International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 3.45 (SJIF-2015), e-ISSN: 2455-2585
Volume 3, Issue 10, October-2017

DESIGN AND FABRICATION OF SOLAR POWERED CAN CRUSHING MACHINE

[1]K. BHASKAR, [2]Dr. M. YOHAN

[1] *PG Scholar Department of Mechanical Engineering, JNTUA College of Engineering, JNTUA, Ananthapuram, Andhra Pradesh, INDIA*
[2]*Professor, Department of Mechanical Engineering, JNTUA College of Engineering, JNTUA, Ananthapuram, Andhra Pradesh, INDIA*

Abstract:

A can crusher is a device which is used for squashing food and beverage cans to save space for recycling. The disposal of the used cans compose a problem because the empty cans occupy space. Also the transport of empty cans become difficult. There is a need to crush these cans. So that they occupy smaller space for storage and transport. This will help recycling of the material of the can. It can be placed everywhere in the park, houses. Recycling plays a very important role to save our natural resources. The Present Paper Focus Ondesign the part of a can crusher and to fabricate the can crusher by using solar power. In present days we need more and more power for driving instruments. In these project with drive and pneumatic valve is operated by using solar cell, solar cell generates the power using sunlight energy. A solar cell, a form of a photovoltaic cell is a device that uses the photoelectric effect to generate the electricity from light, thus generating solar power (energy). Most often many cells are linked together to form a solar panel with increased voltage and/or current. Solar cells produce direct current (D.C), which can be use directly, stored in a battery. The cylinder is connected with the reciprocating mechanism. When a cylinder is moved in reverse stroke the can are placed through inlet valve and during forward stroke the can is crushed and passed away through outlet valve. This will leads to continuous operation

- ***KeyWords: Dc Motors/ wiper motor, 12v 7.5Ams battery, Bearings, Switches, solar panel***

I. INTRODUCTION

This paper aims in producing a mechanical crusher which would be a helping hand for waste management. This crusher can be used for crushing sheet metal wastes, paint cans, cool drink cans, machining scraps for reducing the space occupied by these while carrying it to the recycling plants. This is where the mechanical crusher comes in to play. The crusher would crush the cans thus reducing the gap between them and make them to uniform size and shape so that the materials can be baled up according to the size of the crushing bin. The uniform size and shape of the materials can be obtained by providing a bin onto which the material is to be crushed. The crusher is designed to operate by both mechanical and electrical means. This crusher is designed in such a way that it is simple to construct and would require minimum effort for operating in both mechanical and electrical types of operation.

This paper contains of designing and fabrication of a solar can crusher machine. There have many differences between this can crusher with current design in marketplace. This project is to develop and improving it performance as well so that there has no doubt about the design and concept. This design required little forces to crush the aluminium cans, can crush a can at a time. In this project, it requires lot of skills, information and also knowledge such as Computer Aided Design software, Solid works software, using machine called shearing machine, bending machine, vertical bend saw, bench work and welding process. This design definitely would help the user. So, this design would through much process before it get into prototype term in order to achieve the objectives and off course customer need.

II. DESIGN AND FABRICATION

The modeling of the solar can crusher is done by using the PRO/E software. The main aim to choose the PRO/E is because of the following advantages,

It is much faster and more accurate. Once a design is completed. 2D and 3D views are readily obtainable. The ability to changes in late design process is possible.It provides a very accurate representation of model specifying all other dimensions hidden geometry etc.It is user friendly both solid and surface modeling can be done.It provides a greater flexibility for change. For example if we like to change the dimensions of our model, all the related dimensions in design assembly, manufacturing etc. will automatically change. It provides clear 3D models, which are easy to visualize and understand.PRO/E provides easy assembly of the individual parts or models created it also decreases the time required for the assembly to a large extent.

