PLASTIC RECYCLING BY INJECTION MOULDING AND 3D PRINTER FILAMENT MAKING

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ABSTRACT

This paper's goal is to plastic recycling for 3D printing material. The main principle is to compress the plastic material in a barrel and motor with belt arrangement develops the compressing motion.The plastic materials are poured in a barrel. The heater surrounding the barrel heats the plastic material. Then it is converted into molten state. The molten plastic is injected through the nozzle in a barrel to the die by the compressing force. The die is placed just below the nozzle. After completing the process, we get the product from the die. Different shape of the component can be made according to the die and for 3D printer filament the extruded outlet pin must be changed accordingly to the required mm and then outlet filament is made to cool and connected to the spool and Commercial product like bushes, couplings, switches etc. can also be produced.

Keywords— 3D Printing, Recycling, Injection Moulding

I.INTRODUCTION

I.(A) INJECTION MOULDING PROCESS

Injection moulding (i.e. injection moulding) is a process by which plastic materials, which are molten by heat, are injected into a mould and then cooled and solidified. This process is used to produce moulded products. It is most commonly used in the production of products with complex shapes. injection moulding plays an important role in plastic processing.

I.(B) 3D PRINTER FILAMENT

The thermoplastic feedstock used in most 3D printers for fused deposition is known as 3D printing filament. There are numerous varieties of filament available, each with unique qualities and printing temperatures. Typically, filament comes in two standard diameters: 1.75 mm and 2.85 mm. The less common filament size that has a diameter of 3 mm should not be confused with 2.85 mm filament, which is occasionally mistakenly referred to as "3 mm." There are various combinations of nozzle and filament sizes that can be employed; however, filament size and nozzle size should not be conflated. 0.4 mm is one of the most widely used nozzle diameters; other popular sizes are 0.35 mm and 0.25 mm.

II.MATERIALS AND COMPONENTS

II(A) Frame

Mild steel is used to make this. All of the components are installed in the proper order on this frame framework. To ensure correct alignment of the bearings during assembly, bearing sizes and open bores are bored in a single setting. There are provisions to lubricate the bearings.

