

Designing of a Portable Bottle Crushing Machine

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Abstract

Today, Most of the world's plastic waste still goes to landfill. Plastic waste disposal is one of the cumbersome process which is very less efficient. As plastic containers, bottles are easy to carry they are widely used in many applications in domestic as well as industrial purposes. One of the most prominent application where plastic is not properly disposed is drinking water bottles. As plastic bottles are very widely available in different shapes and sizes that meet the variety of situations economically, people are more leaning towards the plastic bottles other than conventional systems. In most of the functions, parties, events etc, water has been served in bottles of different sizes. These used bottles occupy very large disposal space which usually overflows the dustbins provided at these places and are mostly goes to landfill. This can be prevented by providing crushers at these places. But, today's waste bottle crushing machines are bulky and are not portable. The paper is about design of a Plastic Bottle Crusher which would help to crush the used Plastic bottles and would thereby help in waste management and disposal. This project aims to design a portable Plastic Bottle crusher that could be installed any where and would aid crush of used bottles. This project involves the process of designing the crusher considering forces required for crushing and ergonomic factor that an operator needs. The design of this machine is such that it would require optimum load to crush bottles and will thus not strain the user or operator. After the completion of design process, it could be manufactured and transformed into a Recycle aid able machine. The crusher thus would help in recycling plastic waste. It would also help in reducing the volume of waste generated and will thus help in effective waste management. The crushing of used water bottles will also ensure that the bottles are no used beyond the shelf life of its plastic. Therefore this project will prove to be a useful asset in many ways.

Keywords: Crusher, Bottle Crusher, Crusher Design, Motor, Gear, , Roller.

1. Introduction

A crusher is a machine designed to reduce large solid material objects into a smaller volume, or smaller pieces. Crushers may be used to reduce the size, or change the form, of materials so they can be more easily and efficiently used in the purpose intended to. Crushing is the process of transferring a force amplified by mechanical advantage through a material made of molecules that bond together more strongly, and resist deformation more, than those in the material being crushed do. Crushing devices hold material between two parallel or tangent solid surfaces, and apply sufficient force to bring the surfaces together to generate enough energy within the material being crushed so that its molecules separate from (fracturing), or change alignment in relation to (deformation), each other. The earliest crushers were hand-held stones, where the weight of the stone provided a boost to muscle power, used against a stone anvil. Querns and mortars are types of these crushing devices.

2. Tentative Design Of The New Mechanism

The process initiated was a preliminary design wherein the basic mechanism and working of the project was decided. The ideas and innovations about the working of project were implemented in this stage. The following are the objectives of Design.

3. Objectives Of Design

The Portability, compactness and size of the machine were the major objectives of design, so that the machine thus designed could be stationed easily at any public place. Also the machine had to be simple in design and construction such that it could aid easy maintenance. The Bottle Crusher machine is dc motor operated machine and thus it is important of it to have an optimum usage . Accordingly the mechanism was designed. The conceptualized machine should also have the ability to crush bottles of different dimensions and hence the dimensions and other design aspects were chosen accordingly.

4. Stages Of Design

STAGE 1

In this stage the design of bottle crusher was done according to matching dimensions of the waste bin top. The basic idea behind this project is to manufacture such a machine crusher that could be placed on recycle cans and crushing operation could be carried out easily. Also the crusher should be portable for transport replacement and maintenance. Keeping all the above unit on the waste bin by connecting the opening of inlet of waste bin and opening of outlet of the bottle crusher was designed like a accommodate the mechanism.

