Development of Plastic Strip Making Machine Machine for Packaging Industry

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Abstract **- We observed that, PET (Polyethylene Terephthalate) bottles cutting machine was designed to convert used PET bottles into strips for recycling. Starter tests and mechanical components were widely assessed on the theoretical plans to guarantee that the idea with ideal execution and proficiency is chosen. Cutting force is the resistance of material against the intrusion of the cutting tool. Plastic strip making machine used for cutting the plastic in small strips to make waste management easier. We are making this project model for recycling of plastic wastage in domestic area, industries, etc for packaging and other purpose. The accessible machines used to reuse this PET bottle are expensive. They pack this waste and offer them to the nearby preparing plants. So, the way toward bundling and moving is much expensive. So, our intension behind this project is to process the plastic bottle waste as cheap as possible by making strips where it is made for reducing cost of processing and transportation. Advantage of this machine is the decrease of work which brings about cost decrease.**

Index Terms **- PET bottles, Cutting, Design, Machine, Environment, Plastic waste, Packaging, recycling.**

INTRODUCTION

The Present Paper Describe the Research and Analysis of cutting machine for the reusing plastic strip for useful product. In the industry for making the plastic strip for packaging material and box strapping. This type of plastic strip is made by using hot air gun but if there is any impurity in the plastic material then the plastic strip making process is cut-off and there is some misuse of the plastic material as strip. For reusing of the wastage plastic strip commonly the softening cycle is utilized. But it is economical and more time-consuming process. The effort of the machine is to make strips of plastic bottles of the plastic from waste of plastic material in short span of time with less cost. n this type of machine by using pressure rollers, blades, hot air gun, etc. the wastage plastic strip can be easily transferred to the roller. We chose to make this machine since plastic is not a climate free material and it is squandered all that anyone could need. So, with the assist it with canning limited up to certain and explicit cut-off. Along these lines this undertaking will end up being a valuable resource from various perspectives. Watchwords: plastic bottle, shaper edge, plastic strip, reusing, family use. A potential reuse of PET water bottles is the change into strips. The methodology paper is identified with cutting the PET bottles into strip. PET containers are utilized and arranged on a huge Scale and might be mechanically reused. The methodology configuration empowers contain to be cut and promptly utilized as prime material for an assortment of employments as strips. The Strip in this way acquired assists with tackling home-grown issues, substituting prime materials for use as wires, Strings or harmonies, or modern issues like lashes for bundling. The strip is valuable for manual work for the most part did with strings and might be applied to measures for making crates, tangles and sewing with needles or weaving with a loom. Different cycles might be done after the cutting interaction, for example, heat-framing for deleting the plastic memory of its previous shape, giving it new shapes and specialized highlights and widening its potential as prime material for new uses and articles.

COMPONENTS USED FOR PROJECT

CUTTER BLADE

A blade is the portion of a tool, weapon with an edge that is designed to chop, slice and scrape surfaces or any materials. Blades are made from material that are stronger than those they are to used. Historically, humans have made blades from stone such as shiny and made from various metal such as copper and iron. now a days blades are made of steel. Blades are one of humanity oldest tool, and continue to be used for food preparation, and other purpose. Blades work by concentrating power on the sharp edge.

HOT AIR GUN

A heat air gun is a device used to produce a stream of hot air, at temperatures between 100 °C and 500 °C (200-932 °F) which can be held by hand. Heat air guns have the form of elongated body pointing at what is to be heated, with a handle is fixed to it right angle and trigger, in the same normal layout as a handgun. A lighter duty heat air gun is similar to a portable Hair dryer.

RESSURE ROLLERS

Pressure rollers are type of rollers used for compacting materials such as plastic, iron metals sheets and other sheets metals, etc. There are different pressure roller such as cylindrical rollers, grid rollers, etc. In plastic strip making machine we used cylindrical rollers to compact and to straighten plastic strips with help of heat given by heat air gun. The main purpose of using pressure rollers is that to convert curly shape plastic strip into straight and plain strips.

