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RESEARCH ARTICLE OPEN ACCESS

Failure mode analysis of a Fan Regulator using 3D CAD Modelling

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ABSTRACT
The goal of this research project is to design and develop the injection moulding die that will be used to create the knob for fan regulators and machinery. The fan regulator knob was produced using a single cavity hand injection moulding technique. The shape and product are obtained using the rectangular runner, edge gate, and pin type ejection. Because it is inexpensive and has a good tensile strength even at low temperatures, polypropylene is the material utilised to make the fan regulator knob.
Keywords - Injection Mould die, Design of Die, Manufacturing process and product manufacturing

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I. INTRODUCTION

Plastic component manufacturing is done through the process of moulding. The procedure involves using heat and force to partially melt the polymers. After that, the plastic is pliable enough to be moulded with the help of pressure using a mould.In order to form the cavity and allow extra material to escape as flash, a premeasured volume of powder or a viscous mixture of liquid resin and filler material is poured into a heated mould.

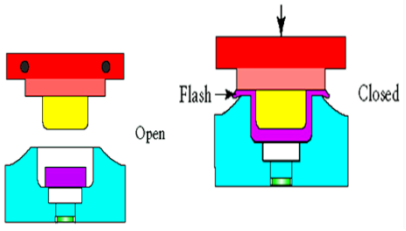

Figure 1 Compression moulding

Blow Molding is a highly improved moulding technology. It is best suited for hollow parts such as plastic bottles with uniform wall thickness, where the outside shape is a major consideration. Blow molding also consumes about ten percent of all plastic worldwide.

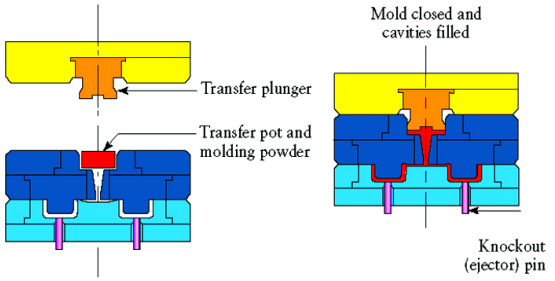

Figure 2 Transfer Moulding

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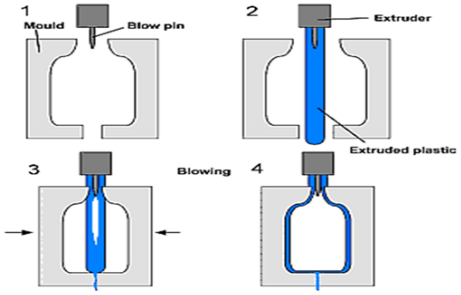


Figure 3 Blow Moulding

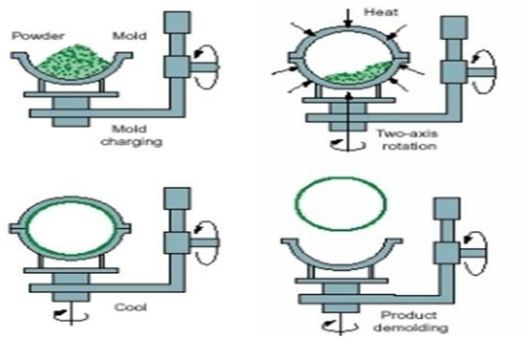


Figure 4 Rotational Moulding

Hand injection moulds are manually operated moulds.This has got a vertical feeding arrangement operated by hand. The mechanism includes a rack and pinion arrangement to actuate the plunger which pushes the heated material through the nozzle of the machine from the barrel.

