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Plastic crushing and injection molding machine

[#1]Akash Ravindra Parale, [#2]Yogesh Ashok Vazre, [#3]Arjun Rajendrasingh Chandel
[#4]Abhinay Chandramohan Kardile, [#5]Prof. P.C.Patil

[1]aparale7@gmail.com
[2]yogeshwazare11@gmail.com
[3]chandelarjun48@gmail.com
[4]kardile928@gmail.com

[#12345]Mechanical Engineering Department
SKN Sinhgad College of Technology and Science Lonavala.

ABSTRACT

The presence of an already molded component during the second and subsequent molding stages makes multi-material injection molding different from traditional injection molding process. Therefore, designing plastic material molded objects requires addressing many additional manufacturability considerations. In this project, we first present an approach to systematically identifying potential manufacturability problems that are unique to the plastic -material molding processes and design rules to avoid these problems. Then we present a comprehensive manufacturability analysis approach that incorporates both the traditional single material molding rules as well as the specific rules that have been identified for multi-material molding. Our analysis shows that sometimes the traditional rules need to be suppressed or modified. Lastly, for each of the new manufacturability problem.

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I. INTRODUCTION

Plastic Injection Molding is an assembling system for making parts from thermoplastic and thermo set materials. Rather than the expulsion (which makes nonstop parts of steady cross area), infusion shaping makes discrete parts (with perplexing and variable cross areas). Liquid plastic is infused at high pressure into a shape, which is the reverse of the coveted shape. The mold is produced using metal, typically either steel or aluminum. Generally utilized for assembling an assortment of parts, from the littlest segment to whole body boards of autos.

Injection molding:

Injection molding is a manufacturing process for producing parts from both thermoplastics and thermosetting plastic or other materials. For this purpose injection molding machine is used. Used for manufacturing of variety of parts from small components to entire body panel of cars.

Mold is a hollowed out block used when components are to be made from plastics or rubber glass etc. The mold is made from metal, usually either steel or aluminium. Designing and making mold for injection molding is more complicated than making extrusion die.

Over the last few years, a wide variety of multi-material injection molding (MMM) processes have emerged for making multi-material objects, which refer to the class of objects in which different portions are made of different materials. Due to fabrication and assembly steps being performed inside the molds, molded multi-material objects allow significant reduction in assembly operations and production cycle times. Furthermore, the product quality can be improved, and the possibility of manufacturing defects, and total manufacturing costs can be reduced. In MMM, multiple different materials are injected into a multi-stage mold. The sections of the mold that are not to be filled during a molding stage are temporally blocked. After the first injected material sets, then one or more blocked portions of the mold are opened and the next material is injected. This process continues until the required multi-material part is created. Nowadays, virtually every industry (e.g., automotive, consumer goods, toys, electronics, power tools, appliances) that makes use of traditional single-material injection molding (SMM) process is beginning to use multi-material molding processes. Some common applications include multicolor objects, skin-core arrangements, in-mold assembled objects, soft-touch components (with rigid substrate parts) and selective compliance objects.

There are fundamentally three different types of multi-material molding processes. Multicomponent injection molding is perhaps the simplest and most common form of MMM. It involves either simultaneous or sequential injection of two different materials through either the same

or different gate locations in a single mold. Multi-shot injection molding (MSM) is the most complex and versatile of the MMM processes. It involves injecting the different materials into the mold in a specified sequence, where the mold cavity geometry may partially or completely change between sequences. Over-molding simply involves molding a resin around a previously-made injection-molded plastic part. Each of the three classes of MMM is considerably different. Each specific MMM process requires its own set of specialized equipment; however, there are certain equipment requirements that are generally the same for all types of MMM. Techniques described in this paper are applicable to over-molding and multishot molding.