DC GEAR MOTOR

This is 12V 60 rpm DC motor used to run the pressure rollers with the help of pinion and chain sprocket. Winding Material: Copper Poles Material: Silicon Steels Magnet Type: Permanent Magnet Brushes Used: Carbon Brushes 2Shaft: Steel Body Cover: Aluminum Lead: Aluminum Diameter of Shaft = 8m

SWITCHEDMODE POWER SUPPLY

An SMPS (switch mode power supply) is an electronic power supply that incorporates a switching regular to convert electrical power efficiently SMPS convert or transfer AC or DC source of current to DC load. For obtaining two DC output for gear motors in plastic strip making machine used SMPS to convert AC source of current.

CYCLE CHAIN

A cycle chain is a roller chain which is used for power transmission, it is used to transfer power from pinion gear to sprocket attached to pressure roller. Its length is 12 inch long.

PINION

Pinion used in plastic strip making machine is having 10 teeths and its inner bore diameter is 8 mm made up of steel.

SPROCKET

A Sprocket used is having 20 teeths and its inner bore diameter is 34 mm and made up of mild steel.

DESIGN CALCULATIONS

Calculation No 1 :-

Power (P) = 24 W

Speed of motor (N) = 50 RPM

Load factor (Kl) =1.75 (for electric motor) Data book Table XI-5

To find :- shaft diameter (d)

Design torque (Td)

$Td = \frac{60\times P\times Kl}{2\times\pi\times N}$

$Td = \frac{60\times 24\times 1.75}{2\times\pi\times 50}$

Td = 8.021 N.m

Maximum stress for solid shaft Data book Table XI-1

$\tau max = \frac{16\times T}{\pi\times d^3}$

Shaft material SAE1030(soft carbon steel) Data book Table II-7

S_{yt} =296 S_{ut} = 527

For design Max stress

$\tau max < 0.30\ S_{yt}$ or $\tau max < 0.18\ S_{ut}$

Data book Table XI-1

Therefore,

τmax = 88.8 MPa

Now,

$88.8 = \frac{16\times 8\times 10^3}{\pi\times d^3}$

$d = 7.71\ mm$

Calculation No 2:-

Power (P) = 37 W

Speed of motor (N) = 65 RPM

Load factor (Kl) =1.75 (for electric motor) data book Table XI-5

To find :- shaft diameter (d)

Design torque

$Td = \frac{60\times P\times Kl}{2\times\pi\times N}$

$Td = \frac{60\times 37\times 1.75}{2\times\pi\times 65}$

Td= 9.51 N.m

Maximum stress for solid shaft Data book Table XI-1

$\tau max = \frac{16\times T}{\pi\times d^3}$

Shaft material SAE1030(soft carbon steel) Data book Table II-7

S_{yt} =296 S_{ut} = 527

For design Max stress

$\tau max < 0.30\ S_{yt}$ or $\tau max < 0.18\ S_{ut}$

Data book Table XI-1

Therefore,

τmax = 88.8 MPa

Now,

$88.8 = \frac{16\times 9.51\times 10^3}{\pi\times d^3}$

$d = 8.17$ mm

Calculation No 3:

Power (P) = 32 Watt

Speed of motor (N) = 60 RPM

Load factor (Kl) =1.75 (for electric motor) Data book Table XI-5

To find :- shaft diameter (d)

Design torque

$Td = \frac{60 \times P \times Kl}{2 \times \pi \times N}$

$Td = \frac{60 \times 32 \times 1.75}{2 \times \pi \times 60}$

Td = 8.912 N.m

Maximum stress

Data book Table XI-1

$\tau max = \frac{16 \times T}{\pi \times d^3}$

Shaft material SAE1030

Data book Table II-1

S_{yt} =296 S_{ut} = 527

For design Max stress

$\tau max < 0.30\ S_{yt}$ or $\tau max < 0.18\ S_{ut}$

Data book Table XI-1

Therefore,

τmax = 88.8 MPa

Now,

$88.8 = \frac{16 \times 8.912 \times 10^3}{\pi \times d^3}$

$d = 7.99\ mm \approx 8mm$

Data book Table XI-4

SELECTED VALUE OF FABRICATION OF MACHINE

Sr. No.	Input Data	Output Data				Shaft Diameter (Mm)
	Speed (RPM)	Power (WATT)	τmax (MPa)	Torque (N.m)	Shaft Material	
1	50	24	88.8	8.021	SAE1030	7.71
2	65	37	88.8	9.51	SAE1030	8.14
3	60	32	88.8	8.912	SAE1030	7.99 ≈ 8

ACTUAL MACHINE IMAGE

MACHINE IMAGE

ARRANGEMENT OF MACHINE COMPONENT

BASE CUTTER

WORKING PRINCIPLE

Working Principle: The process to convert plastic bottles into strip is basically divided into two parts.

