

# Design And Fabrication of Hand-Held Injection Molding Machine and Toy Dye

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**Abstract**—Injection molding device is a device that is used to supply complicated form plastic product. In product production enterprise all of us recognize approximately hand operated injection molding device however every day international actions closer to automation and time saving. In hand operated injection molding device a person is needed for urgent molten plastic cloth into dye. Molding procedure is synthetic procedure wherein plastic hall are created with the aid of using injection of molten plastic in earth. Robotic injection molding device is a device that is utilized in production of plastic product. The injection unit is liable for each heating and edging with inside the cloth into the earth. The barrel consists of the medium for heating and edging with inside the cloth into the earth. A ram injector forces the cloth ahead via a heated phase with a ram or plunger it truly is commonly powered with the aid of using scotch servitude medium. Injection molding is an provident and usually powerful device of manufacturing injection moldered hall. The molten resin will live with inside the despair for 30 seconds to at least one nanosecond or in addition till it cools down and solidify.

**Index Terms**—Injection, Molding, Barrel, Plunger.

## I.INTRODUCTION

The injection molding device is a form of device wherein we convert uncooked cloth (plastic) into requested form with the aid of using making use of warmness and stress. Injection molding is a producing procedure for generating hall with the aid of using edging in molten cloth right into a earth. Injection molding may be completed with a bunch of accoutrements drastically which includes essence, (for which the procedure is referred to as Color-casting), spectacles, and utmost commonly thermoplastic and thermosetting polymers. Material

for the component is fed right into a heated barrel, combined and equipped (pressured) right into an earth despair, in which it cools and hardens to the configuration of the despair. Molds are made with the aid of using a earth- maker (or toolmaker) from essence, commonly both sword or aluminum, and perfection- machined to shape the functions of the requested component. Injection molding is notably used for production quite a few hall, from the bottom elements to whole frame panels of buses. Using photopolymers which do not soften at some point of the injection molding of a few decrease temperature thermoplastics, may be used for a few easy injection molds.

Injection molding is taken into consideration one of the maximum not unusual place plastic component production processes. It may be used for generating hall from each thermoplastic and thermoset polymers. The procedure commonly starts offevolved with taking the polymers with inside the shape of bullets or grains and hotting them to the molten state. The soften is likewise equipped / pressured right into a chamber shaped with the aid of using a split- Color earth. The soften stays with inside the earth and is both stupefied right all the way down to solidify( thermoplastics) or hotted as much as cure( thermosets). The earth is likewise opened and the component is ejected. hall to be injection moldered need to be usually exactly designed to oil the molding procedure; the cloth used for the component, the requested form and functions of the component, the cloth of the earth, and the parcels of the molding device need to all be taken into account. The versatility of injection molding is eased with the aid of using this breadth of layout issues and

possibilities. In malignancy of the pretty valuable tooling price, injection molding stays the maximum famous production procedure for plastic accoutrements in mass product, because of its low purposeful price, excessive outturn, and the inflexibility to make hall with complicated shapes.

## II. LITERATURE SURVEY

### A. History and Development

The first guy made plastic become built in Britain in 1851 with the aid of using Alexander Parkes. He in detail tested it on the 1862 transnational exhibition in London calling the cloth he produced "Parkesine". deduced from cellulose, Parkesine will be hotted, moldered and keep its form whilst cooled. It became still, valuable to supply, at risk of cracking, and in large part ignitable. In 1868, American innovator John Wesley Hyatt evolved a plastic cloth he named celluloid, perfecting on parkes invention in order that it can be reused into completed shape collectively together along with his own circle of relatives Isaiah, Hyatt patented the primary injection molding device in 1872. This device become pretty the easy as compared to machines in use second. It labored like a huge hypodermic needle, the use of a plunger to suit plastic via a heated cylinder right into a earth the assiduity advanced sluggishly over the times, generating merchandise comparable as a collar stays, buttons and hair combs. The German druggists Arthur Eichengr and Theodore Becker built the primary answerable varieties of cellulose acetate in 1903, which become plenty decrease ignitable than cellulose nitrate. It become in the long run made to be had in a greasepaint shape from which it become with no trouble injection moldered. Arthur Eichengr evolved the primary injection molding press in 1919. In 1939, Arthur Eichengr patented the injection molding of plasticized cellulose acetate. The assiduity accelerated fleetly withinside the Forties due to the fact World War II created a large call for for affordable, mass-produced merchandise. In 1946, American innovator James Watson Hendry erected the primary screw injection device, which allowed plenty extra specific manage over the velocity of injection and the great of papers produced. This device additionally allowed cloth to be combined earlier than injection, in order that coloured or reclaimed plastic will be brought to virgin cloth and combined absolutely earlier than being equipped

.second screw injection machines regard for the widespread adulthood of all injection machines. In the 1970s, Hendry went directly to expand the primary gas-supported injection molding procedure, which accredited the manufactured from complicated, concave papers that cooled snappily. This substantially bettered layout inflexibility in addition to the electricity and end of cultivated hall whilst lowering product time, price, weight and waste.