The Mold

The mold is a complex tool that contains the cavity or cavities in which the plastic parts will cool. Because of its complexity, and the fact that it significantly affects the total cost of a molding operation, the mold receives special attention here. There are several ifferent types of molds, including two-plate molds, three-plate molds and multi-piece molds ("space puzzle molds"). Two-plate molds are the most common and will be the only type discussed hereafter. In essence, two plate molds consist of a cavity located inside a set of plates divided into two halves: 1) a moving half, and 2) a stationary half [9]. The stationary half is located on the injection side of the molding machine, bolted onto the stationary platen and connected to the injection unit. The moving half of the mold is bolted onto the clamping unit and moves with it during the mold opening and closing phases.

II. PROBLEM IDENTIFICATION

Problem Identification :(Recycling waste plastic) Now a days the plastic bottles ,supporting frames etc. are normally used after use these plastics are disposed of they take lot of space and as it is this increases pollution .Hence this can have to be recycled taking in consideration and environmental concerns Plastics crushed can be melted and can be used to produce different kind of product but it is an extremely laborious work .Hence we need a simple machine which will reduce the human efforts.

Problem Definition: (Plastic Recycling Machine) Plastic recycling machine is a simple machine, compact, light-weight. A pneumatic cylinder is used to compressed the molten plastic heated by coil heater of capacity 100W.Liquid plastic is than delivered t under high pressure(10 bar) to the die to produce a required product.

III. LITERATURE SURVEY

[1] AlirezaAkbarzadeh and Mohammad Sadeghi"Parameter Study in Plastic Injection Molding Process using Statistical Methods and IWO Algorithm" International Journal of Modeling and Optimization, Vol. 1, No. 2, June 2011 pp-141 Dimensional changes because of shrinkage is one of the most important problems in production of plastic parts using injection molding. In this study, effect of injectionmolding parameters on the shrinkage in polypropylene (PP) and polystyrene (PS) is investigated. The relationship between input and output of the process is studied using regression method and Analysis of Variance (ANOVA) technique. To do this, existing data is used. The selected input parameters are melting temperature, injection pressure, packing pressure and packing time. Effect of these parameters on the shrinkage ofabove mentioned materials is studied using mathematical modelling. For modelling the process, different types of regression equations including linear polynomial, Quadratic polynomial and logarithmic function, are used to interpolate experiment data

[2]Prof. S. B. Khedkar1, Prof. R. D. Thakre2, Prof. Y. V. Mahantare3, Mr. Ravi Gondne4 "Study of Implementing 5S Techniques in Plastic Moulding" International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.5, Sep.-Oct. 2012 pp3653-3656.It will impact the instructors and workman of Industry that work within the selected place. By following the 5S methodology, this research effort may show significant improvements to safety, productivity, efficiency, and housekeeping. The research documents improvements by using before and after pictures. It also intends to build a stronger work ethic within the workman and engineer who would be expected to continue the good practices.

[3]Poonam G. Shukla, Gaurav P. Shukla"Design& Fabrication of Pneumatically Operated Plastic Injection Molding Machine" International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 7, January 2013 pp-98.The use of plastic is increased now days in many industries like automobile, packaging, medical, etc. The reason behind this is that the plastic made things are quiet easier to manufacture, handle and reliable to use. So the plastic goods manufacturing industries are striving hard to produce good quality products at large scale and cheaper cost. The hydraulically operated machines solve the problem, but they are too costlier for small scale and medium scale industries. This paper deals with design and fabrication of pneumatically operated injection plastic molding machine. The manually operated machine is converted into pneumatically operated machine by applying proper design procedure.

