Design and Fabrication of Aluminium Tin Can Crusher

A.S.Shinde[1*], A.D. Landge[2] , A.K. Biradar[3], S.M. Kondawar[4]
[1]Assistant Professor, Mechanical Engineering Department, APSIT, Thane, asshinde@apsit.org.in
[2]Assistant Professor, Mechanical Engineering Department, APSIT, Thane, amarnathlandge@gmail.com
[3]Assistant Professor, Mechanical Engineering Department, B.R.H.CoE, Vangni, akbiradar@gmail.com
[4]Assistant Professor, Mechanical Engineering Department, APSIT, Thane, smkondawar@apsit.org.in

Abstract: It has been observed that tin cans constitute significant part of garbage at public places. In order to recycle and process these cans their collection and transportation is necessary. This paper talks about detailed design of a tin can crusher. Tin can crusher helps achieve 65%volume reduction and reduces transportation costs. It is compact in size and can be operated manually by hand. It will help to keep earth neat and clean as the model eco-friendly

Keywords: *Tin Can Crusher, Volume Reduction, compact size, Eco-friendly.*

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1. Introduction

This Paper consists of designing and fabrication of manually operated aluminium tin can crusher. A can crusher can be defined as "A device used for crushing aluminium cans for achieving 65% volume reduction and reduces transportation costs". Generally, crusher is made up of steel. [11]

The main aim of a can crusher is to smash an empty aluminium can into the smallest unit possible. Anyone who drinks a couple of sodas a week may never see the need to compact the cans, but others who are heavy drinkers may find these devices very helpful. Canteens, restaurants, bars, catering halls, cinema halls and recycling plants are places where a can crusher is pretty much a must. Can crusher are the most efficient, convenient, space saving and easy way to reduce your aluminium waste while fulfilling recycling duty. They are convenient, fun, easy to use and friends of the environment. Crush the can and save the space, time and energy. The earth will thank you. [2]

In order to reduce the waste, we planned to create a can crusher that will reduce the volume of aluminium cans upto eighty percent. Can crushers are primarily used to save space and for recycling. It can be placed everywhere, in the park, restaurants, canteens, and railway stations etc where one can see the waste in the form of cans. The basic requirements for this project are knowledge of Computer Aided Design software like AutoCAD and Solid work, use of laser cutting machine, Truama Bend V Series (bending machine), shearing machine, vertical bend saw, bench work and welding processes.[12]

1.1 Background of The Work:

Different types of existing tin can crushers are:

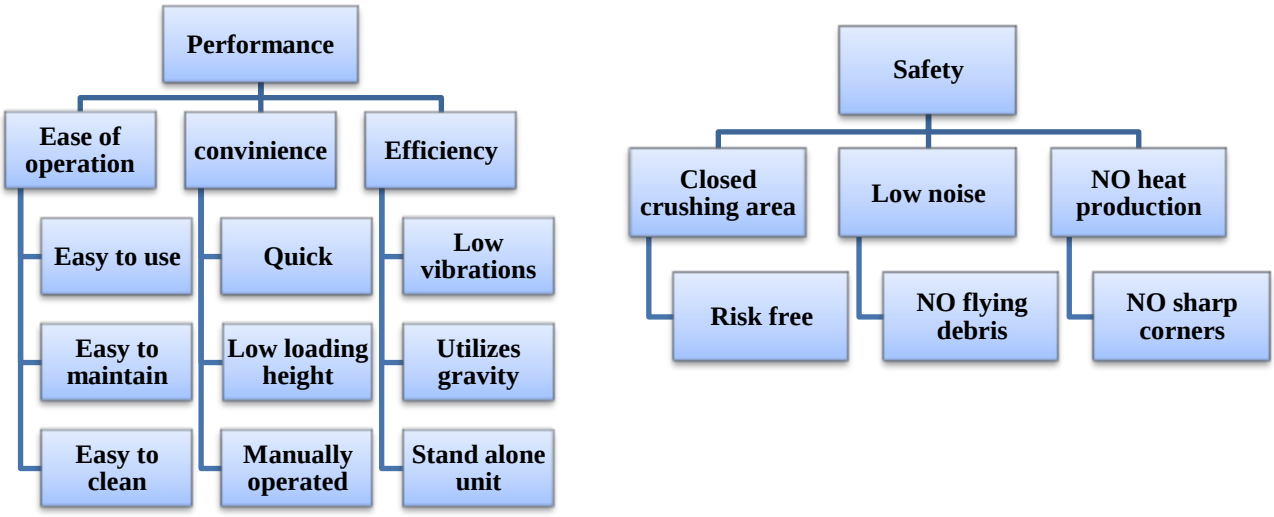
1) Manually operated single can crusher,
2) Manually operated multiple can crusher,
3) Pneumatically operated single can crushers
4) Garbage pail crusher

