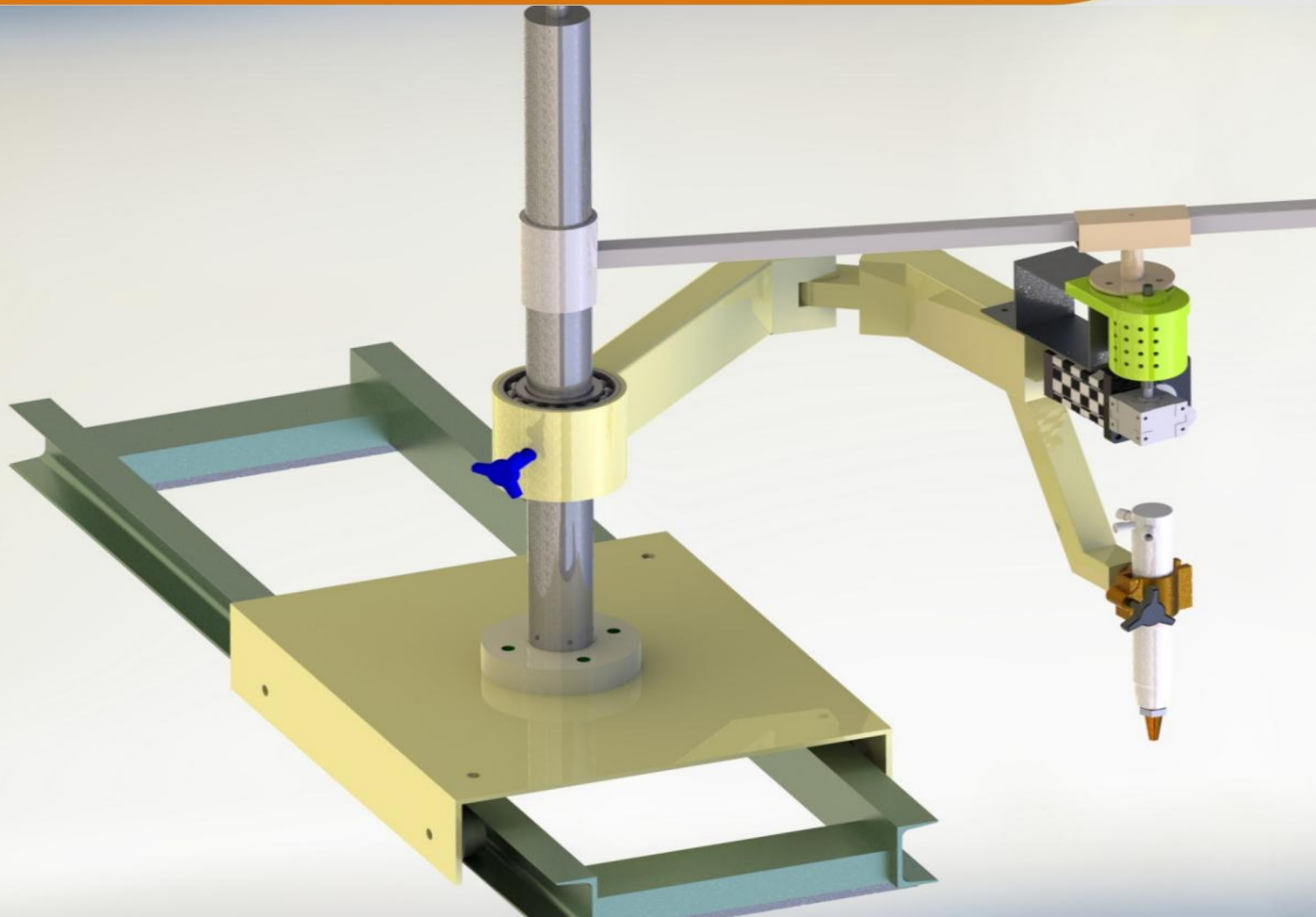


## ECONOMICAL PUG MACHINE



A

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## ABSTRACT

The aim of the project is to design and fabricate a metal cutting machine which reduces the amount of molten metal spillage, spatters along with the reduction in overall cost which ultimately reduces the overall cost of production.

It has been a big challenge for the practicing engineers in the area of welding and cutting to reduce the cost of production. This need was recognized at the present work, therefore considering the need of the small enterprises for an economical Pug cutting machine, the authors of present work have designed the Pug cutting machine which can reduce the material wastage, at a comparatively faster rate.

The product designed can be a good replacement of a conventional gas cutters, Pug cutting machine and profile cutting machines in SME's. It is expected by the authors of present work that the designed cutting system is more reliable and efficient than conventional cutters. The problem of back firing in conventional gas cutters is also solved by the use of three seat nozzle in the product.

