

# Design and Fabrication of Automatic Fruit Slicing Machine-Design and Calculation

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**Abstract**— In the automation of the production process for food industry, especially for the fruits and vegetable sector the concept automation is used and utilized for saving the cutting time. In the many area like domestic, restaurants and some small scale fruits industries where cutting of fruits and vegetables are cuts manually, need to replace by automated machine which requires some skill for increased rate of cutting of chips, with minimum effort, that can be reduce the chances of cutting by sharp edges of the cutter to the operator and save work load with faster rate in order to increase cutting quality and productivity. The design purpose is to design a automatic fruit slicer machine is to cut/slice many fruits like apple, cucumber, carrots, as well as vegetables like potato, onions all are sliced uniformly even size and also it requires a skilled worker to slice them evenly. The project purpose includes the electrically operated motor which is prime power source and rotary blade attachment with the power transmission system like pulley, belt shaft. The capacity of mechanism is 60-80 kg of fruits and vegetable per hour. Locally and easily available materials like cast iron, mild steel and stainless steel are used for the fabrication. This machine allows in its simplicity of design and modest cost with the ability to generate thin uniform slices.

**Keywords:** Automatic Fruit Slicing Machine, Hopper, Rotary Cutter

## I. INTRODUCTION

The slicing technology has already been developed in abroad in 1970s, in the mid-eighties most of the slicers can process large diameter up to 125 mm (5 inches), like the horizontal inside diameter slicing machine manufactured by Mayer Bbu Geyer company in Switzerland.

As to the structure of the slicer, it can be divided into horizontal type and vertical type which depends on its principal shaft supported by the air bearing or rolling bearing. There're inside diameter slicer, outside diameter slicer, single-blade slicer and multi-blade slicer and the former one is more popular.

Its advantages are to cause less kerfs, small deviation, even cut surface, big quantity and less costs.

The main purpose of the research is to design a small scale industrial slicer to slice the fruits and root vegetables. Its body, material inlet, blade, material outlet, baffle plate, manual adjuster together and the materials are processed by the material inlet and material outlet. It's characterized by small volume, high processing efficiency, good uniformity, stability and safety.

## II. REVIEW OF LITERATURE

- 1) Atul Anand Mishra, Jyoti Jain, RN Shukla, Parvinder Kaur and Vivekand, "Design and Fabrication of Twisted Potato Crisp Maker, IOSR Journal of thr Environmental

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## III. MACHINE MATERIAL PARTS AND METHODS

Sr. No.	Part	Material	Dimension
1.	Rotary Blade	Stainless Steel	305 mm
2.	Shaft	Mild Steel	Ø 25 mm
3.	Pulley	Cast Iron	Ø 254,52
4.	Belt	Rubber	

Table 1: Material and Dimensions

### A. Hopper:

Circular part used to feeding fruit and vegetables. Different diameter. No need feeding mechanism.

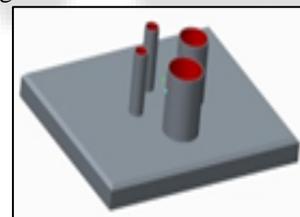


Fig. 1: Hopper

### B. Rotary Cutter and Shaft:

Rotary cutter made of stainless steel including multiple cutting slots on periphery. Blade is mounted to vertical to its axis of position linear shaft located to in vertical position. One end is Connected to blade and another to pulley drive.

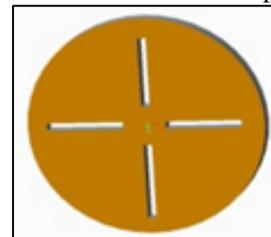


Fig. 2: Rotary Cutter

### C. Pulley & Belt:

Pulley for V belt with web type construction diameter of 150 mm. 6- arms and 2 set for 1440 rpm.

V belt of medium grade and double thickness.  
V belt material – rubber.