Recycling is wonderful way to help the environment, even if you think otherwise when you're hauling big, bulky bags crammed with empty cans to the curb. One device that will make our life easier, and our recycling haul much more compact, is the can crusher. Can crushers are available in a number of styles, sizes and speed, with models to suit everyone from the heavy soda drinker to the recycling center manager. In this project, we have developed a manually operated can crusher that can crush the tin as flat and as symmetrically as possible before landing into the bin. The design is environment friendly and uses simple mechanism. [6]

1.2. Objective of Tin Can Crusher while designing:

- Design must have a continuous can feeding mechanism.
- Only one tin can must be fed at a time for crushing.
- The can must be in good condition when supplied to the device (i.e. not dented, twisted or pressed).
- Device must be a standalone unit.
- 80% volume reduction must be achieved.
- Crushed aluminium tin must immediately fall into the aluminium can bin without human intervention.
- Arrangement for the aluminium can to slide from hopper to the crushing area

More objectives regarding performance and safety are explained in the form of flow chart



1.3. Purpose of Aluminium Tin Can Crusher:

Aluminium doesn't occur naturally in the earth's crust, it has to be extracted from its ore-bauxite which is mined and then smelted in a very energy-intensive process. Although great care is taken to rebuild the land after mining, changes do occur as a result of mining that are detrimental to the surrounding environment. It takes 80-100 years for aluminium can to decompose. Compared to mining and smelting, recycling aluminium drink cans is far less energy intensive. Recycling aluminium requires only 5% of the energy and produces only 5% of the CO2 emissions as compared with primary production. A recycled aluminium can saves enough energy to run a television for three hours. More than 100 billion aluminium cans are sold in the United States each year, but less than half are recycled. A similar number of aluminium cans in other countries are also incinerated. Aluminium cans are one of the easiest materials to recycle. New drinks cans appear on the shelf just six weeks after recycling. A single aluminium can is said to, when recycled, saves about as much as oil as would be poured into it to fill up.

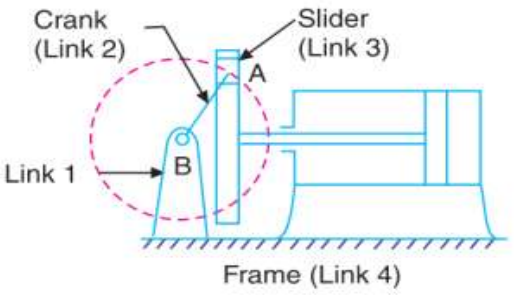


Fig.1.1 Mechanism [4]

This mechanism is used for converting rotary motion into a reciprocating motion. The inversion is obtained by fixing either the link 1 or link 3. In Fig, link 1 is fixed. In this mechanism, when the link 2 (which corresponds to crank) rotates about B as center, the link 4 (which corresponds to a frame) reciprocates. The fixed link 1 guides the frame.[4]

The design can be decomposed into different mechanisms according to the functions i.e. crushing mechanism, slot disposal, retraction mechanism and automatic feeding mechanism.

1.4. Concept of the Tin Can Crusher:

Advantages of Tin Can Crusher	Disadvantages of Tin Can Crusher
• Easy to operate &reduces volume upto 70 %.	• Crushes only single can at a time.
• Portable & Suitable for both steel and aluminium cans.	• Operator is required.
• Less force and less time required to crush can.	• Required can condition is good in manner.

2. LITERATURE

2.1. Introduction:

Title development of recycle bin tin can crusher requires an amount of good understanding on the knowledge of the science. Therefore, executing a research is necessary to obtain all the information available and related to the topic. The information or literature reviews obtained are essentially valuable to assist in the construction and specification of this work. With this grounds established, the project can proceed with guidance and assertiveness in achieving the target.