This gas cutting equipment can be an aid to the present small scale fabricators and steel plate cutting dealers in India. The present work can reduce cost of acquiring two products i.e., Pug cutting machine and Profile cutting machine. The trend of having two products was found in most of small scale industries and shops in India. The present work can replace these two products with a single product providing functionality of both the products. Thus, this product will prove to be a boon to the present fabricators in India.



**Figure 5 : Pug Cutting Machine [13]**

### 3.2.1 Advantages

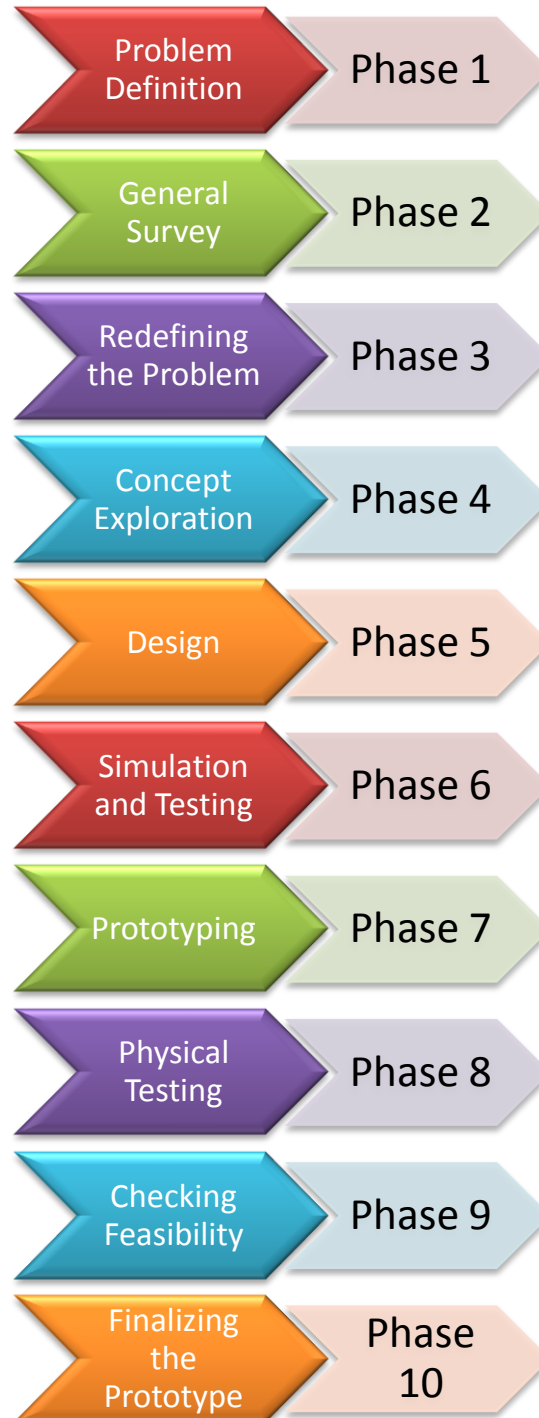
- (1) **Easy to handle:** These machines are light weight and they have a wrap around handle for easy portability and protection.
- (2) **Body:** Made of pressed steel with asbestos heat deflector.
- (3) **Versatile:** Using extendable tracks, these machines can produce straight cuts on any length, square or bevel edge. With the same precision, these machines can cut circles and also shape with gradual curves, when hand-guided.
- (4) **Circle Cutting:** This can be done with the use of circle cutting attachments, supplied as optional extra. The arrangement can be attached to the machine by two screws.
- (5) **Cutter:** Injector type, specially designed to prevent backfire.
- (6) **Cutter adjustment:** The cutter can be swivelled to cut levels up to 45 degrees with Rack and Pinion.
- (7) **Fuel Gas:** Acetylene or LPG can be used by selecting the appropriate nozzles.
- (8) **Motor:** the machine is fitted with 220 volts Fractional Horse Power Geared reversible motors. Power is fed through a forward-reverse toggle switch.
- (9) **Track:** Approximately 1.8 meter long Aluminium Track is supplied as optional extra.

## CHAPTER-4

### METHODOLOGY

#### 4.1 Introduction

This chapter incorporates the process adopted to feasibly design and fabricate the proposed prototype.



**Figure 10: Methodology Chart**

## 4.2 Design and drawing

The drawings explain about the design and sketching of the final virtual prototype. All the designed components in the prototype are reported.

## 4.3 Design concept

The design is conceived in three phases. First, all the possible designs were proposed. In second phase, the most feasible design was selected on the basis functionality and ease of commercialization. In the final phase, the complete design with the final dimensions (keeping standard sizes in consideration), simulation and bill of materials was made. Besides that the cost of designing and fabrication and the allocated budget was also kept in consideration. The criteria that must be considered in designing the machine are:

- (1) **Durability** : the machine must be durable when it rotates and vibrates.
- (2) **Material** : The material must be suitable to fabricate the machine and easily available.
- (3) **Cost** : It depends on material and manufacturing processes. It should minimize the cost.