A) Bottle base cutter

B) Bottle strip making machine

a) Bottle base cutter:

Firstly the bottle of any suitable size is put inside the cutter from the extreme end and clamp is provided for proper fixing of the bottle which is closed after bottle enter.

The cutter is fixed according to the size of bottle and later bottle is rotated and in single rotation base is remove from the body.

b) Bottle strip making machine:

The cutted bottle is put inside the vertical rod and deadweight is applied on the bottle for proper fixing and downward movement.

Cutter blade is provided at the bottom of the rod for strip cutting in horizontal direction. Blade is making 5-degree angle with bottle to cut strips easily.

The cutted strips are then goes into the pressure roller after heated by hot air gun at certain temperature, the work of pressure roller is to straight strips with combination of heat and pressure.

Further roller is rotated and the strip coming out from pressure roller and fixed into the wounder on other end. Later as the motor starts pulley starts rotating leading to cut strips smoothly and cutted strips are collected on the wounder drum.

PRACTICAL EXPERIMENTATION AND ITS RESULT

We have done experiments on different bottles with various size for making the strips.

Sr. No.	Company Name of Bottle	Original Dimension			Strip Dimension by Our Machine (inch)	Time Required for Making Strip
		Height(inch)	Diameter(inch)	Volume(Cubic inches)		
1	BISLERI 1LTR	10.75	3	61.0231	(205 cm) 80	49.02sec
2	BISLERI 0.50 LTR	8	2.5	30.51	(144 cm) 56.69	34.56 sec
3	THUMBS UP 0.75LTR	10.25	2.75	45.76	UNABLE TO DRAW	------

PRODUCT SPECIFICATION

Raw material

Final output product

APPLICATIONS OF PLASTIC STRIP MAKING MACHINE

- The efficiency of a machine is based upon how much plastic strips is obtained in one hour.
- In this process plastic is converted into plastic strips by using the cutter.
- In this process one can avoid the melting process of plastic strip instead the plastic is used for recycling purpose.
- Plastic industry for making the plastic strips for packing material and box strapping.
- It is also used in craft work.

DISCUSSION

1. Cost compare with existing and our design: The previous designs of crushing and stripper machine has many parts and that was difficult to handle and operate. We are making a new design which is much lighter than previous designs and is therefore portable to any place. The existing design is very costly compare to proposed one and is therefore can't use in large scale.
2. Less Time Require: The existing model of crusher machine work slow as compared to the new plastic bottle stripper machine. Thus the new model can be use in large scale and in short time large amount of strips can be pulled out of the plastic bottle.
3. Economically suitable: The new plastic bottle stripper machine is very fast in working and thus make huge amount of strips in a very short amount of time thus increasing the productivity. Also it is helpful to minimize the waste management cost by simply recycling plastic bottles. We can use these strips further to make objects like mate, chair, basket, net, etc.

RESULT AND CONCLUSION

Our outcome is basic simple to build bottle strip shaper that meets all the objective boundaries. New plan improves all the issue looked in existing plan. They remember boundaries for saw simplicity of development saw convenience, percent recurrence of persistent and complete container strip. What's more, reused material. The as it were one there residual markers to be estimated that we don't anticipate meeting is target of 80% reused material. Eventually, our plan focused on a compelling apparatus over the utilization of reused material and we accept that some of moderately reasonable materials required structure; the last plan is as yet open to those with restricted livelihoods. The new plan of plastic bottle strip shaper

is resolved to utilize plastic waste and keep trying different things with business items produced using PET Plastic strips. We accept that the eventual outcome of this task will be of incredible advantage to the middle and their objectives. By and large, we are extremely satisfied with the last new plan made for the bottle shaper and the plan cycle as a rule. The new plan is basic, simple to build and utilize, solid, modest, and most amusing to utilize.

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