2.2. Terminology:

Can recycling is a very important part of any family and community. Aluminium recycling is one of the easiest things you can do to help the environment. Recycling of can began long ago and started to become common place back in the early 1970s.

The literature review for tin can crusher is as follows:

Table 2.1 Finding of Literature Review:

Author name	Subject	Findings	Year of publication
Woodworker's Journal, America	Can do Can Crusher	Tilting mechanism with piston & slot	2007
Freshman academy ITC project report	Design & fabrication of pneumatic tin can crusher	Piston – cylinder mechanism operated by Pneumatically	2012
Muhammad Hanis Bin Muhammad Zulkifli, Malaysia	Design of recycle bin tin can crusher	Can feed mechanism	2008

3. SYSTEM DESIGN

Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific function with maximum economy & efficiency.

Hence a careful design approach has to be adopted. The total design work has been split up into two parts;

1) System design

2) Mechanical Design.

System design mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on main frame at system, man - machine interactions, Number of controls, position of controls, working environment of machine, chances of failure, safety measures to be provided, servicing aids, ease of maintenance, scope of improvement, weight of machine from ground level, total weight of machine and a lot more. In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely,

- Designed Parts
- Parts to be purchased

For designed parts detailed design is done & distinctions thus obtained are compared to next highest dimensions which are readily available in market. This amplifies the assembly as well as postproduction servicing work. The various tolerances on the works are specified. The process charts are prepared and passed on to the manufacturing stage. The parts which are to be purchased directly are selected from various catalogues & specified so that anybody can purchase the same from the retail shop with given specifications.

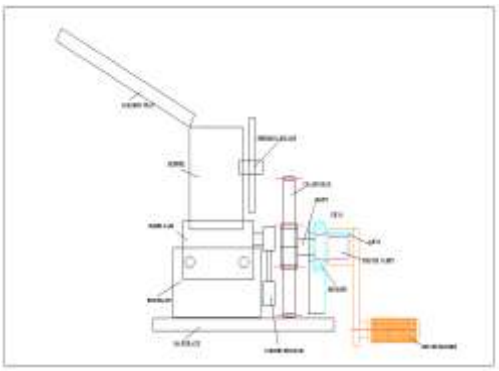


Fig.3.1: Design Drawing

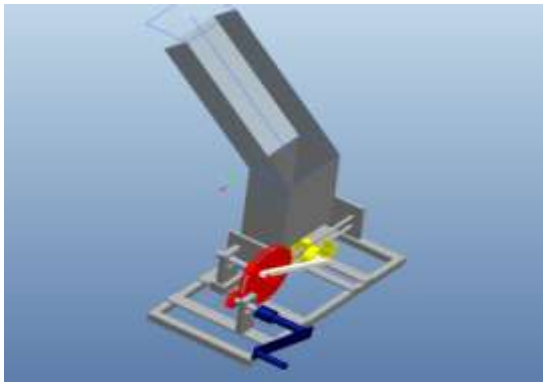


Fig.3.2: 3-D Model (Creo) of Tin Can Crusher

4. FABRICATION PROCESSES

4.1 Introduction:

After designing phase, fabrication processes take place. These processes are about using material selection and make the product base on the design and by followed the design dimension. Many methods can be used to fabricate a product, like welding, cutting, bending, grinding, drilling and many more methods. Fabrication process is a process to make only one product rather the manufacturing process was used at the whole system production. This way include part by fabrication until assembly to others component.

4.2 Process Involve:

In order to make the design to come in reality, fabrication process needs to be done first. The fabrication process starts from dimensioning the raw material until it finishes as a desire product. The processes that involve are:

1) Getting Material: The material will be available in UMP mechanical laboratory. This rack have more types of steel like L shape sheet, rectangular hollow steel, rectangular steel, and etc.

2) Measurement and Marking: After getting the material, the next step is measurement and making of material. The equipments used in this process are measuring tape and maker pen. The scale is from solid work software and this scale is the true.

3) CUTTING MATERIAL: The next step is cutting the material using shearing machine after measurement and marking process.

4) DRILLING: Mark the position for drilling using scriber before start drill. After that, start the drilling.

5) Bending process: After drilling process, the sheet metal will undergo process bending, using bending machine to get true shape for the project.