## 4.4 Drawing

The final idea is drawn by using CAD Software and the various parts of the model are represented by 2-D Drawings.





**Figure 13: Pug Cutting Machine [13]**



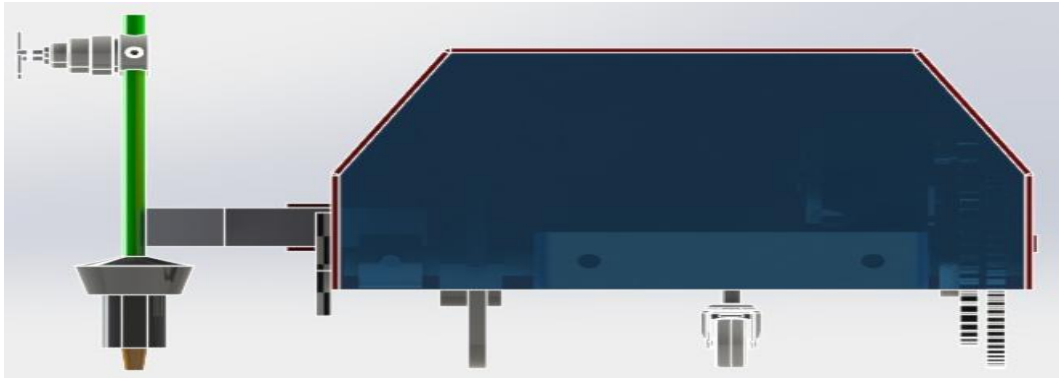
**Figure 14: Profile Cutting Machine**

## CHAPTER-6

### DESIGNING

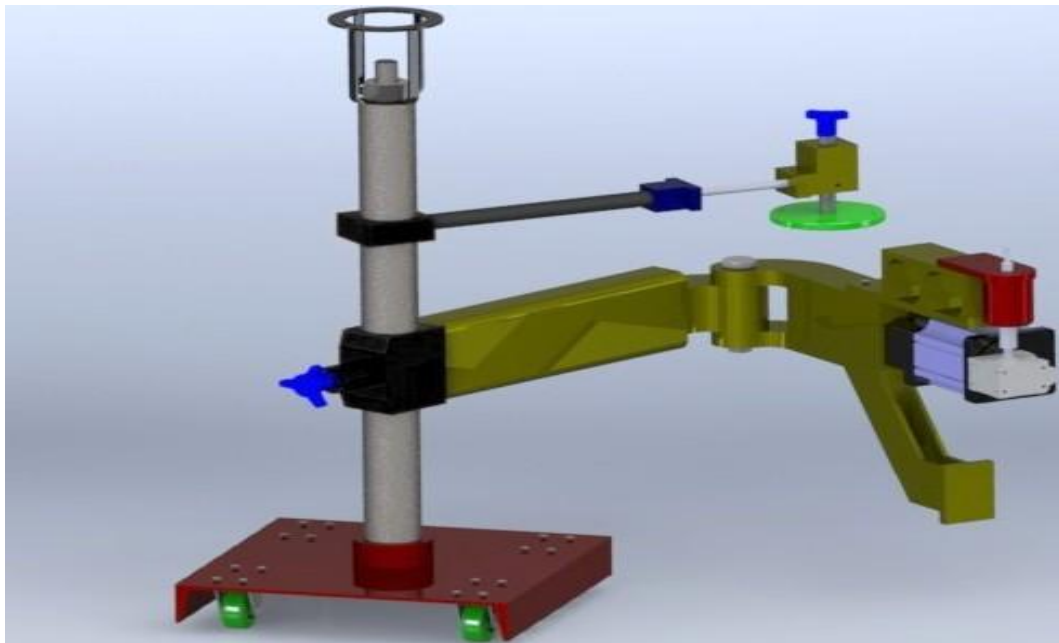
#### 6.1 Introduction

This chapter incorporates rendered images and analysis of design of present work. The discussion of evaluation on proposed designs is also reported in this chapter.



**Figure 17: Tentative Design of Pug**

The first step of design process was the designing of the pug machine, followed by a relevant solution and hence, the substitute for the two machines.