IV. DESIGN METHODOLOGY

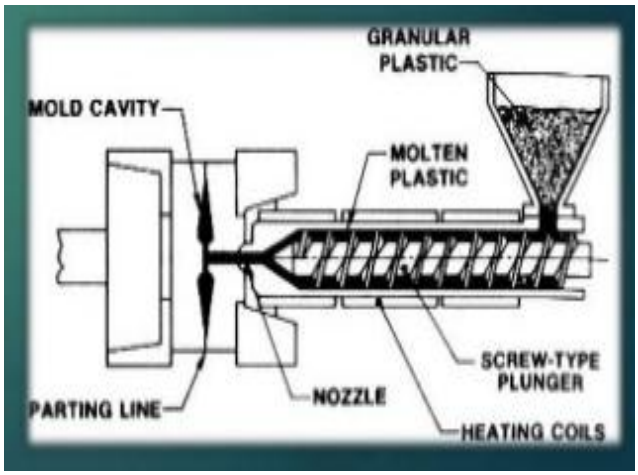

Fig 1. Design

Plastic in granular or pelletized form is fed from hopper and fall into barrel through its throat. Then it is melted through heating by heaters which surround the barrel. The material in heating chamber is forced around a spreader to make its

better contact with heated wall and as a result it forms a viscous liquid. This viscous liquid is collected in a pool in a barrel known as injection chamber. Molten plastic is then forced to move forward by the action of plunger (ram). Inside the barrel, there is a rotating screw which carries the molten plastic along the barrel to the mold. The reciprocating screw moves back as molten plastic moves forward. Again by the action of ram, this molten plastic is injected through a nozzle into mold cavity. Mold is kept warm before plastic injection. To avoid shrinkage or hollows, pressure inside the mold is kept maintained usually 15,000psi until solidification occurs. Finally Solid material is injected by opening the mold and then entire cycle is repeated.

V. COMPONENT USED

HOPPER

A hopper is a large, pyramidal shaped container used in industrial processes to hold particulate matter that has been collected from expelled air. Hoppers are usually installed in groups to allow for a greater collection quantity. They are employed in industrial processes that use air pollution control devices such as dust collectors, electrostatic precipitators, and baghouses/fabric filters. Most hoppers are made of steel.

- A storage container used to dispense granular materials through the use of a chute to restrict flow, sometimes assisted by mechanical agitation
- A paintball loader
- A storage container used to collect granular materials designed to easily dispense these materials through the use of gravity.
- Part of an agricultural aircraft to store the chemicals to be spread
- Part of a combine harvester
- Part of a wheel tractor-scraper to store the soil load
- Hopper (particulate collection container), a large container used for dust collection

Shaft:

Fig 2. Shaft

A drive shaft is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them. As torque carriers, drive shafts are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, whilst avoiding too much additional weight as that would in turn increase their inertia.

To allow for variations in the alignment and distance between the driving and driven components, drive shafts frequently incorporate one or more universal joints, jaw couplings, or rag joints, and sometimes a splined joint or prismatic joint.

Bearing

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts.

Fig 3. bearing

Specification

Manufacturer	SKF
Type of bearing	single row deep groove ball
Internal diameter	15mm
Outside diameter	35mm
Width	11mm
Rolling element material	bearing steel
Cage material	steel
Race material	bearing steel
Kind of Bearing	rolling
Bearing seal	metal plates, two-side
Radial clearance	normal

NOZZLE

A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits (or enters) an enclosed chamber or pipe.

A nozzle is often a pipe or tube of varying cross sectional area, and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy.

Nuts and bolts:

A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to

fasten two or more parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together. In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: lock washers, jam nuts, specialist adhesive thread-locking fluid such as Loctite, safety pins (split pins) or lock wire in conjunction with castellated nuts, nylon inserts (Nylon), or slightly oval-shaped threads. The distinction between a bolt and a screw is unclear and commonly misunderstood. There are several practical differences, but most have some degree of overlap between bolts and screws.

Fig 4. Nut and bolt

A nut is a type of fastener with a threaded hole. Nuts are almost always used opposite a mating bolt to fasten a stack of parts together. The two partners are kept together by a combination of their threads' friction, a slight stretch of the bolt, and compression of the parts. In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: Adhesives, safety pins or lockwire, nylon inserts, or slightly oval-shaped threads.