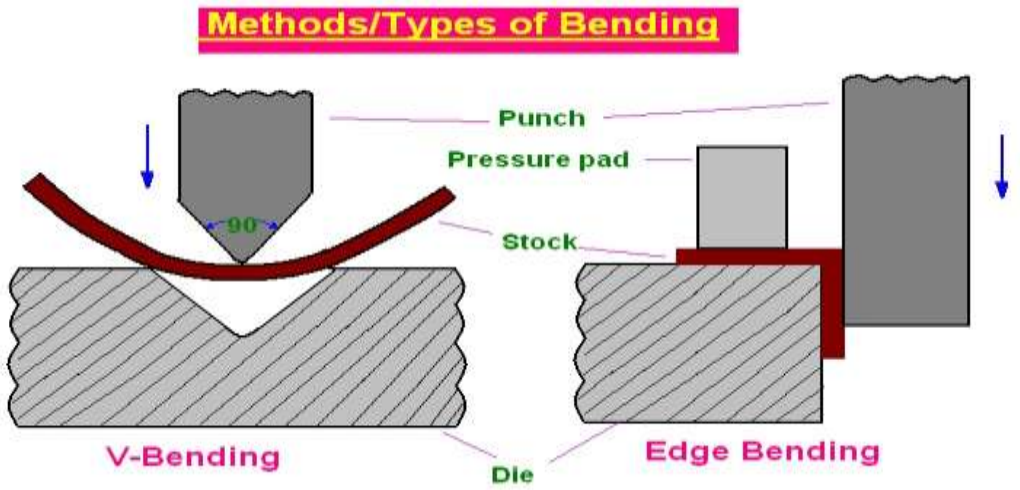


Fig. 4.1: Process bending sheet metal

5) Welding: Welding is a fabrication or sculptural process that joins materials, usually metals or thermo plastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the workpieces to form a bond between them, without melting the work pieces.

6) KNURLING: Knurling is a manufacturing process, typically conducted on a lathe, whereby a diamond-shaped (criss-cross) pattern is cut or rolled into metal. The operation performed for producing indentations on the part of the workpieces. Knurling allows hands or fingers to get a better grip on the knurled object than would be provided by the originally smooth metal surface. Occasionally, the knurled pattern is a series of straight ridges or a helix of "straight" ridges rather than the more-usual criss-cross pattern.

4.3. Material Procurement:

Material is procured as per raw material specification and part quantity. Part process planning is done to decide the process of manufacture and appropriate machine for the same.

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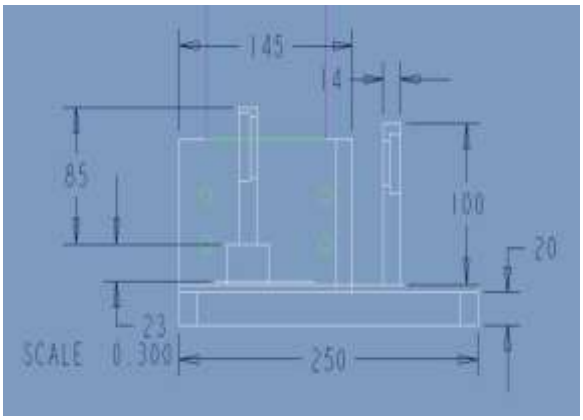