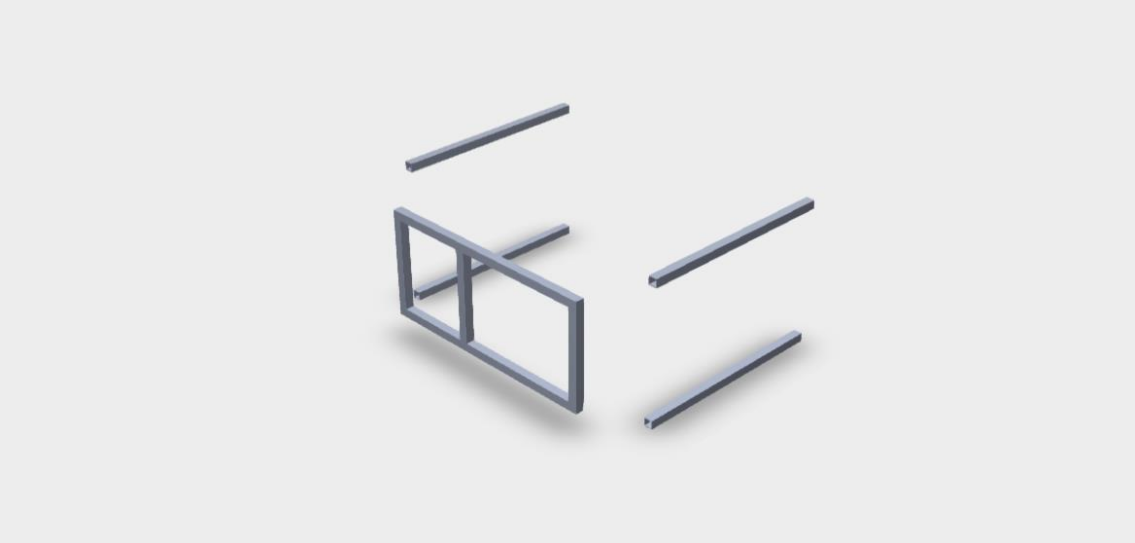

Fig. 1. Frame – Isentropic View

II(B) AC motor

An electric motor powered by alternating current (AC) is known as an AC motor. An outer stationary stator with coils powered by alternating current to create a rotating magnetic field and an interior rotor coupled to the output shaft to create a second revolving magnetic field are the two basic components of an AC motor. Permanent magnets, reluctance saliency, or DC or AC electrical windings can all create the rotor magnetic field. Less frequently found, linear AC motors provide linear motion rather than rotation by having their stationary and moving parts arranged in a straight line. They function similarly to rotating motors in theory.

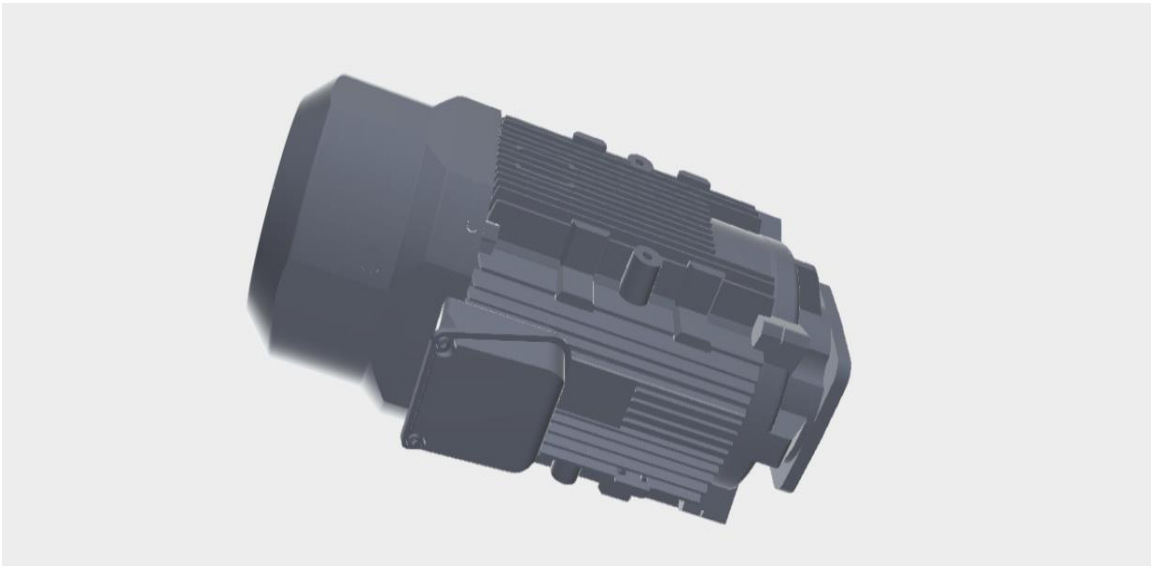

Fig. 2. AC motor – Isentropic View

II(C) Belt drive

A belt is used in belt drives to transfer power between at least two pulleys. The belt is driven by one pulley (the driving pulley) and is driven by the other pulley (the driven pulley). Because belt drives frequently have lower speeds, the smaller of the two pulleys serves as the driving pulley in these situations. The power transmission in belt drives is often friction-locked.