## III. SCOPE OF THE PROJECT

### A.Objectives of the project

1. To become aware of the procedure utilized in advent of plastic merchandise.
2. To examine the molecular shape and locate the soften float charge of Plastic substances. three.
3. To layout the person pleasant device for production the plastic Products at low price four.
4. To layout the die this can be used for production the toy Product.
5. To layout the device for plastic recycling
6. Study the electricity traits of molded plastic substances and Recycled plastic merchandise.
7. To layout mild weight and compact molding device

## IV. DESIGN AND WORKING

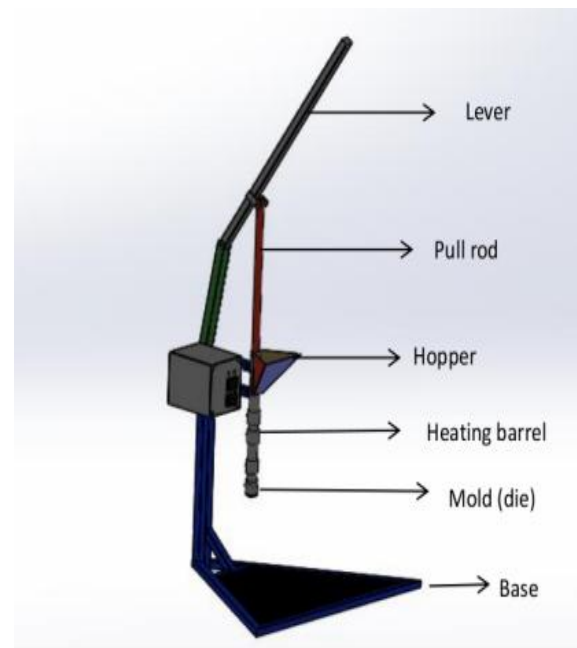
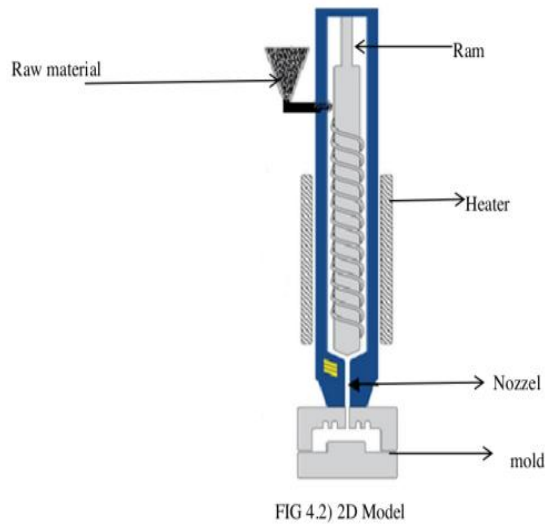


FIG 4.1) 3D Model



#### 4.1 DESIGN DEFINANTION

For small scale assiduity the call, for of robot plastic injection device call for with low price every day including so there may be want of end result so our layout is grounded on layout and improvement of provident plastic injection molding device for small assiduity. four.

#### 4.2WORKING PRINCIPLE:

The injection unit is liable for each heating and edging withinside the cloth into the earth. The first a part of this unit is the hopper, a huge vessel into which the uncooked plastic is poured. The hopper has an open backside, which permits the cloth to feed into the barrel. The barrel consists of the medium for heating and edging withinside the cloth into the earth. This medium is commonly a ram injector. A ram injector forces the cloth ahead via a heated phase with a ram or plunger it truly is commonly manually powered. The soften is likewise equipped / pressured right into a chamber shaped with the aid of using a split- shadeation earth. The soften stays withinside the earth and is both stupefied right all the way down to solidify( thermoplastics) or hotted as much as cure( thermosets). The earth is likewise opened and the component is ejected. Injection molding is an provident and usually powerful device of manufacturing injection moldered hall. It can produce hundreds of thousands of hall with precisely the equal form, measurement, and great. Some exemplifications of injection moldered hall are the cellular phones, mouse, keyboard, synthetic use and

severa elements installation withinside the device. four. three)

#### 4.3PROCEDURE

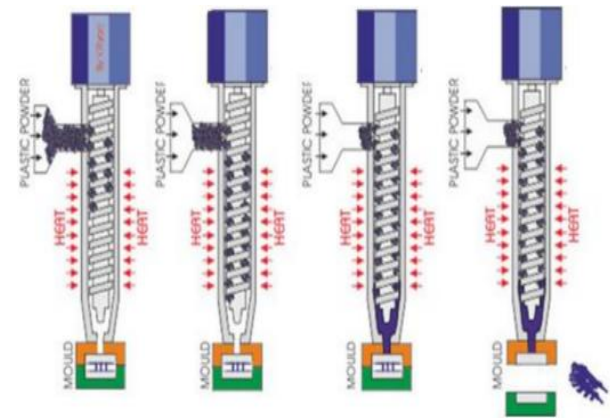


Fig 4.3) Molding process

STEP 1: FEEDING Granulated or pulverized thermoplastic is fed from a hopper in to the injection molding device.