The defining distinction, per Machinery's Handbook, is in their intended purpose: Bolts are for the assembly of two unthreaded components, with the aid of a nut. Screws in contrast are used with components, at least one of which contains its own internal thread, which even may be formed by the installation of the screw itself. Many threaded fasteners can be described as either screws or bolts, depending on how they are used. Bolts are often used to make a bolted joint. This is a combination of the nut applying an axial clamping force and also the shank of the bolt acting as a dowel. Pinning the joint against sideways shear forces. For this reason, many bolts have a plain unthreaded shank (called the grip length) as this makes for a better, stronger dowel. The presence of the unthreaded shank has often been given as characteristic of bolts vs. screws but this is incidental to its use, rather than defining.

Aluminium Strips:

Aluminium is the most abundant metallic element and constitutes about 8% of the Earth's crust. Aluminium salts are widely used in water treatment as coagulants to reduce organic matter, colour, turbidity and micro organism levels. Such use may lead to increased concentrations of aluminium in finished water. Where residual concentrations are high, undesirable colour and turbidity may ensue. Concentrations of aluminium at which such problems may occur are highly dependent on a number of water quality parameters and operational factors at the water treatment plant. Aluminium intake from foods, particularly those containing aluminium compounds used as food additives, represents the major route of aluminium exposure for the general public. The contribution of drinking-water to the total oral exposure to aluminium is usually less than 5% of the total intake.

Fig 5. Aluminium strips

LEAD SCREW

Lead screw (or lead screw), also known as a power screw or translation screw, is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms. Common applications are linear actuators, machine slides (such as in machine tools), vises, presses, and jacks. Lead screws are manufactured in the same way as other thread forms (they may be rolled, cut, or ground).

A lead screw is sometimes used with a split nut also called half nut which allows the nut to be disengaged from the threads and moved axially, independently of the screw's rotation, when needed (such as in single-point threading on a manual lathe).

Advantages of lead screw

Lead screws are used to raise and lower the front door of the Boeing 747-8F Freighter aircraft.

The advantages of a lead screw are:

Large load carrying capability
Compact
Simple to design
Easy to manufacture; no specialized machinery is required
Large mechanical advantage
Precise and accurate linear motion
Smooth, quiet, and low maintenance
Minimal number of parts
Most are self-locking

Heating coil

Heat coils, also known as protectors, bugs or carbons serve as a surge protector between the telephone exchange and outside plant. They are commonly the last point of appearance for a telephone circuit before it leaves the office, for example on the outside plant side of the main distribution frame. On some competitive local exchange carrier circuits there are two heat coils, the extra one being at the point of interface between their circuit and where the incumbent local exchange carrier or Regional Bell

Operating Company receives it. Their primary purpose is to protect central office equipment from surges of high voltage. If a surge comes down the line it will melt the connection between the central office and outside plant sides, as in a fuse, thereby protecting the equipment. Some heat coils have springs in them, so that when a surge breaks the circuit their tension is released and the plastic cover pops off as a visual indicator that the line is somehow defective.

Fig 6. Heat coil

Catia Setup:

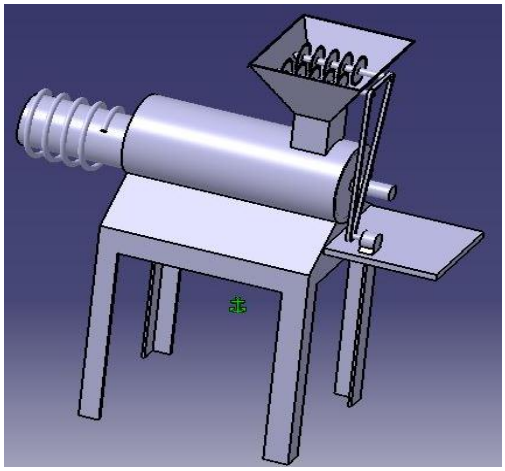

Fig 7. Catia design

VI. CONCLUSION

Due to its low cost, this working model can be successfully inducted in small scale molding units and can be used to manufacture small plastic component at an acceptable cycle rate within an effective cost component.

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