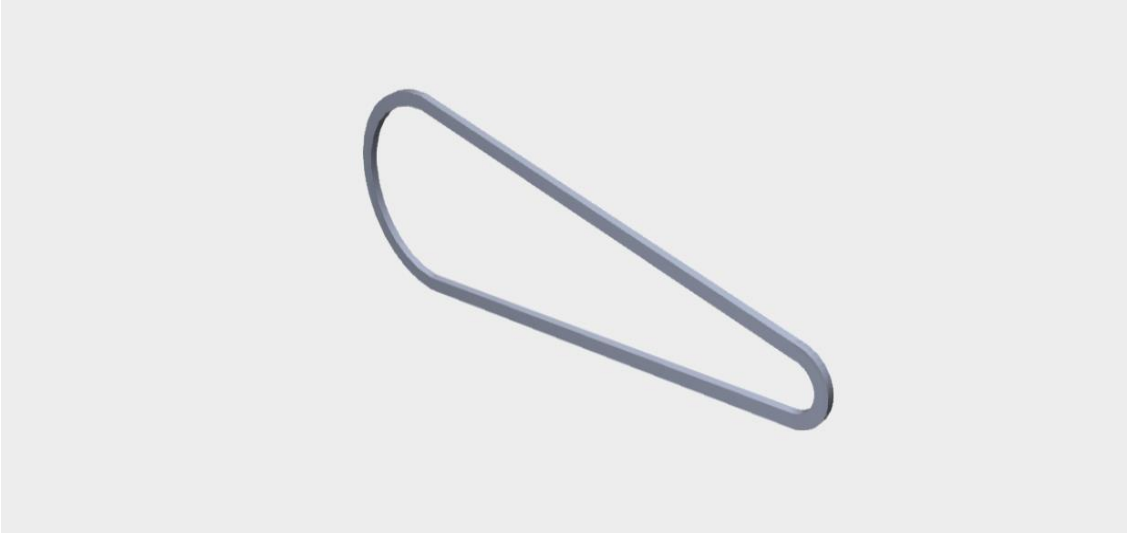

Fig. 3. AC motor – Isentropic View

II (D) Pulley

A pulley is a wheel that is attached to an axle or shaft and is intended to facilitate power transmission from the shaft to the cable or belt or to support the movement and direction changes of a taut cable or belt. The supporting shell is referred to as a block, and the pulley may also be referred to as a sheave when it is supported by a frame or shell that guides the cable or applies force without transferring power to a shaft. To help with cable or belt location, a pulley's circumference may contain one or more grooves between flanges. A rope, cable, belt, or chain can serve as the drive element in a pulley system.

