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Design and Fabrication of Can Crusher

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ABSTRACT: The main aim to make such a mechanical oriented project is to reduce the scrap volume and use it for recycle purpose properly. Now a day there is widely usage of cans have been done in hotels and canteen and for their storage large volume of space is required. These research papers include design and structure analysis of can crusher. There are so many researchers who have done work on design and analysis, but still there are so many areas of scope regarding this design and analysis. This project involves processes like design, fabrication and assembling procedures. Even though there are many types of the can crusher machine in the market, the completion of the new model provides a more practical usage than previous one.

KEYWORDS: Design Consideration, Calculation, Size Reduction, Cans.

I. INTRODUCTION

The main purpose of the project is to get knowledge of design and fabrication. The design is an environment friendly and uses simple properties such as mechanical single slider and automation properties which uses crank mechanism. The design is done so that knowledge of designing, mechanism and forces analysis are increased. In order to reduce the waste, we planned to create a can crushing machine that will reduce the volume of aluminum cans by approximate eighty percent. This machine primarily usage is to save space and for recycling. It can be placed anywhere in park, restaurant, canteens, etc. in today's life most of the food items are packed in canned. Cold and hot drinks and other beverages are also comes in cans. Commercial establishments like cafeteria and bars, have to deal with leftover cans. Storage is often a problem and cans consume lot of space, thereby increasing total volume of trash. The transportation cost is also high for moving such a huge number of cans. Thus this machine will help to recycle and maintain eco-friendly environment also. This project involves the process of designing the different parts of the crusher machine considering the forces and ergonomic factor for people to use. This project mainly about generating a new concept of can crusher that would make easier to bring anywhere and easier to crush cans. After design has completed, it was transformed to its real product where the design is use for guidelines.

II. LITERATURE REVIEW

Can recycling is very important part of any family and industries for recycling program. Aluminum recycling is one of the easiest things you can do to help the environment. Recycling of can began a long ago and started to become common place back in early 1970's. Can is 100% renewable. This means that can you take to your local recycling Centre today becomes a new aluminum can. There are no waste products in the process of making a 100% renewable resources and one of the best things can recycle. You might be surprised to know that within 60 days an aluminum can is able to go from your recycling centre and becomes a brand new can to be used by consumer.

Crusher

A crusher is a device to reduce large solid material object into a smaller volume or pieces. Crusher reduces the size or change the form of waste material so they can more easily disposed or recycles. This is sometimes accomplished by

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compacting the mass of the object. At other times the crusher will be used force to break the object into a series of smaller piece. This usually involves placing the object between two solid surfaces. The crusher gives you extra space by flattening either single or multiples cans.

Crank mechanism

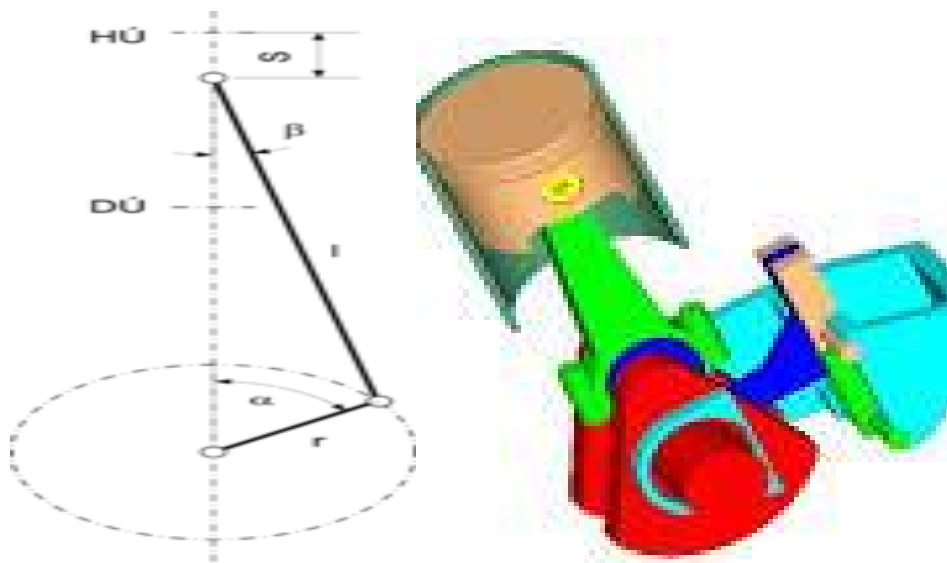
A crank is an attached at right angles to a rotating shaft by which reciprocating motion to or received from the shaft. It is used to convert circular motion into reciprocating motion