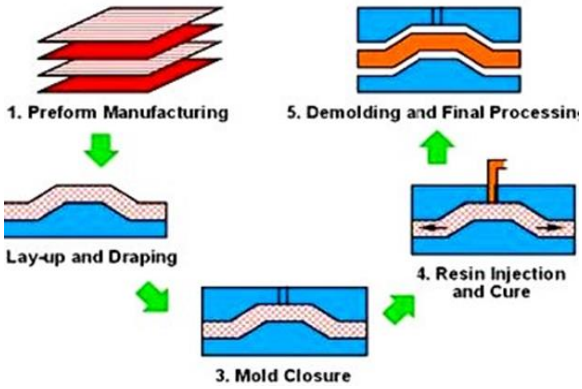


Figure 5 Hand Injection Moulding

Hot runner system is a unit incorporated in plastic injection moulds to replace the conventional flow channels namely sprue, runners and sub runners. Large molding such as automotive dash boards , bumpers, computer housing etc. could be produced in practice without multiple melt supply. The material in the hot runner is maintained in the molten state and is not ejected with the molded part. Hot runner systems are also called as hot-manifold systems or runner less molding. Hot runner system can be semi hot runner system or a fully hot runner system. By using semi hot runner system major part of main runner is eliminated. Full hot runner system eliminates runners and sub runners completely.

The cost of the product (fan regulator knob) depends upon the function of design, material used and processing method. In this research work, an attempt has been to design the injection mould die for casting of fan regulator knob

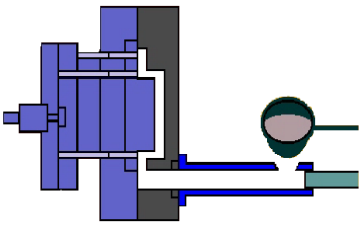


Figure 6 Hot Runner Moulding

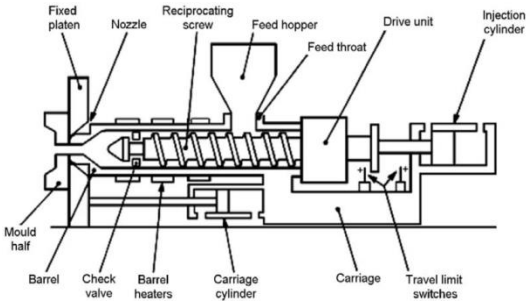
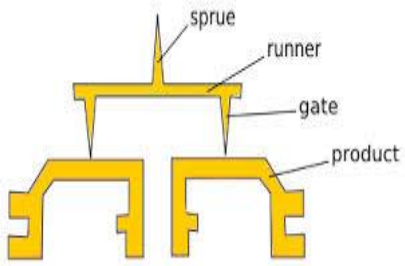


Figure 7 Injection Moulding

II. METHODOLOGY

The mould consists of two primary components, the injection mould (a plate) and the ejector mould (b plate). Mould; the sprue bushing is to seal tightly against the nozzle of the injection barrel of the moulding machine and to allow molten plastic to flow the barrel into the mould, also known as the cavity. The sprue bushing directs the molten plastic to the cavity images through channels that are machined into the faces them, so they are referred to as runners. The molten plastic flows through the runner and enters one or more specialized gates and into the cavity geometry to form the desired part.



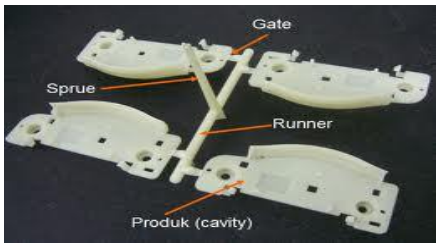


Figure 8 Runner and Gateway of the mould

To ease maintenance and venting, cavities and cores are divided into pieces, called inserts, and sun-assemblies, also called inserts, blocks, or chase blocks by substituting interchangeable inserts, one mould may make several variations fo the same part. More complex parts are formed using more complex moulds. When the mould is opened, the slides are pulled away from the plastic part by using stationary "angle pins" on the stationary mould half. These pins enter a slot in the slides and cause the slides to move backward when the moving half of the mould opens. The part is then ejected and the mould closes. The closing action of the mould causes the slides to move forward along the angle pins.