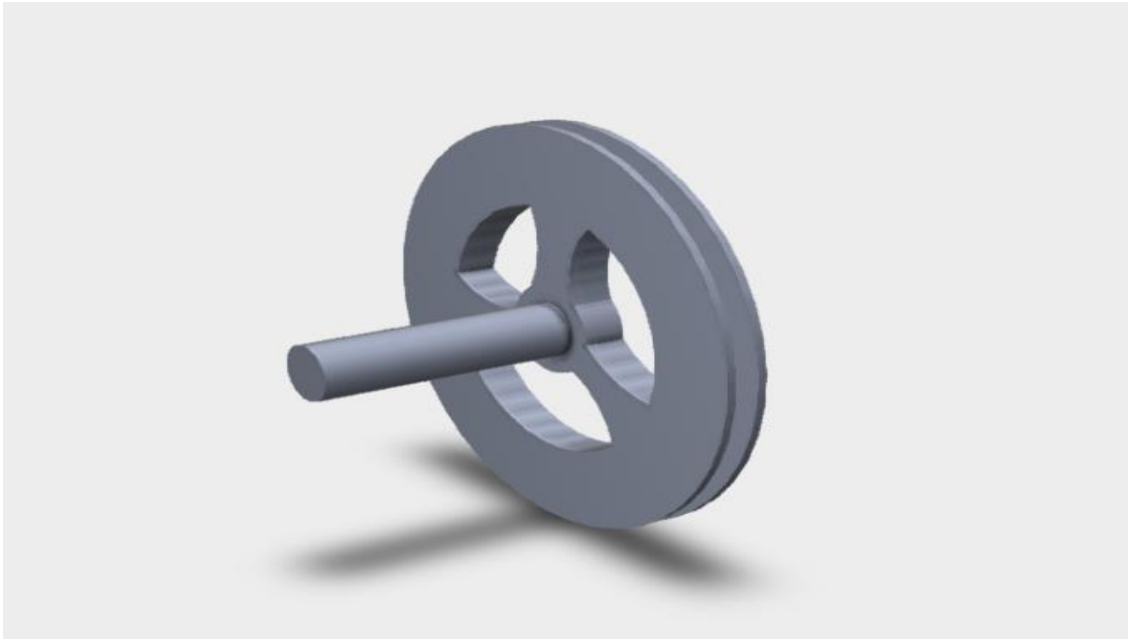

Fig. 4. Pulley – Isentropic View

II (E)Gear box

A gear train that is positioned between the motor and the machinery to slow down the speed at which power is transferred is called a speed reduction. Gear reducers, another name for speed reducers, are mechanical devices that are typically used for two purposes.

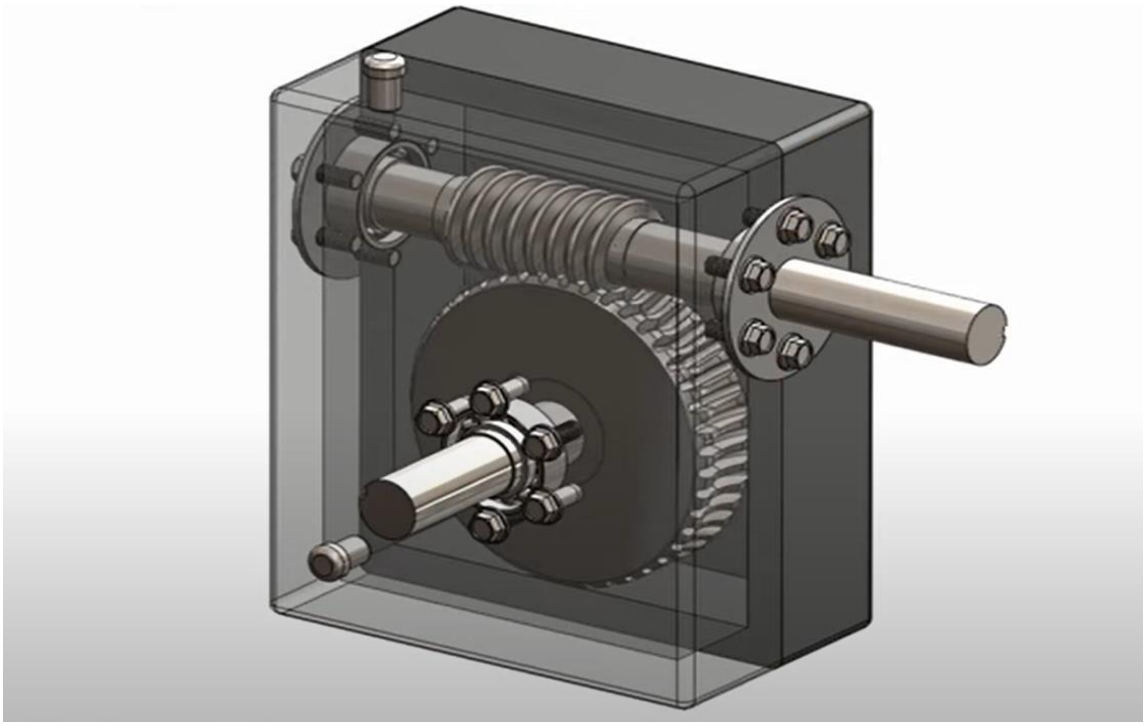

Fig. 5. Gear box – Isentropic View

II (F) Hopper

An industrial operation uses a hopper, which is a big pyramid-shaped container, to collect particulate matter from exhaled air. Hoppers can be deployed in groups, which makes it possible to collect more data. Most hoppers are constructed from steel.