STAGE 2

In this stage the top opening and side body of the crusher is designed according to the dimensions by considering the length of the rollers which are to be place inside. Thickness of the out body is different from side to another side because one side of the body acts as main support for the motor, gears and roller shafts with complete hole to allow the shaft from one side to other side for fitting gears and another side support for roller shafts with slots with suitable depth and its self acts as a body cover for closing roller shaft ends. Connecting plates to one chamber to chamber to another chamber are designed and storage spaces for crushed bottles is designed at bottom , battery chamber and motor chamber are designed in this stage

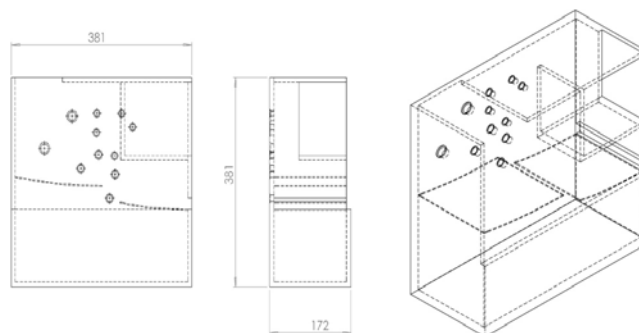


Figure : 1

STAGE 3

In this stage first level rollers are designed this first level rollers act as pickup rollers by its surface and projections on it. Projections on the first level roller are spicks which are used to catch the bottle with out slipping and to leak the air or water in it. few threaded holes according to dimensions of spikes are designed in the rollers to place spicks on the roller surface, spicks are designed with threading system at end for fitting. The negative projection of the spicks are designed as grows in the rollers for avoiding locking of rollers. Spicks are designed with smooth surface and sharp edges to punch easily and to release the material after punching.

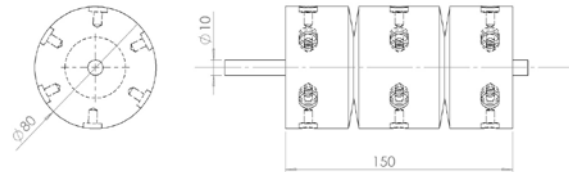


Figure : 2

STAGE 4

During the crushing stroke, the volume of the bottle decreases, which in turn, increases the pressure of the air inside the bottle and obstructs the crushing load. To avoid cutting operating is performed. Spikes are used to punch the bottle during the crushing time in starting which will aid in removal of air present inside the bottle.

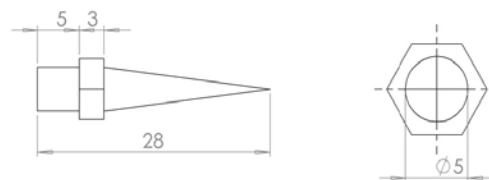


Figure: 3

STAGE 5

In the further stage second level rollers are designed with number of flat headed projections on the surface for crushing the bottle passing through it removes remaining water or air by crushing tightly, as like as first level rollers the negative imager of the flat head projections are designed in the second roller. for avoiding locking or jamming of rollers.

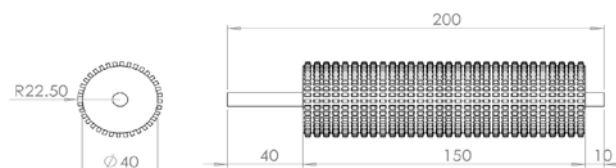


Figure : 4

STAGE 6

In this stage rollers with smooth surface with out any projections or spicks are designed this are heating rollers with particular temperature depending up on the material of the bottles inserting into the crusher this are the last level rollers

which completely crushes the bottle by using temperature, the property of the plastic is, it will become soft when it is heated by using this advantage we can crush the bottle into very thin sheet.

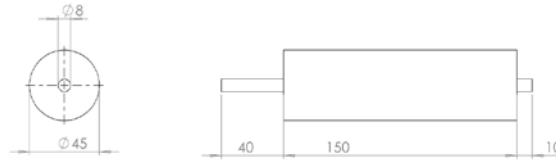


Figure : 5

STAGE 7

In this stage by comparing the thickness of the rollers holes to the side body are designed for placing shaft with bushes for free rotation of the rollers. The image of the holes designed in the side body is repeated on the parallel side of the body in which the rollers are placed between. gears and bushes are designed considering motor speed, distance between roller for developing crushing load, finally gear box for covering transmission system and Plats for connecting three stages of crushing chambers.