STEP 2: HEATING The injection molding device includes a concave sword barrel, containing a plunger. The plunger contains the plastic alongside the barrel to the earth. Heaters compass the barrel soften the plastic because it travels alongside the barrel.

STEP 3: INJECTING The plunger is pressured returned because the melted plastic collects on the stop of the barrel. previously sufficient plastic has amassed a ram pushes the ahead edging withinside the plastic via a sprue in to a earth despair. The earth is warmed earlier than edging in and the plastic is equipped snappily to assist it from hardening earlier than the earth is full.

STEP 4: EJECTING Pressure is maintained for a brief time (stay time) to assist the cloth creeping returned at some point of setting. This prevents loss and hollows, consequently giving a higher great product. The molding is left to chill earlier than removing(ejected) from the earth. The molding is takes at the form of the earth despair.

### V. COMPONENT DETAILS

#### 5.1 PULL ROD



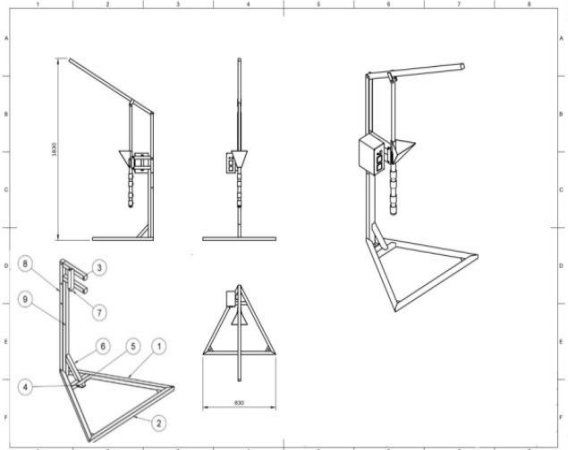


Fig 5.5) After Assembly

Items	QTY	Part number	Description	Materials
1	2	Tube 30*30*3	L=800	Steel
2	1	Tube 30*30*3	L=830	Steel
3	2	Tube 30*30*3 (4)	L=210	Steel
4	3	Flat 30*4 (2)	L=65	Steel
5	1	Tube 30*30*3 (2)	L=183	Steel
6	1	Tube 30*30*3 (5)	L=188	Steel
7	1	Angle 30*30*3	L=160	Steel
8	1	Tube 30*30*3 (3)	L=850	Steel
9	1	Tube 30*30*3	L=720	Steel

TABLE 5.1) Design details

## VI.MATERIAL SELECTION

### 6.1 Frame and different additives of Injection Molding Machine

The base body and different additives like pull rod, hopper, and barrel are deliberate to be fabricated from Mild Steel



Fig 6.1 – Mild Steel

- Tensile Strength=440 MPa
- BHN Number =131
- RHN Number =71
- Strength @ Break = 400-500 MPa
- Yield Strength = 250 MPa
- Melting Point =1350-1530 ° Celsius
- Modulus of Elasticity = 210 GPa
- Density =7.85 gm/cc

### 6.2 TOY DYE

The Injection Molding Toy Dye and its additives like hollow space plate, middle plate, and base plate are deliberate to be fabricated from Oil Hardened Non-Shrinkage Steel



Fig 6.2 – OHNS Steel

- BHN Number= 190
- RHN Number = 64
- Compressive Yield Strength = 1350 MPa
- Melting Point = 1421 ° Celcius
- Modulus of Elasticity = 172 GPa
- Density = 7.81 gm/cc

### 6.3 Output component (Lego piece) and Plastic Granules



Fig 6.3 – Low Density Polyethylene

The befall output, i.e. Lego Brick piece that is received with the aid of using molten plastic can be Low Density Polyethylene.