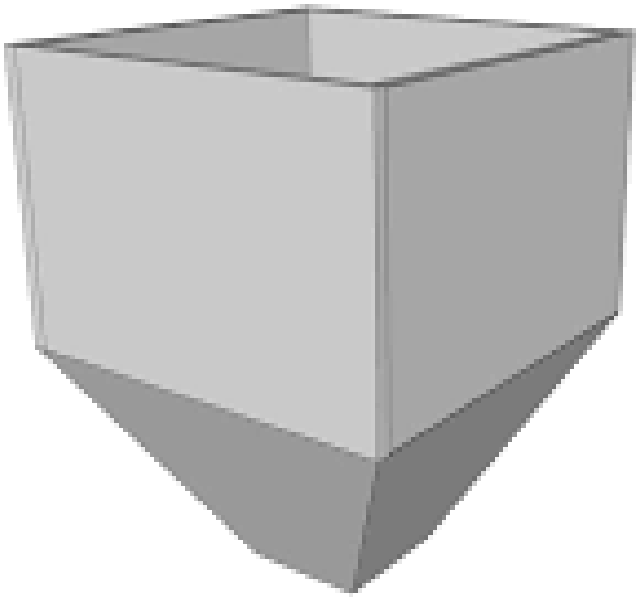

Fig. 6. Hopper - Isentropic View

II (G) Heating coil

An electrical device that produces heat by converting electric current is called an electric heater. Every electric heater has an electrical resistor as its heating element, which operates on the Joule heating principle: an electric current flowing through a resistor will transform electrical energy into thermal energy. Nichrome wire is the active element in the majority of contemporary electric heating

equipment; the heating element seen on the right is made of nichrome wire supported by ceramic insulators

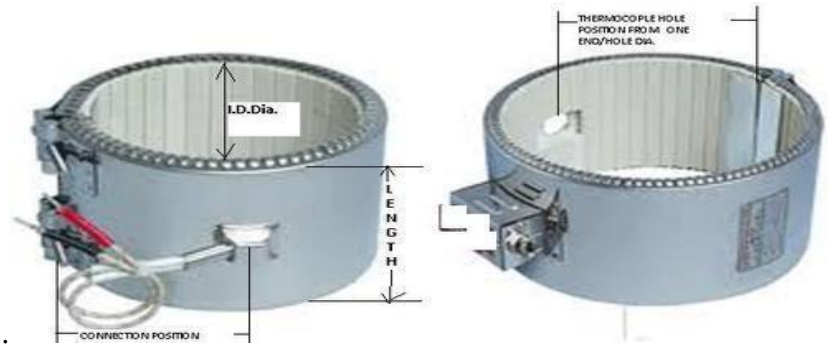

Fig. 7. Heating coil - Isentropic View

III. Selection of Material

Commercial carbon steels that do not meet standard requirements are also referred to as "mild steel." This steel may contain as little as 0.3% carbon, or very low amounts. While it is technically incorrect and should not be used as a phrase in engineering, commercial "mild steer" may generally be considered to be easily weldable and have reasonable cold bending qualities. The most popular kind of steel since it is less expensive and less brittle is mild steel. Although mild steel is sufficiently strong, it is not easily tempered or hardened.

III (A) Mild steel Composition

- Mild steel contains –C45
- Carbon 0.35 to 0.45 % (maximum 0.5% is allowable)
- Manganese 0.60 to 0.90 %
- Silicon maximum 0.40%
- Sulfur maximum 0.04%
- Phosphorous maximum 0.04%
- Mildest grade of carbon steel or mild steel contains a very low amount of carbon – 0.05 to 0.26%
- Tensile strength – 63-71 kgf/mm2
- Yield stress -36 kgf/mm2
- Izod impact valve min -4.1 kgf m
- Brinell hardness (HB) – 229

IV. WORKING PRINCIPLE

This work is based on the process of plastic waste management system. It is consist of mechanical part mainly electric AC motor, hopper, gear box, heating coil, belt, pulley, controller, and nozzle. The crushing units are rotate in direction to squeeze the bottle pieces and the controllers driven by a gear box. The ac motorand belt drive arrangement is mainly used to rotate the recycling unit and the gear box used for the purpose control the speed of the motor.