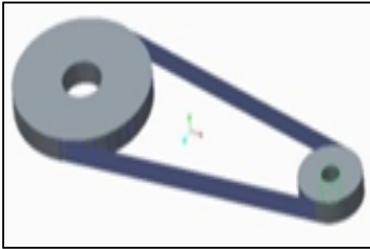


Fig. 3: Pulley and Belt

#### D. Electric DC Motor:

1 HP electric DC motor.  
1440 rpm with pulley at one end.  
Vertical position.

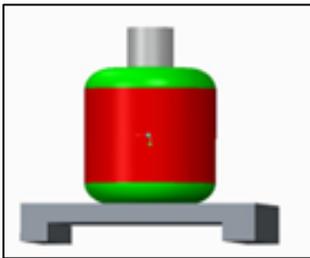


Fig. 4: Motor

#### IV. OBJECTIVE & IMPACT OF MACHINE

The automatic fruit slicing machine is suitable for various fruit of different size such as orange, pear, pineapple, melon, mandarin orange, apple, peach, papaya, lemon kiwi, guava, potato and persimmon, etc.

It also helpful for cutting of vegetable like potato, onion, lady fingers.

It is widely need in the fruit processing factory and snack store and cannery industry. On one side, it can reduce the labor intensity.

On the other side, it can improve the production efficiency.

#### V. DESIGN CALCULATION

##### A. Shaft Design

$D=25$  mm,  $L= 458$  mm, Power= 20 kw,  $N= 1440$  rpm.  
Torque transmitted by the shaft  $(T) = (Pr*60)/(2\pi N)$   
 $= (20000*60)/(2\pi*1440)$   
 $= 132.63$  N-mm.

##### B. Pulley Design

Design Power  $(P_d) = Pr*K_1$   
 $= (20000*1.4) = 28*10^3$  watt.  
 $K_1$  = Load Factor  
Belt Speed  $(V_p) = (\pi*D_1*N)/(60*1000)$   
 $= (\pi*52*1440)/(60*1000)$   
 $= 3.92$  m/sec. or 235 m/min.  
Belt Tension  $(F_1-F_2) = (P_d/V_p)$   
 $= (28000*3.92) = 7142.8$  N.  
Central Distance  $(C) = D_1+D_2$   
 $= 52+ 254 = 306$  mm.  
Length of Belt  $(L) = \pi/2(D_1+D_2)+(2*C)+(D_1-D_2)^2/4C$   
 $= \pi/2(52+254)+(2*306)+(254-52)^2/4*306$   
 $= 728$  mm.

#### VI. CONCLUSION

At the end of the project, the automatic fruit slicing machine successfully completed.

The design of the blades, motor and driving mechanism is capable enough to cut the chip with uniform thickness with maximum output.

#### VII. DESIGN AND WORKING PRINCIPLE

In this machine is included the power transmission system of belt and pulley arrangement which is connected to the electric motor. The position of hopper top in place on the rotary cutter housing through which the fruits and vegetables are pouring. At the base of rotary cutter rotates the potato and vegetables strike against the inner blades which removes the slice depending on the type and condition of the products. As the slices cuts it falls on the tray below the rotary cutter. We design and fabricated a wide range of slicing machine which requires low maintenance and give high performance. This machine has some following advantages.

- 1) Compact design thus occupies very little space.
- 2) Body is from stainless steel with cast iron ring stands for better vibration.
- 3) Easy to operate, high rinsing and slicing ratio, no damage to worker.
- 4) Low maintenance and original ingredient cannot destroy.

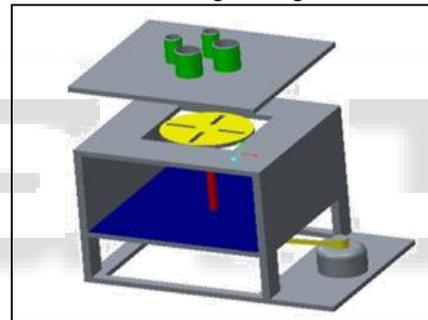


Fig. 5: Automatic Fruit Slicing Machine

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- [4] Roshan M. Hatwar, Kunal T. Rahandale, Mohan G. Trivedi, "Concept, Design and Development of Semi Automated Potato Slicing Machine", International Journal for Scientific Research & Development, vol 4, Issue 02, 2016/ ISSN(online): 2321-0613