Example

- Mechanical pencil sharpener.
- Manually operated car window.
- The crank set that drives a bicycle via the pedals.

III. CONCEPT

This machine is basically works on the principle of Single Slider Crank Mechanism which is the heart of this machine and it converts rotary motion into a reciprocating machine to crush the Cans/Plastic bottles. In this, link 1 is fixed and link 2 which is a crank is rotating about fixed link 1 and converts this rotary motion into the reciprocating motion of slider (corresponds to the link 4) by means of connecting rod which corresponds to the link 3. This is the inversion of single slider crank which is obtained by fixing link 1.



Single Slider Crank Mechanism

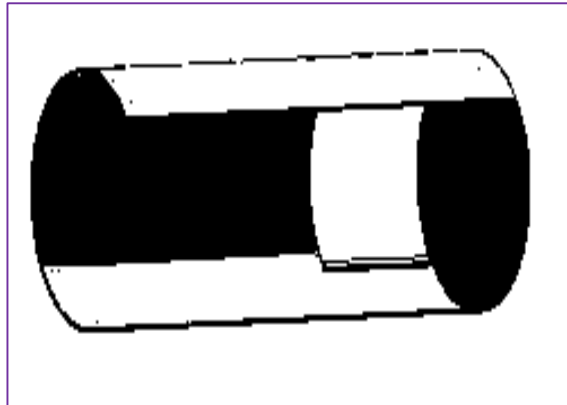
HOLLOW PIPE

This component is made up of mild steel and it is used when cans are put in a rectangular box after which it holds the cans and main important factor is to grip it and get it crushed one by one. To design this component mild steel is taken on which design is marked then it is cut by hack saw machine according to the marked then this pipe structure is faced from both the ends. Gas cutting is done on the rectangular pipe using gas cutter. Then welding is done on the rectangular face

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FRAME

We have selected standard L section frame of material mild steel. The frame is supported due to possibility of vibration are more. Therefore, for foundation purpose pad plates are provided in between two legs a support of angle is given to avoid splitting of edge. Hinge of male type is fabricated and female is welded in frame and slotted plate known as table plate welded with male hinged accept on frame. The shaft is made according to IS-C-45 on centre lathe machine in workshop and alignment of the shaft is supported between the centre lathe during fabrication.



Frame

IV. DESIGN PROCEDURE

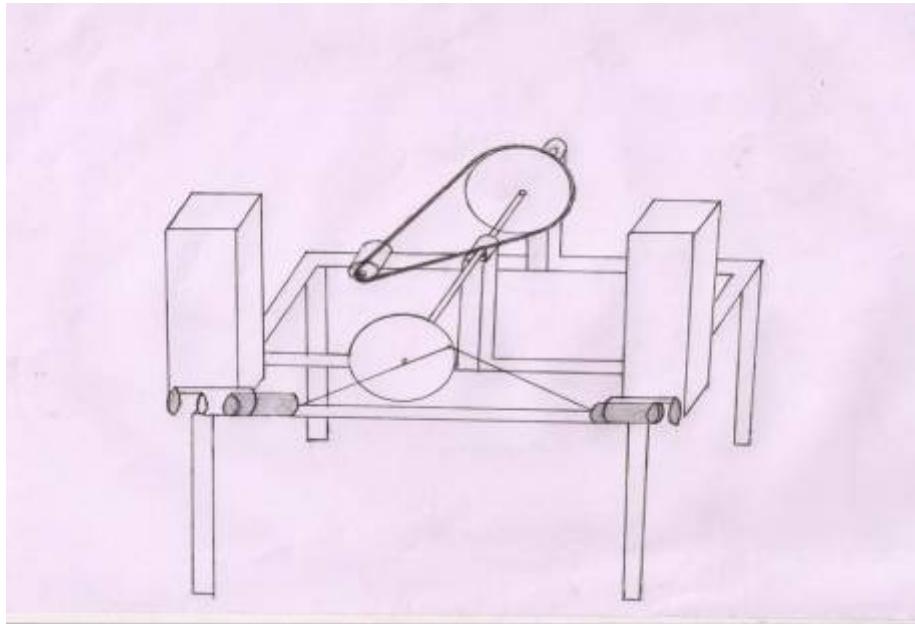
The aim of this is to give the complete design information about the double side can crusher machine. In this, the explanations and some other parameters related to the project are included. With references from various sources as journal, thesis, design data book, literature review has been carried out to collect information related to this project. The working of the project picture have been made and its image format is taken and uploaded here