- Low Density Polyethylene
- Hardness=40-50
- Stiffness= 0.245 to 0.335 GPa
- Strength at Break = 10-20 MPa
- Strength at Yield= 10-15 MPa
- Toughness = 55-99 J/m
- Young Modulus = 0.13-0.3 GPa
- Melting Point = 105-115° Celsius
- Density = 0.940 g/cc

#### 6.4 BAND HEATER



Fig 6.4 Band Heater

Band heater, barrel heater, vessel heater or barrel heater- is used to lessen density of beverages and gels with the aid of using hotting so that it will fill, pump or bottle the separate liquid or to assist beverages from indurating withinside the barrel

### VII. FABRICATION AND CALCULATION

#### 7.1) DESIGN OF HOPPER

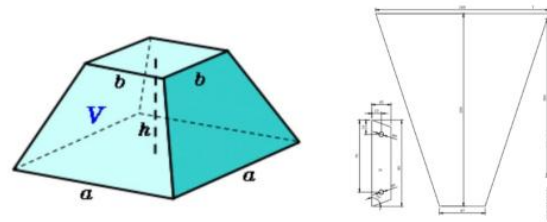


Fig 7.1) Design of Hopper

- a=180,
- b=47
- h=200

> VOLUME:

$$v = \frac{1}{3}(a^2 + ab + b^2) \cdot h$$

$$V=2871266.66 \text{ mm}^3$$

> LATERAL AREA:

$$F = 2(a + b) \sqrt{\left(\frac{a - b}{2}\right)^2 + h^2}$$

$$F=95687.70 \text{ mm}^2$$

> SURFACE AREA:

$$S=F+a^2 + b^2$$

$$S=130296.70 \text{ mm}^2$$

#### 7.2) DESIGN OF ROD

At F=50kg, P=1mpa

$$P = \frac{F}{A}$$

$$1 = \frac{50 \cdot 9.81}{\frac{\pi}{4} \cdot d^2}$$

$$d=24.99$$

$$d=26$$

#### 7.3) DESIGN OF BARREL

$$P_i = \frac{b}{r^2} - a$$

$$\sigma = \frac{b}{r^2} + a$$

$$1 = \frac{b}{13^2} - a$$

$$84 = \frac{b}{13^2} + a$$

$$b=7106.53, a=41.94$$

$$P_o = \frac{b}{r_o^2} - a$$

$$0 = \frac{7106.53}{r_o^2} - 41.94$$

$$r_o=15.39$$

Checking for stress:

$$s=84\text{mpa}$$

$$P = \frac{2s}{d_o}(t - 1.65) - 0.879$$

$$P = \frac{2 \cdot 84}{34}(4 - 1.65) - 0.879$$

$$P=10\text{mpa}$$



VIII.RESULTS & DISCUSSIONS

1. Optimum Utilization of plastic cloth
2. User pleasant plastic injection molding device.
3. Low price plastic injection molding device.

IX. EXPENDITURE DETAILS

Machine part	Material	Details	Quantity	Cost
□ Square tube	Steel	30x30x3MM	569.1cm	3000
• Round bar	Steel	26x680MM	58.5cm	1000
o Tube	Steel	34x26x4MM	53 cm	180
Sheet metal	Steel	1mm	-	550
-Strip	Steel	20x3mm	18cm	256
- Strip	Steel	30x4MM	152.5cm	500
Band Heater	metal	35x45MM	1	1050
Granules	Plastic	-	-	500
Travel	-	-	-	1500
KSCST	-	-	-	1000
<b>MACHINING AND FABRICATION COST</b>				
Fabrication	-	-	-	2500
Machining of die	-	-	1	2000
<b>TOTAL</b>				<b>14036</b>

TABLE 9.1) Cost Estimation

X.ADVANTAGES, DISADVANTAGES & APPLICATIONS

10.1ADVANTAGES

1. Indispensable for plastic mugs and plates.
2. Cheaper and fluently to be had cloth used.
3. Quick response.
4. No hearthplace chance hassle because of over lading.
5. nonstop operation is feasible with out stopping.
6. High product charge.
7. High forbearance.
8. Occupies decrease backside space. 9.Minimum scrap losses.

10.2) DISADVANTAGES

- 1.Difficulty in designing molds.
- 2.Problem with required heating and cooling plastic cloth.
- 3.Shrinkage. Simple shapes only.
- 4.Slow molding cycles.

10.3 APPLICATIONS

Injection molding is used to supply several outcomes comparable as line spools, bottle caps, car hall and elements, toys.

XI. CONCLUSION

Due to its low price, this operating version may be efficaciously instated in small scale molding devices and may be used to fabricate small plastic detail at an first rate cycle charge inside an powerful price detail. The Injection molding Machine is usually easy, presto, correct and smooth to use. All electric powered is frequently supposed for the smallest electricity price, severe reproducibility, slim processing window for skinny walled detail in engineering polymers, dragged delicacy and immediate repetition, excessive uptime, decrease shot length application, low emigration, water saving, quiet terrain want, smooth room necessity

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