

# MACHINERY FOR PAPER-PENCIL FABRICATION.

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**Abstract** -The product 'Paper pencils' is becoming familiar and rapidly increasing. Thus manufacturing these pencils has become a difficult job because of the machinery required for manufacturing. It costs approximately 3 to 4 lakhs and further price increases in rural areas. Therefore the raw material required is high in the source (newspaper, magazines, waste papers, etc.) and the manufacturing of these pencils is low in production. In this paper, we will discuss the alternative machinery that can be produced with low-cost machinery items and equipment.

**Keywords:** Paper pencils, alternative machinery, low cost, raw material, cost difference.

## Introduction

Paper pencils are manufactured by waste papers like newspapers, magazines, waste scraps, etc. This highly reduces the production of wooden pencils. Even though the need for pencils is increasing day by day it requires a lot of wood to produce normal wooden pencils. Considering this downside there is no option other than finding an alternative (Paper Pencils). Even though this concept of making paper pencils are spoken about a long time ago. It still does not get familiar with production because of the high expense in machinery. To solve this compact and low-cost machinery is made to produce these paper pencils. Which contains a normal conveyer belt process, gearbox, motor, and pulleys.

### 1.1 The target of low-cost paper-pencil machinery.

#### 1. Waste of Sources:

It is not acceptable that the production of a product should not be decreased due to high-cost machinery. Even still if we do not maintain these sources like waste papers and others it also causes pollution in various forms.

#### 2. Increase in need:

By understanding this we need to make machinery with low selling price with simple mechanical components.

These products should not be only produced in large-scale factories but also minor factories and small-scale industries.

### 3. Solution:

From the collected data on paper-pencil machinery, we can make a small-scale and low-priced device with a simple and common design and the (close to) same efficiency as the high-cost machinery. It doesn't want to be with complex design and with high-cost material. The device contains a metal frame, a motor, gearbox, conveyer belt, and pulleys. And these components used in machinery doesn't have any conditions like it should be used well as new. We can obtain it from the other machinery and smaller components from non-usable devices.

### 1.2 Construction

#### 1. Raw Materials:

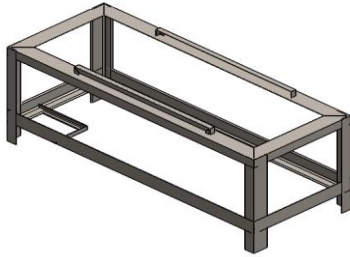
As we already discussed before the components used are simple and compact in design. It consists of

1. Metal Frame.
2. Conveyer belt.
3. Motor. (0.5 HP)
4. Plummer block bearings.
5. Belt Pulley Drive.
6. Gearbox.
7. Pressure Plates and springs. (Wooden)

#### 2. Material Classification and Technical aspects

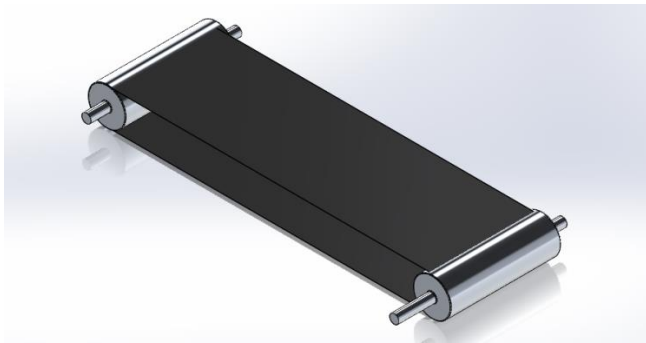
Lowering of price is the priority of this machinery construction. And the material used should be less in cost and good in quality.

### 1. Metal Frame:



An L-shaped angle rod is used for the construction of the frame. 2.5 - 3 mm thickness is used in concern of load factor. The machinery we are about to manufacture is a light-duty machine.

### 2. Conveyer belt:



The conveyer belt is used for the unloading of the manufactured pencils. A Flat Belt Conveyor is used for pencils which are rolled after it is glued is taken through the storage for finishing purposes after drying of pencils. This belt is passed through the pressure plate and surface plate for the rolling of pencils and an end drive is used for this conveyor.

### 3. Motor :

A 0.5 hp Ac induction motor is used for the rotation of the conveyer belt under pressure plates. It gives about 1500 rpm which is quite useful for the production time and gives out the required compression on the pencils while rolling.