The figures drawn in PRO/E are,

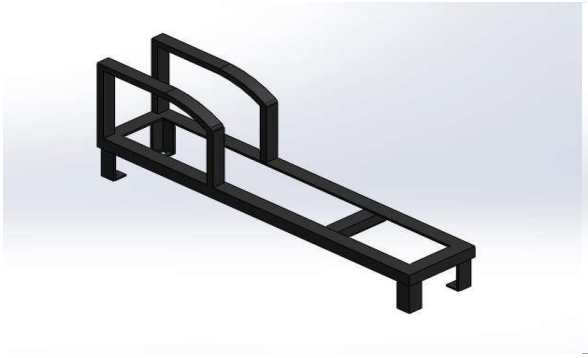

Fig 1.Base frame of can crusher

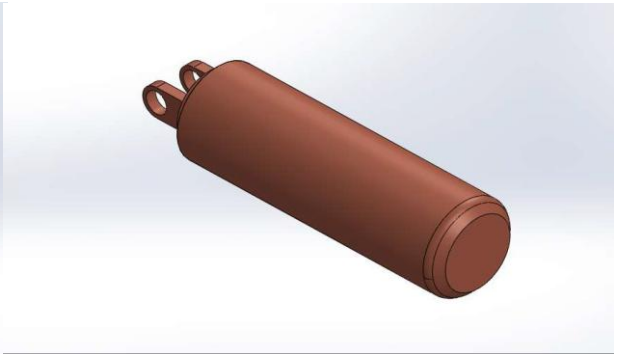

Fig 2. Cylinder

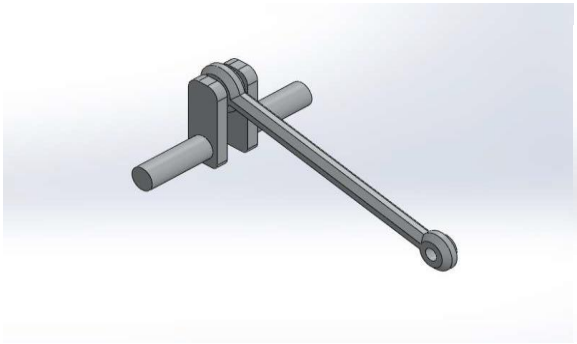

Fig 3. Crank Assembly

Fig 4.Driven shaft

III. components

The major components used in the solar can crusher are,

- Dc Motors/ wiper motor
- 12v 7.5Ams battery
- Bearings
- Switches
- crank mechanism
- solar pamel

DC Motors: It is said that the invention of the AC induction motor was the deciding factor in the 19th Century battle between AC and DC. However, the DC motor has still been with us since then. Good speed-torque characteristics and ease of variable speed control are the main advantages of the using DC motors over AC. With the advent of power electronics (especially the thyristor) in the late sixties, the use of squirrel cage induction in variable speed applications starting emerging. The squirrel cage induction motor is robust and virtually maintenance free as compared to its DC counterpart which uses brushes. Thus there has been a continuous drive to refine the power electronics to attempt to achieve a DC motor performance from an AC squirrel cage induction motor. Although the AC induction motor has virtually replaced the DC motor for small and medium size installations, the DC motor is still used in lifts in high speed gearless applications. In this lesson, we examine the principle of operation of DC motors, and the speed torque characteristics of some of the DC motor types.

Fig 5 DC motor

Wiper Systems: Configuring the optimum wiper system for a vehicle requires the proper motor, linkage, arms and blades. Attention must be focused on the correct application of these parts to ensure that a robust yet cost-effective system is achieved. The following information will assist in determining system requirements, selecting components and

configuring the system. Define the Sweep Pattern Everything starts with the sweep pattern. In order to develop the most appropriate pattern, input from persons knowledgeable about where the vehicle operator needs to see must be utilized. The sweep pattern is then created, defining the sweep angle, arm configuration and blade length. Always allow an additional 5% of the nominal sweep angle on each side of the pattern for growth of the wipe angle (due to wear and installation tolerances of wiper arms). This will prevent collisions between the wiper blade and window frame or molding. Also make sure in multiple arm systems that there cannot be any collisions between adjacent wiper blades. Once the sweep pattern is established, the next step is determining the proper motor size to run the system.

Fig 6 wiper motor

Battery: The inscription of *NiMH* on a battery pack does not automatically guarantee high energy density. A prismatic Nickel-Metal Hydride battery for a mobile phone, for example, is made for slim geometry. Such a pack provides an energy density of about 60Wh/kg and the cycle count is around 300. In comparison, a cylindrical NiMH offers energy densities of 80Wh/kg and higher. Still, the cycle count of this battery is moderate to low. High durability NiMH batteries, which endure 1000 discharges, are commonly packaged in bulky cylindrical cells. The energy density of these cells is a modest 70Wh/kg.

Compromises also exist on lithium-based batteries. Li-ion packs are being produced for defense applications that far exceed the energy density of the commercial equivalent. Unfortunately, these super-high capacity Li-ion batteries are deemed unsafe in the hands of the public and the high price puts them out of reach of the commercial market.

Fig 7 Battery

Bearings:A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may *prevent* a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

Fig 8 Bearing

Solar Panel: Solar panels absorb the sunlight as a source of energy to generate electricity or heat. A photovoltaic (PV) module is a packaged, connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W). The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 W module will have twice the area of a 16% efficient 230 W module. There are a few commercially available solar modules that exceed efficiency of 22% and reportedly also exceeding 24%. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically

includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.

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 (Pd) = PR × 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, $Vp = \pi D1N1/60$

D1 = Diameter of smaller pulley

i.e. electric motor shaft pulley,

N1 = Speed of electric motor shaft pulley.

If this velocity

Now, assuming Velocity Ratio,

VR to calculate speed of driven pulley.

