

FULLY AUTOMATIC 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 days there is widely usage of cans have been done in hotels and canteen and for their storage large volume of space is required. This research paper 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. Microcontroller makes up the backbone for this project. 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, sensor, Size Reduction, Microcontroller, 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 microcontroller and sensor. 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 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.

2. LITERATURE REVIEW

Can recycling is very important part of any family and community recycling program. Aluminium 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 aluminium can. There are no waste products n 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 aluminium can is able to go from your recycling centre and becomes a brand new can to be used by consumer.

2.1. Crusher

A crusher is a machine designed 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.

2.2. Pneumatics

Pneumatics is a section of technology that deals with the study and application of pressurized gas to produce mechanical moton. Pneumatic system, which are used extensively in industry and factories are commonly plummed with compressed air or compressed inert gases.

3. DESIGN

The main aim of this is to study the complete design of Automatic can crusher machine. in this design and calculation procedure parameters have been taken into consideration from design data book, thesis, journals to carried out this project.

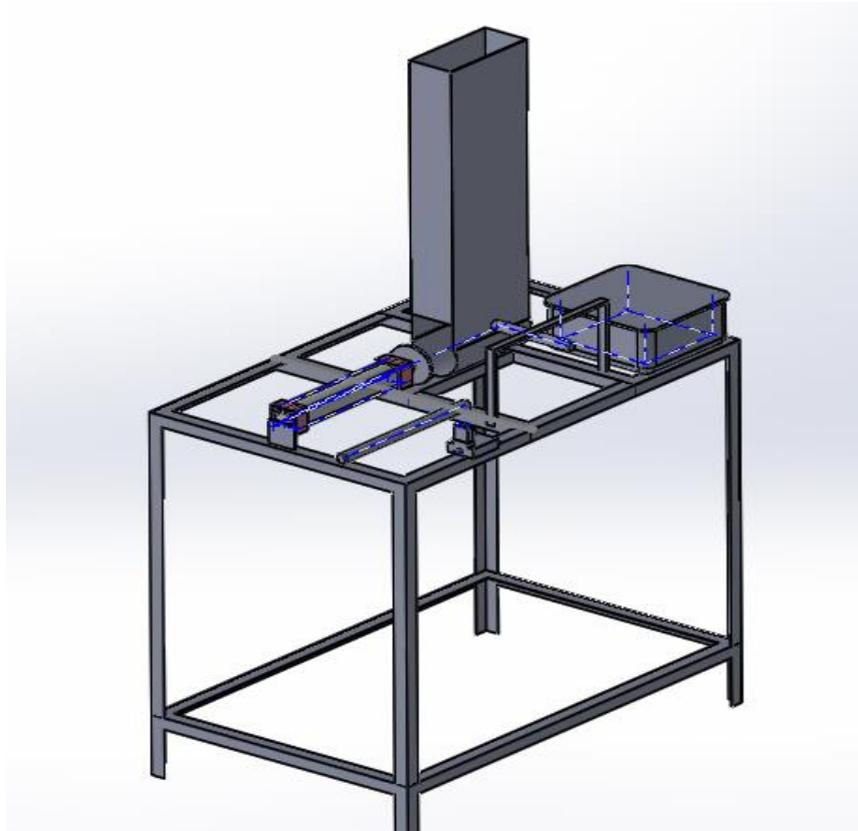


Figure 1 Modeling of machine

3.1. Cylinder

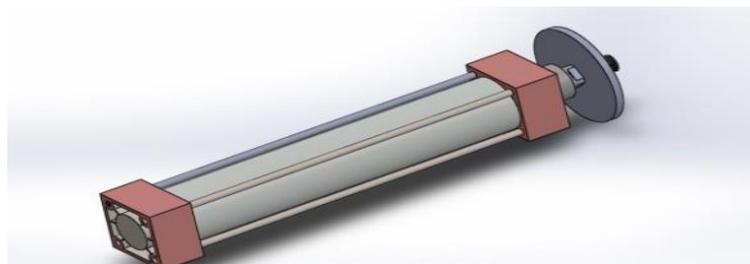


Figure 2 Cylinder

The material used for the cylinder is aluminum, which is having specification of 50 diameter, 100mm in length and permissible load (ft) 180N/mm². We have selected 50mm diameter cylinder so as to get proper force intended on can and it get crushed ,here is the calculation carried out:-

$$\text{Thickness} = \frac{D}{2} \left(\sqrt{\frac{ft + P}{ft - P}} - 1 \right)$$

$$t = 0.68\text{mm}$$

$$\text{Therefore, } t = 3\text{mm}$$

The outer diameter of the cylinder,

$$\begin{aligned} \text{Outer diameter } D_o &= D_i + 2(t) \\ &= 50 + 2(3) \\ &= 50 + 6 \\ &= 56 \text{ mm} \end{aligned}$$