### 4. Plummer blocks

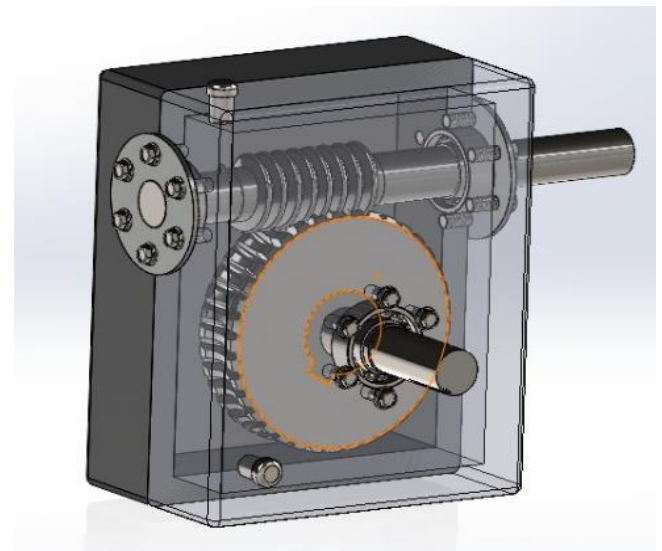
A diameter of about 55-60 mm plumber blocks with a bore of 30- 35 mm is used for the conveyer at four ends of the frame. MS steel Plummer block is used.



### 5. Belt Pulley Drive :

A belt pulley drive is used for power transmitting from motor to gearbox and gearbox to conveyer belt. Smaller pulley about 10 - 12 cm and bigger pulley is 18 - 22 mm these two pulleys are attached to gear input and gear output. A pulley is connected to the motor shaft for transmitting power to the gearbox input.

### 6. Gear Box:



A worm gear is used to transmit motion and power when a high-ratio speed reduction is required (60:1 and higher can be obtained from a single reduction and can go as high as 500:1). Input gear shaft is connected with motor and the output gear shaft is connected to the conveyer pulley. Gear setup for speed reduction:

To determine the power and speed transmission in worm gear, the speed of the motor is equal to the speed of the gear input shaft.



Therefore input shaft speed (N1) = 1500 rpm and the teeth in worm spur gear (Z1) = 37.

Velocity ratio (i) = number of teeth in spur gear/ number of thread in worm shaft.

$$I = 37/1$$

Velocity ratio (i) = speed of input shaft (N1)/ speed of the gear shaft (N2)

$$37 = 1500/N2; N2 = 1500/37 = 40.5$$

$$N2 = 40 \text{ rpm}$$

To find initial torque:

$$\text{Torque (t)} = P \cdot 60 / 2\pi N = (0.5 \cdot 746) 60 / 2\pi \cdot 40$$

$$T = 2.37 \text{ Nm}$$

Therefore verifying initial power and output power:

Finding initial power (p1) with N1 = 1500rpm

$$\text{Power (P1)} = 2\pi \cdot 1500 \cdot 2.37 / 60 \text{ watts} = 373.064 \text{ watts.}$$

$$P1 = 373.064 \text{ watts.}$$

Finding output power (N2) = 40 rpm

$$P2 = 2\pi \cdot 40 \cdot 2.37 / 60 \text{ watts} = 9.948 \text{ watts.}$$

## 7. Pressure Plates with Springs:

The wooden pressure plate is surrounded by a rubber sheet is given, to roll the graphite lead covered by the paper. When the paper reaches the plates, due the partial compression provided by the plates helps the paper with lead to rotating. Therefore it gives the exact shape to the pencil.

### 2.1 Machining process/working:

#### Process 1:

1. As we already discussed, Papers (newspapers) are sliced according to the size for binding the graphite lead inside the paper by folding it first. Then the glue is applied to the paper while it passes through the conveyer belt.

#### Process 2:

1. Pressure plates are present in the way, when the papers pass through these plates, it starts rotating due to the resistance of the pressure plates against the rotation of the conveyer belt.
2. Due to the spring support given to the pressure plates, it does not squeeze out the pencil while moving. Therefore the rotational speed of the conveyer is limited by the gearbox, the belt speed does not affect the rotational resistance caused by pressure plates.

#### Process 3:

1. Due to the pressure plate resistance, the graphite needle with paper starts rotating hence it gets the shape of the pencil.
2. Even though the process is done, the pencil is wet due to the excess glue used on it. The drying process takes place after the wet pencils are obtained. If this process is absent, the pencil obtained will remain wet and will not obtain the properties of the pencil.

#### Process 4:

1. Then after drying, finishing or filing takes place to give the pencil an exact shape. It is used to remove the hardened glue in the pencil while the drying process and gives the pencil circular or any other shape required.

2. After all these processes the paper pencil is obtained which gives the same usage as the normal wooden pencil.

**Conclusion:**

In this paper, we have discussed the total manufacturing of paper pencils and their manufacturing process. This paper is mainly focused on the manufacturing machine which creates the same output as the machine which costs a higher price. This paper focuses on the fabrication of the required machine and the technical challenges that take while manufacturing the product. We have tried to cover all the terms required for the fabrication of a low-cost paper-pencil manufacturing machine.

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