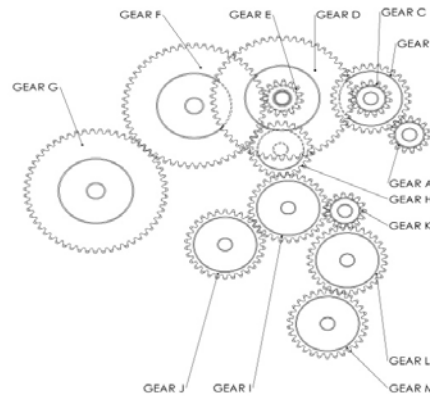


Figure: 6

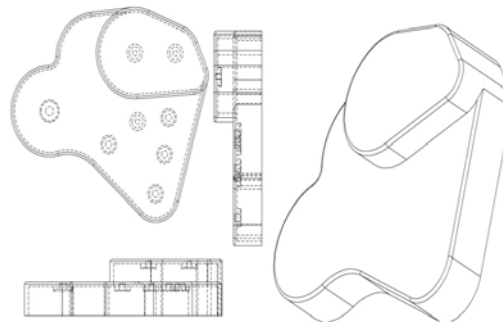


Figure : 7

STAGE 8

This is the final stage, assembling all the designed components in order, spicks are fitted to the first level rollers and rollers are inserted by adjusting the side body in selected holes with bushes. in the same way next two level rollers are assembled. Power supply is given to the heating rollers which are at the end. Connecting plats to the three crushing chambers are assembled to create correct path for the bottle entering into the crushing machine. both supporting sides are

fitted without any play, gears and motor are fitted on the side of the body in allotted the space, gear box cover is assembled after placing motor and all gears to the roller shafts.

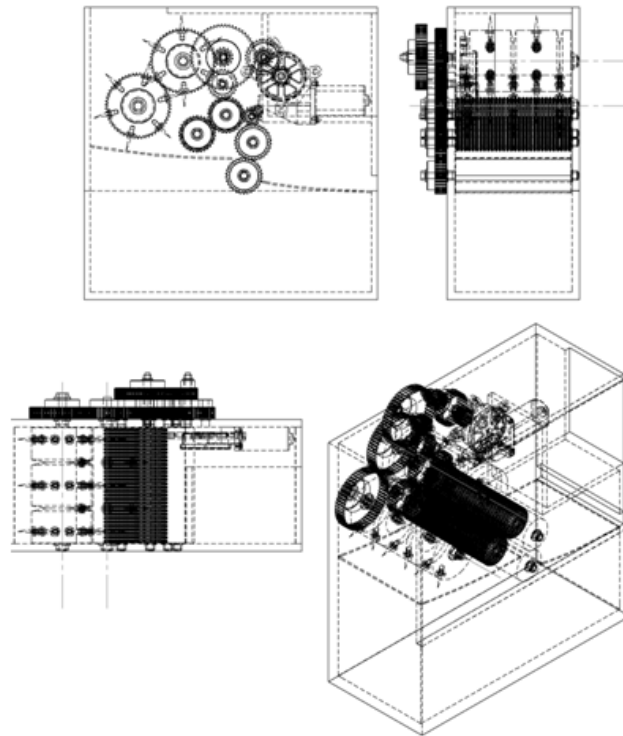


Figure : 8

5. Feature Scope

in this crushing machine we used geared 12 volt dc motor, to which dc power is supplied by wire by designing battery space in the machine and adding the 12volt battery in the crushing machine, we can move it any ware with out searching plug points for power supply, by adding solar charging system by arranging solar cells to the body charging can be done easily, by integrating advanced sensors like object sensors, wifi sensors, level indicators we can receive the data of over flowing of bottles in the waste bin and automatic opening and closing of inlet mouth of crushing machine, by using strong heating rollers we can reduce crushing levels from three to two by that we can reduce the manufacturing cost of the crushing machine.

6. Conclusion

The study on operation and mechanism of various types of crushers was done in the process and subsequently a crusher mechanism was designed to crush plastic Bottles. The mechanism designed can be used as a portable crusher and can be installed on waste bins. The design of exit port is such that it gives mechanism the agility to crush bottles as well as Cans of various dimensions. The mechanism designed is simple and utilizes optimum effort to crush bottles and cans and thud reduces volume of waste and aids recycling. The fabrication and analysis of this mechanism is in process

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