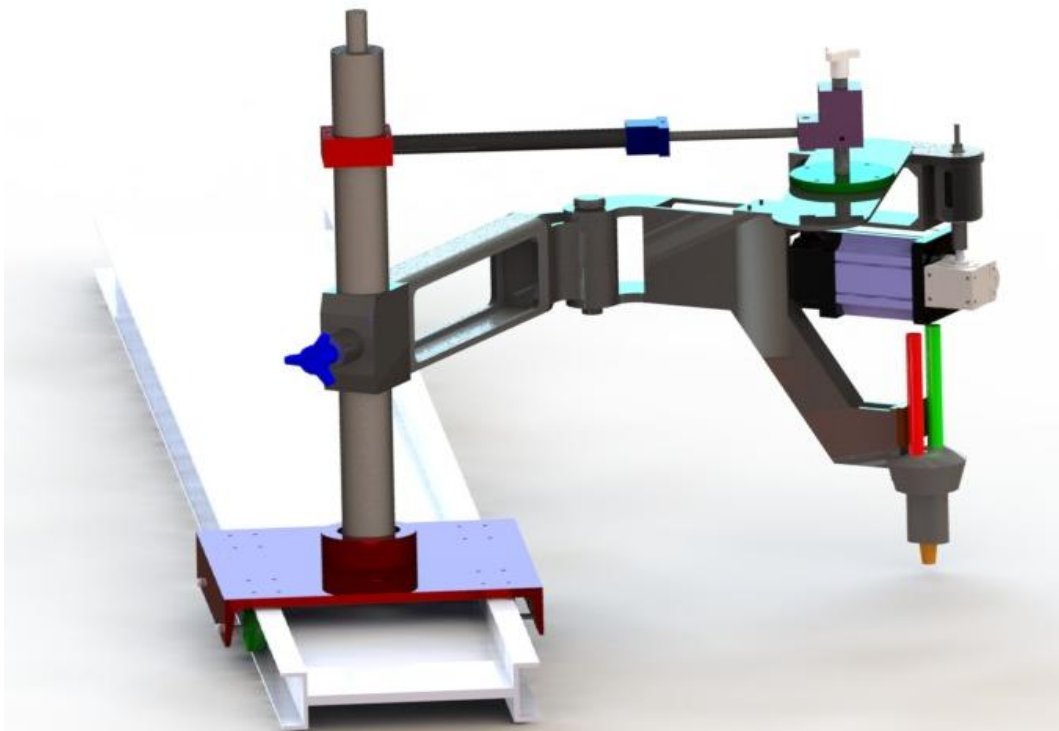
**Figure 18: Intermediate Design of the Pug Profile Cutting Machine**

This design had problems regarding balancing and stability because there was excessive weight on one side of the machine. Therefore, either counterweight had to be used or the radial arm sections had to be made lighter by making them hollow. Also, the base of the machine had to be made heavier to increase stability.

The proposed model was simplified and an approximate resultant force was applied at a specific area in deformation analysis of the model. The details have been discussed in the Appendix II. The summary results are shown below:

**Table 2: Simulation Results**

PARAMETERS	RESULTS
Maximum Deflection	0.242751 mm
Maximum Strain	5.83491e-005
Maximum stress	1.68796e+007 N/m <sup>2</sup>



**Figure 21: Changed Rail Design for Increasing Counter Reactions**

The rail design was changed so that problem of increased weight on one side, due to the pantograph arm, is reduced to the minimum. This was done by making rail shaped as shown in the figure above. This type of rail design provided counter reaction by the rollers and thus providing more stability as compared to other designs.



## CHAPTER-10

### ASSEMBLY

#### 10.1 Introduction

This chapter incorporates the procedure of the assembly of the machine.



**Figure 48: Assembly Image**

#### 10.2 Features

Machine is designed such that it can be assembled in less than 15 minutes. All the parts of machine are designed for ease of use. All the parts can be assembled with minimal effort. Use of nuts and bolts is minimized, and they are replaced by knobs. Minimum degrees of motions are applied without constraining any performance or advantage of machine so that least complexity of machine can be attained.

#### 10.3 Procedure of assembly

- (1) Place the track on floor (recommended) or any flat base according to convenience and safety.

## CHAPTER-11

### CONCLUSIONS

A pug cutting machine is designed and fabricated at itm University. The machine has the following features:

- (1) Portability
- (2) Maintainability
- (3) Usability
- (4) Easy to assemble
- (5) Can be used for complex profile.
- (6) Light weight
- (7) Can be used for large plate.
- (8) Flexible height adjustment of radial arm and torch
- (9) 360 degree movement of radial arm.

The machine is also designed to enhance its commercial value by keeping low cost manufacturing, simplified operations, compact, least maintenance and using standard parts. The machine has been successfully tested for Mild Steel. It has also been tested for various profiles such as circular, elliptical and other complex profiles.

This gas cutting equipment can be an aid to the present small scale fabricators and steel plate cutting dealers in India. The present work can reduce cost of acquiring two products i.e., Pug cutting machine and Profile cutting machine. The trend of having two products was found in most of small scale industries and shops in India. The present work can replace these two products with a single product providing functionality of both the products. Thus, this product will prove to be a boon to the present fabricators as well as promote the growth of those new to the fabrication industry.