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DIAGRAM



V. WORKING

Can crusher is worked based on the single slider crank mechanism, Here crank shaft is used to convert the rotary motion to reciprocating motion by using connecting rod which is continuous to the piston. A can crusher for environmental protection is generally composed of a single slider crank mechanism to drive a piston forward or reverse backward. When the piston is move forward a plate which act as a bore of the piston moves along the piston crushes the can. By the reciprocating movement of the piston, can is crushed easily by the mechanism.

BEFORE CRUSHING



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AFTER CRUSHING



Design consideration

- Maximum Force required to crush the Can/Plastic bottles
- Considered elements
- Standard size of cans/plastic bottles

Design calculations

Force required to crush the plastic bottle

Force required to crush the Soda/Pepsi Can

So, we considering maximum of it.

Torque, $T = F \times r$

Where, r is radius or length of the crank.

F is required crushing force.

Power is given by,

$$P = T\omega/60$$

T is torque required

ω is angular velocity $= 2\pi N/60$

Where, N is speed of the crank.

Again, Power can be calculated by static force analysis

Design of V-Belt

Design Power (P_d) $= PR \times KL$

Where, PR = rated power

Load Factor, $KL = 1.10$

Selection of belt on the basis of design power. Nominal width, w Nominal thickness, t Recommended Diameter, D

Centrifugal tension factor, KC Bending stress factor, Kb

Peripheral Velocity, $V_p = \pi D_1 N_1 / 60$

D_1 = Diameter of smaller pulley

i.e. electric motor shaft pulley,

N_1 = Speed of electric motor shaft pulley.

If this velocity

Now, assuming Velocity Ratio,

VR to calculate speed of driven pulley.

$N_1/N_2 = VR$ Angle of lap or contact on smaller pulley,

$$\theta_1 = \pi - (D_2 - D_1)/C$$

$$\theta_2 = \pi + (D_2 - D_1)/C$$

By using velocity ratio with neglecting slip,

$$= N_2 / N_1$$

Centre to Centre distance for V-belt,

$$C = (D_1 + D_2)$$

Centrifugal Tension, $FC = KC * (V_p / 5)^2$

No. of Strands $= P_D$ Power / Belt

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Length of the Belt,

$$L = \pi/2 * (D_1 + D_2) + 2C + (D_1 - D_2)^2 / 4C$$

VI. FABRICATION

Mechanical Components

- Shaft.
- Pulley (2Nos).
- Belt.
- Single Slider Crank Mechanism.
- Separating Bin..
- Crushing Tray.
- Angles (For Frame)
- Piston (2Nos).

VII. CONCLUSION

The above design procedure is been adopted for the fabrication of fully automatic can crusher machine which will make the product durable for the long time as well as make it efficient and also helps to understand the concept of design. Thus with the help of this design we can fabricate an automatic can crusher machine to simply reduce the volume of cans as well as to reduce the human fatigue. Also the automatic operation can be possible using the mechanical power transmission operated by electric motor or electric actuator etc. This solely will reduce the volume of the cans or bottles to reduce the transportation cost by reducing its volume.

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