EGR 218 Manufacturing Team Project

Team 6:Cesar Ortiz, Andrew Dickenson, Luke Jeffs, Marcus Lemke

Ira A. Fulton Schools of Engineering
Arizona State University

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Overview: Paper Mate Mechanical Pencil

- ➔ Our group chose to do the manufacturability case study on a Paper Mate mechanical pencil.
- ➔ Sturdy product with the potential to have a long lifespan.
- ➔ Parts can be manufactured quickly and cheaply.
- ➔ Primarily made of plastic.

Selling price

- ➔ They sell for about $5 per pack of three.
- ➔ Simple design and available at all office supply stores as well as most “Big-box” stores such as Walmart and Target.
- ➔ Can come in different quantities ranging from a single pencil up to a dozen.

Product decomposition

Made up of 6 parts:

- Main housing
- Upper housing
- Lower housing
- Subassembly
- Plastic button
- Lead sleeve

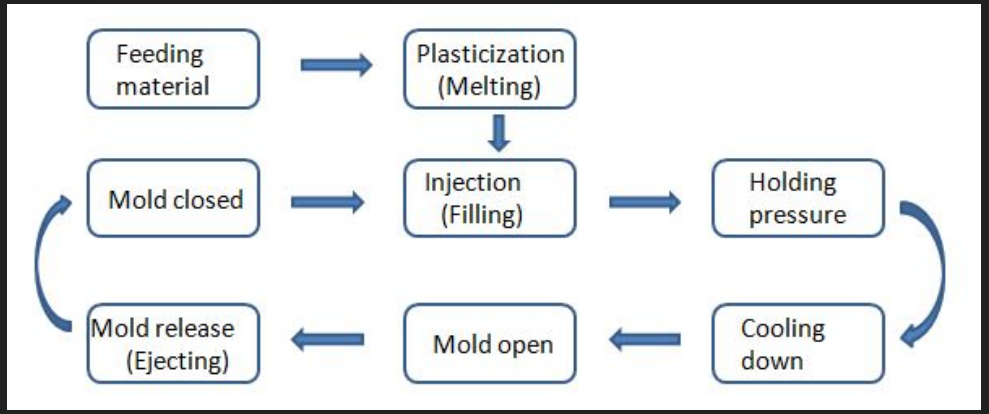
Standard Materials Used

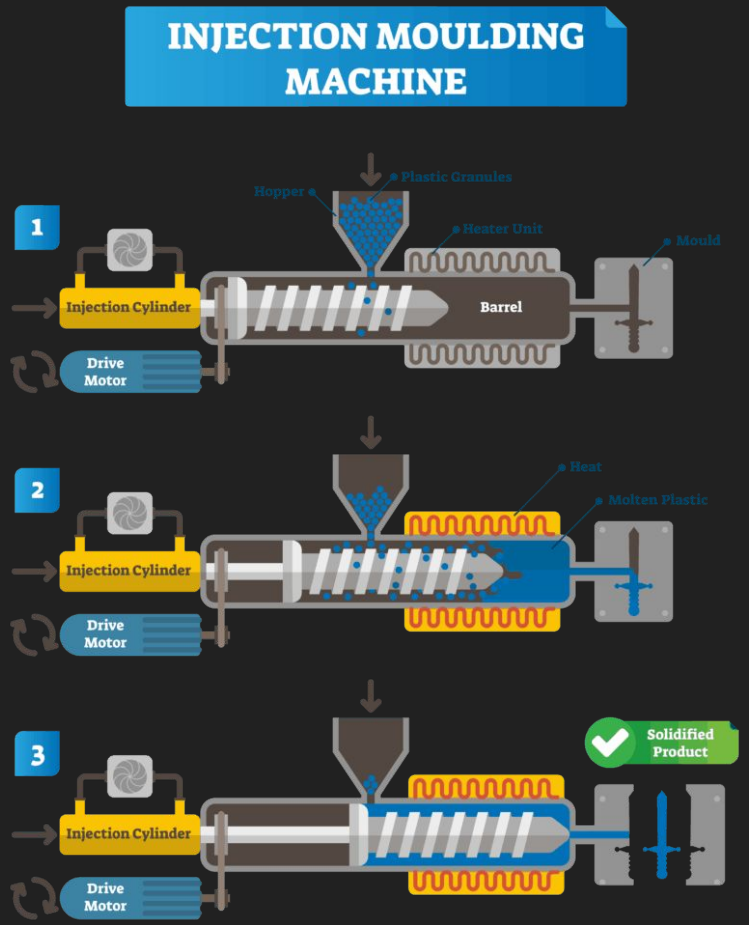
- High Carbon Steel
  - Metal Alloy
- Acrylonitrile Butadiene Styrene (ABS)
  - Thermoplastic
- Synthetic Rubber
  - Latex Polymer

Standard Manufacturing Methods

Material:	Acrylonitrile Butadiene Styrene (ABS)	Acrylonitrile Butadiene Styrene (ABS)	Acrylonitrile Butadiene Styrene (ABS)	Synthetic Rubber	Acrylonitrile Butadiene Styrene (ABS)	High Carbon Steel
Parts:	Main Housing	Upper Housing	Lower Housing	Subassembly	Plastic Button	Metal piece to guide lead at tip
Manufacturing Process Used	Injection Molding	Injection Molding	Injection Molding	Polymer Casting or Injection molding	Polymer Casting or Injection molding	Extrusion for the metal tip and injection molding for the plastic

Injection Molding Process





Cheaper Materials Used

- High Carbon Steel
  - Metal Alloy
- Polystyrene
  - Thermoplastic
- Natural Rubber
  - Elastomer

Cheaper Manufacturing Methods

Material:	Polystyrene	Polystyrene	Polystyrene	Natural Rubber	Polystyrene	High Carbon Steel
Parts:	Main Housing	Upper Housing	Lower Housing	Subassembly	Plastic Button	Metal piece to guide lead at tip
Manufacturing Process Used	Injection Molding	Injection Molding	Injection Molding	Polymer Casting or Injection molding	Polymer Casting or Injection molding	Extrusion for the metal tip and injection molding for the plastic

Pros of Cheap

- Cheaper to Produce.
- Materials Easier to Gather.
- Manufacturing Process Stays the Same.
- Cost of pencil can be lowered making it more affordable.
- Cost of pencil could also stay the same and increase the profits made on each pencil sold.

Cons of Cheap

- Pencil is less durable than before.
- More brittle because of a cheaper thermoplastic being used.

High-End Materials Used

- 304 Stainless Steel
  - Metal Alloy
- Polyurethane
  - Elastomer

High-End Manufacturing Methods

Material:	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel	Polyurethane	304 Stainless Steel	304 Stainless Steel
Parts:	Main Housing	Upper Housing	Lower Housing	Subassembly	Metal Button	Metal piece to guide lead at tip
Manufacturing Process Used	Metal Casting	Metal Casting	Metal Casting	Polymer Casting or Injection molding	Metal Casting	Extrusion for the metal tip

Pros of High-End

- Increased Durability.
- Sturdier.
- Higher Quality.
- Aesthetically Pleasing

Cons of High-End

- Manufacturing Process would have to change entirely.
- Changing the Manufacturing Process will be costly.
- Materials used would cost more.
- The price of the pencil will go up.
- Production would slow down.

Questions?