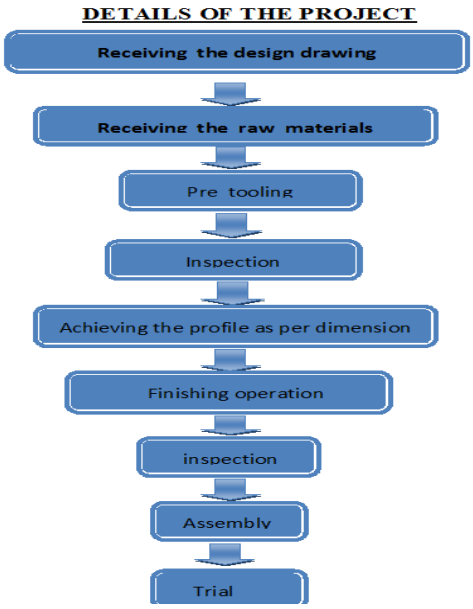


Figure 9 Flow chart

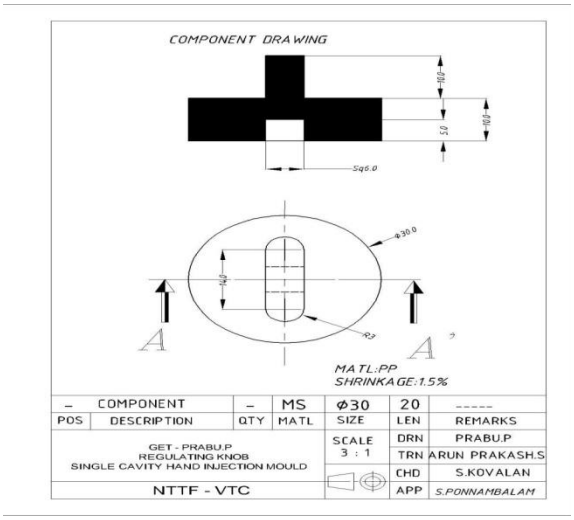


Figure 10 Regulator Knob Specification

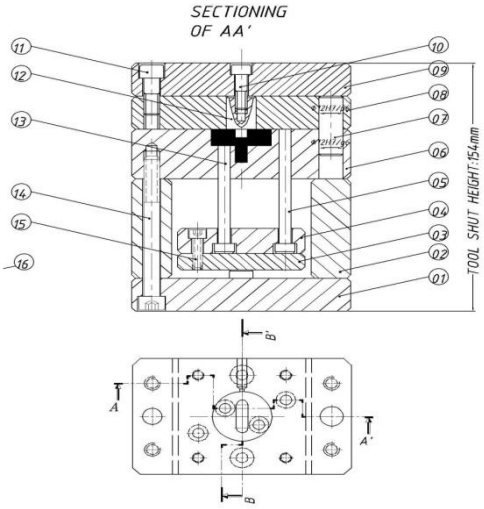


Figure 11 Mould assembly

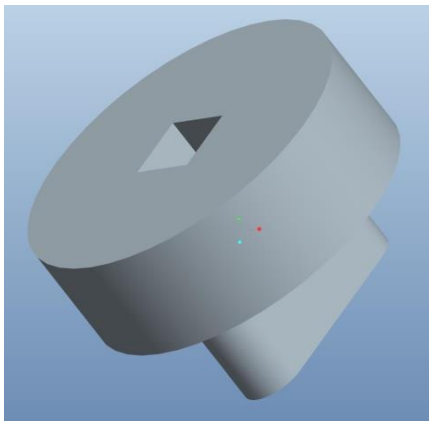


Figure 12 3 D modeling of the regulator Knob

From the specification of the drawing, the 3 D assembly is created using the Catiamodling software. According to the drawing specification, the injection mould die was manufactured using diffecrent machines. The final assembly of the injection mould die is shown in figure 14.

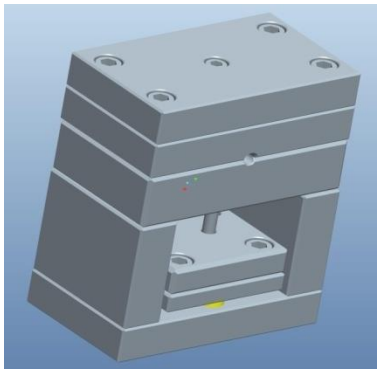


Figure 13 3- D Assembly of injection mould die

Figure 14 Injection mould die

III. CONCLUSIONS

The injection mould die for fan regulator knob was successfully design and fabricated with specification given by the customer and the following conclusion were made

- The low temperature of the raw material causes the following product as shown in the figure. This problem can be eliminated by increasing the temperature of the mould and pressure

- The low clamping force and pressure in the injection mould die produces the following product with defect. This defect can be eliminated by choosing the correct clamping force and pressure in the injection mould die.

- final product can be produced with no defects ensures the quality of the mould die. The good product produced by selection of proper parameters and shown in the figure.

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