MATERIALS PRODUCTION

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CAP</th>
<th>BARREL</th>
<th>BALL BEARING</th>
<th>POINT</th>
<th>INK</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIAL</td>
<td>(PP) POLYPROPYLENE</td>
<td>(HDPE) HIGH DENSITY POLYETHYLENE</td>
<td>TUNGSTEN CARBIDE</td>
<td>BRASS</td>
<td>DYES, RESINS, PIGMENTS, SURFACTANTS, THICKENERS, PRESERVATIVES</td>
</tr>
<tr>
<td>PRODUCTION METHOD</td>
<td>INJECTION MOLDING</td>
<td>COMPRESSION &amp; LAPPING</td>
<td>PUNCHING</td>
<td>MIXING</td>
<td></td>
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</tbody>
</table>

Plastic pellets are heated through a barrel and then the melted plastic is injected into a mold. Plastic pellets are heated through a barrel and then the melted plastic is injected into a mold. Tungsten carbide powder is compressed, creating a 1mm pellet. Then they are sanded with a diamond paste in a lapping machine and lubricant is added. This is done for over 5 days. This socket point, made out of brass, is punched out. Then the ball bearing is mounted into the point. Ink is made up of dyes, resins and solvents to create the right viscosity, to create this fast dry ink. The ink is housed in a plastic tube, which is formed by being heated and then extruded through a bath of water.

**Assembly**
The plastic cartridges are filled with ink, then they are attached to the ball point. At this stage, other components such as the cap and ends are incorporated. Other finishing steps, such as adding coatings or decorations or performing a final cleaning, are also done.

**Packaging**
The finished pens are then packaged according to how they will be sold. Single pens can be put into blister packages with cardboard backings. Groups of pens are packed into bags or boxes. These sales units are then put into boxes, stacked on pallets, and shipped to distributors.

**Transportation** accounts for 57% of emissions and 3% of the flows.

**ENVIRONMENTAL IMPACTS**

**Material Content for Each Pen**
- 5 grams of plastic
- 5 grams of brass
- 6.8 ml of crude oil
- 1 gram of carbide tungsten

**Manufacturing**
- 79% of BIC pens are made in Bic-owned factories. These factories are implementing annual energy and water consumption, CO2 emissions and waste.

**CO2%**
- 88% Plastics and metals from drilling to delivery
- 7% Energy to mold the plastic, manufacture and assemble
- 4% Transportation to stores
- 1% Resources used while using product
- 1% End of Life

**FACTS**
- Invented in 1931 by Lazlo Biro
- Patented in 1945 by Bich
- Price $.50 cents each
- 1 million pens sold every hour
- Sold in 160 countries
- Writes for 2 kilometers
- MOMA permanent exhibit
### BIC Ballpoint Pen

**Object Analysis**

- Multiple use
- Easy to use
- Glass ink bottles can be refilled or reused
- Maintains original qualities
- Higher value

**Reconceptualization**

**Refillable Cartridges**

- Refillable cartridges system
- A ballpoint pen that uses refillable cartridges with incorporated suction system
- Glass ink bottles engraved with logo. They can refill many cartridges and can later reused

**Recycled Materials**

- Same pen, different materials
- Post consumer recycled materials
  - Plastic
  - Replacement of brass for nickel
- Collection system in stores like: staples, office depot, etc. User will get a discount for next purchase

**Impact Addressed**

- Resource depletion (fossil fuels, fresh water, metals)
- Ecological Damage (Global warming, Ozone depletion, acid rain, habitat alteration, ecotoxicity)
- Human health Damage (air pollutants, carcinogens, health damaging substances)

**Design Criteria**

- Maintain relative low cost and price
- Add emotional value
- Reduce raw material used
- Maintain quality, ease of use, main features
- Extend product life
- Use recycled materials

**Material**

**Recycled Materials**

- Easy to implement
- Same pen
- Maintains original qualities

**Proposed Solution**

**Stages Addressed**

- Raw Materials
- Use
- End of Life

**Key Points**

- Multiple use
- Easy to use
- Glass ink bottles can be refilled or reused
- Maintains original qualities
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**Stages Addressed**

- Raw Materials
- End of Life

**Key Points**

- Easy to implement
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