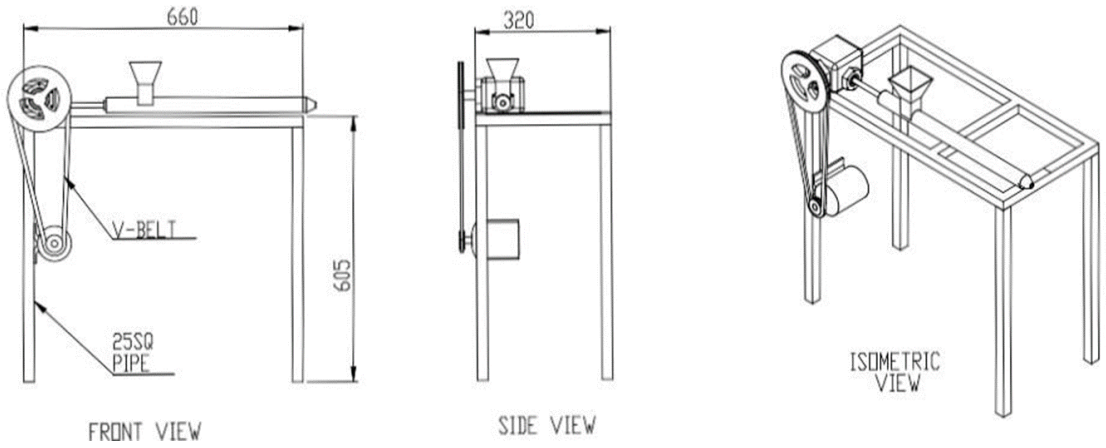

Fig. 8. Orthographic view of plastic recycing by injection moulding 3D printer filament Setup

In order to perform this rotation we have adopted meshing arrangement from the motor. The machine is provided with the opening at the top side recycling unit. The waste plastic pieces/pallets are kept inside the hopper. Simultaneously the plastic pieces/pallets will fall on crushing hopper and goes to melting process by the heating coil. The melting plastics are collected for the purpose of further uses.

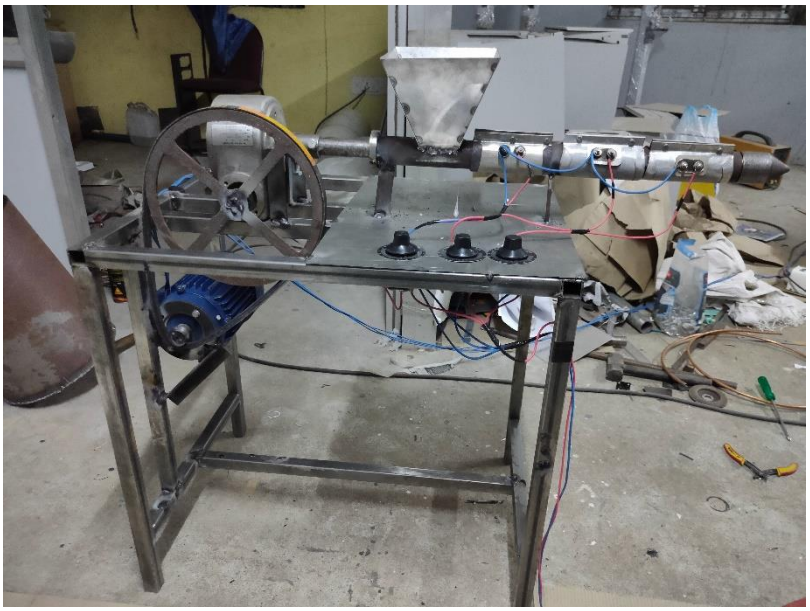

Fig. 9 . Fabricated model of plastic recycing by injection moulding 3D printer filament Setup

V CONCLUSION

Plastic recycling by injection molding and a 3D printer filament making setup was fabricated. The present study is to reduce, reuse, recycle, recover, redesign, and remanufacture the plastics. It can be modified and developed according to the applications where the plastic waste can be recycled and reused according to its properties.

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