Therefore, Force generated by cylinder

$$\begin{aligned} F &= P \times A \\ A &= \frac{3.14}{4} \times D^2 \\ A &= \frac{3.14}{4} \times 50^2 \\ A &= 1964 \text{ mm}^2 \\ F &= 2.45 \times 1964 = 4808 \text{ N} = 490 \text{ kg} \end{aligned}$$

3.2. Hollow pipe

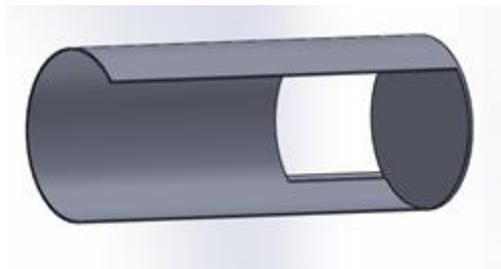


Figure 3 Hollow pipe

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

3.3. Frame

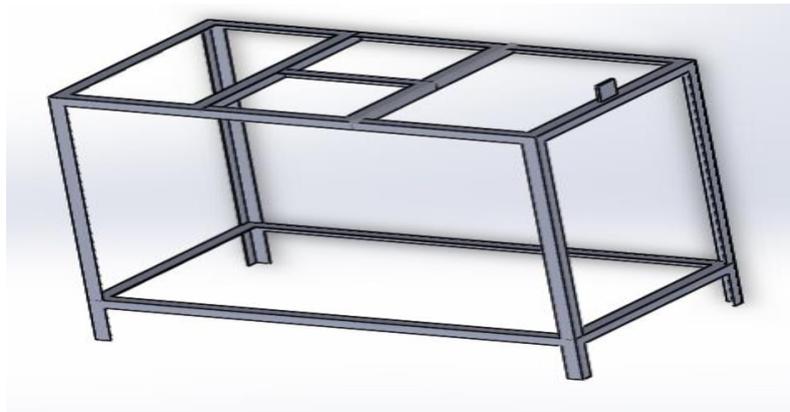


Figure 4 frame

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. Below the table plate toe angle are welded on legs. On this 'S' shaped brackets are mounted, these brackets are used as bearing housing. In this brackets bearing are fitted. Bearing arbor is fitted which is main part of the machine and whole accuracy depends on it. 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.

3.4. Design of weld joint:-

Checking the strength of the welded joints for the safety. The transverse fillet weld welds the side plate and stiffness plates, the maximum load which the plate can carry for transverse fillet weld is,

$$P = 0.707 \times S \times L \times f_s$$

Where, S = size of weld, L= contact length =25mm

The load of shear along with the friction is 30kg = 300N

Hence, Eqn becomes

$$300 = 0.707 \times 3.4 \times 25 \times f_s$$

$$\text{So, } f_s = \frac{300}{0.707 \times 3.4 \times 25}$$

$$f_s = 5 \text{ N/mm}^2$$

since the above calculated is smaller so permissible value f_s is taken as 21 N/mm² which is very safe .

4. WORKING

The engine is attached at compressor site .the compressor is made ON till the pressure in storage tank reaches 5 bar pressure. Here, the minimum operating pressure is 3bar to crush the can. The flexible hose coupled with the compressor tank and the air storage tank installed on the air engine .Here we use combination of electronic circuit, 5/2 solenoid valve for running cylinder compressor .the utility valve which supplies the air from the air tank to the direction control valve is gradually opened. The 5/2 direction control valve is operated as can placed in front of the opto sensor.

A can crusher for environmental protection is generally composed of a pneumatic system 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. A separate pneumatic cylinder is used to push the can in crushing zone. A groove formed at an inner bottom portion to drain any residue left in a can to a collecting bin.

