successfully used in small scale moulding units and can be used to manufacture small plastic component at an acceptable cycle rate within an effective cost component.
- This machine is compatible with the operator.
- This machine is simple in design and easy to operate.
- This machine is simple in maintenance resulting low maintenance cost.

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