N1/N2 = VR Angle of lap or contact on smaller pulley,

$\theta 1 = \pi - (D2 - D1)/C$

$\theta 2 = \pi + (D2 - D1)/C$

By using velocity ratio with neglecting slip,=N2/ N1

Centre to Centre distance for V-belt,C = (D1 + D2)

Centrifugal Tension, FC = KC* (VP/ 5)2

No. of Strands = PD Power /Belt

IV. WORKING PRINCIPLE

The crusher is designed to operate on a crank and slotted lever mechanism and the power for the electrical operation of the crusher is taken from an electrical motor. It is designed to use a 3 phase induction motor for the electrical operation of the crusher as the power required for crushing the sheet metal is high as compared to that of a normal paint or cool drink can. The distance between the motor and the larger pulley commonly called as the Centre distance plays a major role in the fabrication of the crusher as this distance is the critical parameter for maintaining the crushing force .

The Centre distance is fixed in such a way that the torque is more and the speed of the rotation is less. By increasing the Centre distance higher force can be obtained and motor running speed can be reduced. The basic structure or frame of the crusher is to be built using a flat rod of mild steel material. The power transmission from the motor is by means of a pulley and the pulley is to be attached to a main shaft. The main shaft is supported at the Centre by means of ball bearings as the distance between the pulley and the crank is more. This bearings eases the power transmission and reduces the transmission losses.

The main shaft houses the crank plate. The crank plate made up of mild steel in circular shape is a solid thick plate onto which the piston rod is to be connected. This is the one which plays a key role in converting the rotating motion of the motor to the required reciprocating or oscillatory motion. If the diameter of the crank plate is small, then the speed of reciprocating motion will be high and this reduces the crushing force. If the diameter of the crank plate is high, then the piston reciprocates slowly and the crushing force exerted by the piston will be really high thus damaging the bin which is at the end of the piston. Therefore, optimum diameter of the crank plate should be maintained for the effective operation. The main shaft is a circular rod made up of mild steel and round thick plate is used as a crank Which is in turn attached to the piston rod and the piston. A rectangular bin of mild steel is constructed to withstand the high crushing force that

the piston exerts on the bin while crushing the waste materials. The bin shape, material and design of the bin varies according to the crushing material. This is so because the crushing force required for crushing the tin is not same as that of the force required for crushing a sheet metal waste or a metal scrap. The material is put into the crusher using a hopper and the bottom plate of the bin can be removed as to the crushed waste can be taken from the bottom part. The removed waste is in the shape of the bin and holds together as a single solid model and is easy to transport.

V. CONCLUSION

The 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.

REFERENCES

[1] Vishal N. Kshirsagar, Dr.S.K.Choudhary, Prof. A.P. Ninawe (2014). An Automatic Approach for Can/ Plastic Bottle Crusher Machine.International Journal of Research in Aeronautical and Mechanical Engineering.Vol.2 Issue.7, pp.102-113, July 2014.

[2] SurveQais, SayedSaif, SayedJafar, ShaikhNadeem (2015). Fully Automatic Can Crusher. International Journal of Mechanical and Industrial Technology. Vol. 2, Issue 2, pp.155-159.

[3] Vishal N. Kshirsagar, Dr. S. K. Choudhary, Prof. A. P. Ninawe (2014). An Automatic Can / Plastic bottle crusher machine. International Journal for Scientific Research & Development. Vol. 2, Issue 02, 2014,pp.66-68.

[4] Vishal N. Kshirsagar, Dr. S..K Choudhary, Prof. A.P Ninawe (2014). Design Consideration in an Automatic Can/Plastic Bottle Crusher Machine. International Journal of Engineering Research and General Science.Volume 2, Issue 4, June-July, 2014, pp.769-779.

[5] Shadab Husain, Mohammad Shadab Sheikh (2015). Can crusher machine using scotch yoke mechanism. IOSR Journal of Mechanical and Civil Engineering. pp. 60-65.

[6] A. Elfasakhany, J. Marquez, E.Y. Rezola, J. Benitez (2012). Design and Development of An Economic Autonomous Beverage Cans Crusher. International Journal of Mechanical Engineering and Technology. Volume 3, Issue 3, pp.107-122.

[7] Vishal N. Kshirsagar, Dr. S. K. Choudhary, Prof. A. P. Ninawe (2014). Experimentation and Analysis of an Automatic Can/Plastic Bottle Crusher Machine. International Journal for Innovative Research in Science & Technology| Vol. 1, Issue 2, pp.1-5.

[8] Dr.Sc. Shaban A. Buza, Dr.Sc. Kastriot A. Buza, BSc. KrenarPllana (2014). Can Crusher Design in response to Environmental Concerns. Journal of Trends in the Development of Machinery and Associated Technology.Vol. 18, pp.179-185.

[9] Yeshwant M, Sonkhaskar, AnuragSahu, AmitChoubey, RaghavSinghal, Amritpal Singh (2014). International journal of Engineering Research and Technology. Vol.3,Issue-10, pp.297-300.

[10] Mohd. ShahjadAspak Sheikh (2010).Design and Fabrication of Pedal Operated Chilli Crusher Machine. International Journal on Recent and Innovation Trends in Computing and Communication. Volume: 3 Issue: 2, pp.26-30.