The working of the project picture have been made and its imeg format is taken and uploaded here

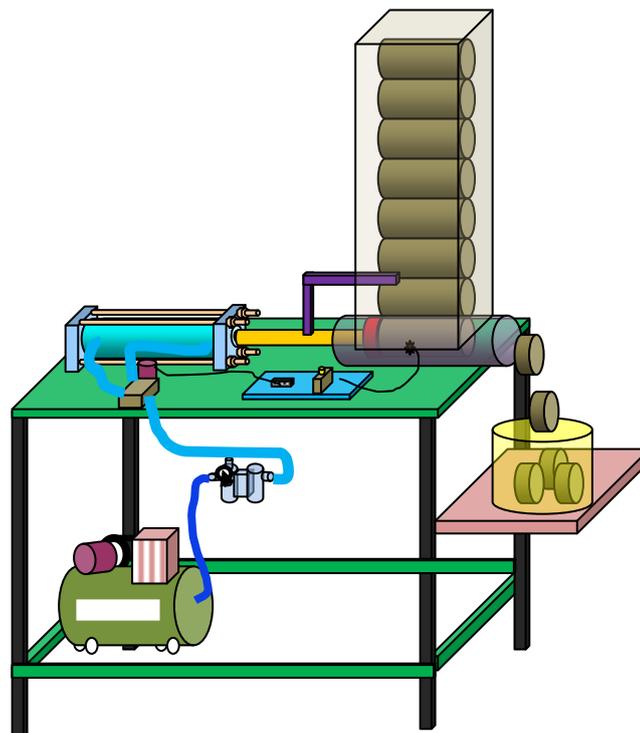


Figure 4 project model

5. CIRCUIT

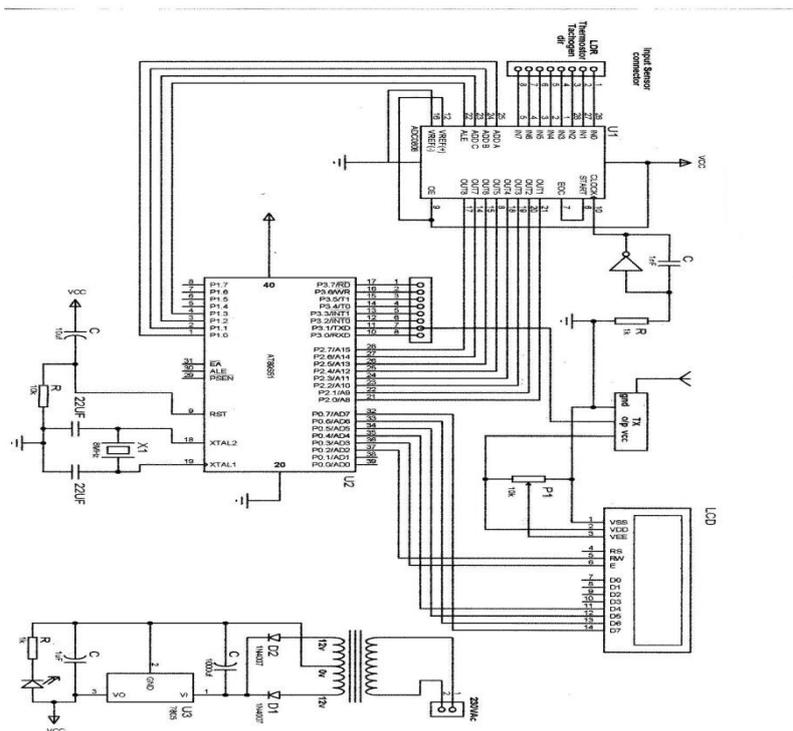


Figure 5 Circuit diagram

This is the circuit represented in our project which has been assembled with respect to microcontroller and opto sensor. This linkage of circuit is assembled with the cylinder and the can holder that is hollow pipe. In this the sensor is fitted with respect to the hollow cylinder which emits the signal and forward to the micro controller which gives the forbidden to actuator to crush the cylinder.

6. FUTURE SCOPE

By placing the micro controller and sensor instead of manual operated gives more result and for future it can be handfull for can crushing .this model can also be made with hydraulic.

7. 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.

REFERENCES

- [1] Mr. Ramkrushna S.More, Sunil J.Rajpal publishes a paper on “study of crusher”. International Journal Of Modern Engineering Research (IJMER), Vol 3, Issue.1, 2013 PP-518-522 ISSN: 2249-6645
- [2] .Mr.Shahdab Hussain Mohammad present paper on “can crushing machine using pneumatics” IOSR Journal of Mechanical Engineering (IOSR – JMCE) e-ISSN: 2278-1684,P-ISSN: 2230-334X PP 60 – 63
- [3] Mr.Shoichi Kitani, Keicchiro Hayashi , Mitsiuro Yamashina and Keiko Takei present paper on “Automatic can crusher”.
- [4] Design Data Book for Machine Elements and Textbook of Machine Design by R.S.Khurmi and J.K.Gupta 14th edition S.Chnad Publication.