Fig.4.2: Side View of Frame

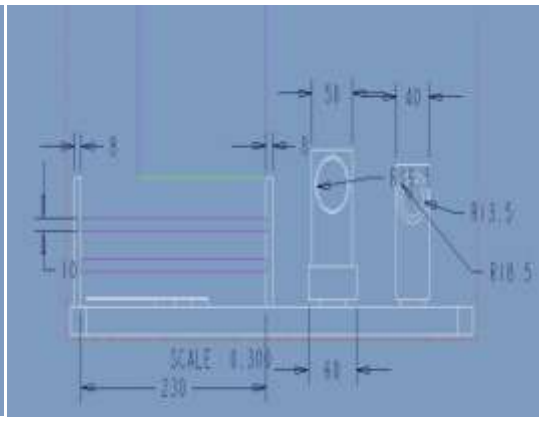

Fig.4.3: Front View of Frame

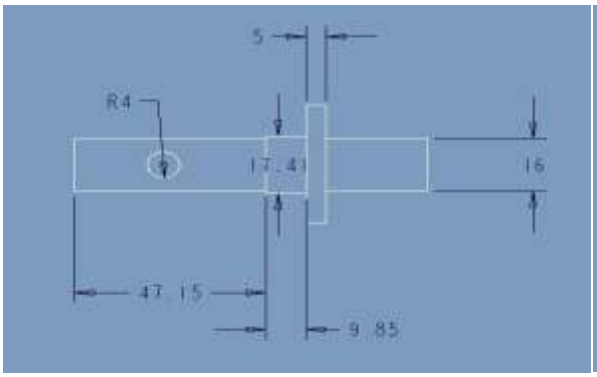

Fig.4.4: Crank shaft

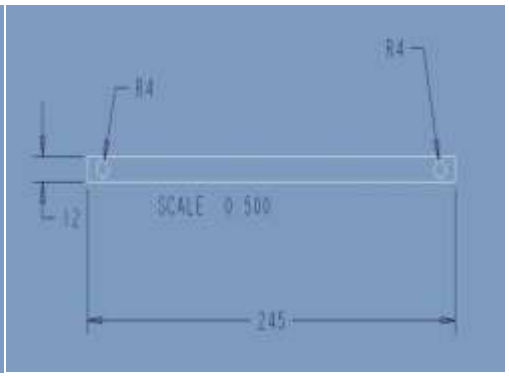

Fig. 4.5: Connecting rod

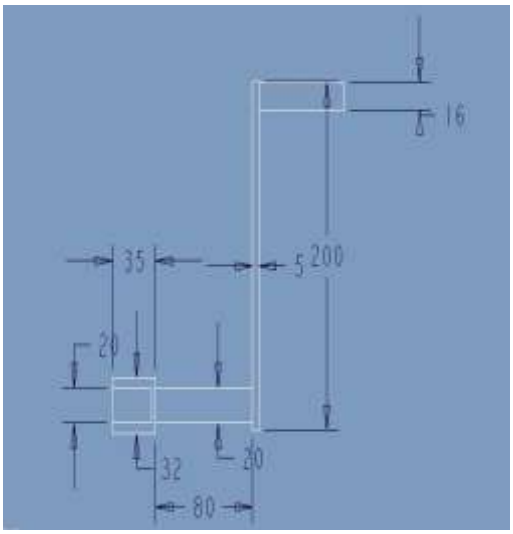

Fig.4.6: Handel and Coupling

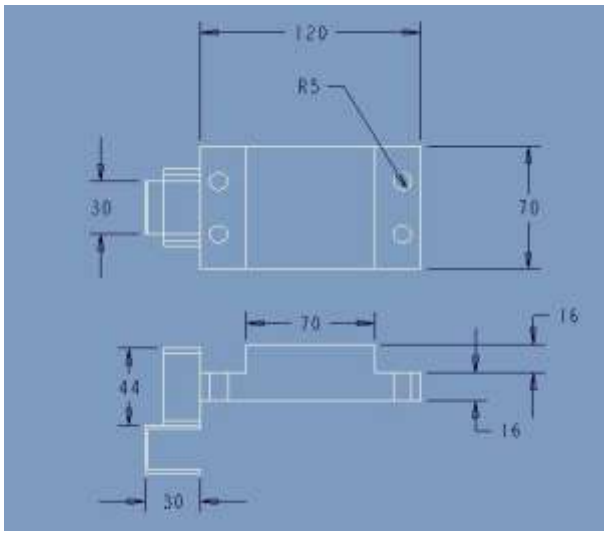

Fig.4.7: Crusher or Piston

GENERAL MATERIAL USED:

1. C55- Alloy Steel
2. C45- Plain Carbon Steel
3. MS-Mild Steel
4. STD- Standard Parts Selected from PSG Data Book.

5. Future Scope:

This work has various futuristic technologies which are still under R&D and hence it will be surely used in the near future. Much work in the project is constrained because of lack of essential resources and their high-cost.

- With automation system can become more robust.
- Crushing multiple cans with the help of a strong,

rigid and larger can basher. Developing hoper and feeding mechanism it can crush tin both stroke of piston.

- It can be driven by electric motor also by maintaining reduction ratio.
- Crushing plastic bottles can also be thought of.
- Adjustable mechanism to accommodate varying can and bottle sizes.
- We can provide belt drive to separate aluminium tin as well as plastic bottle.

6. CONCLUSION

In this project we carried out the study of the current can crushers and the various mechanisms employed. Some of the technological aspects like robust design, volume reduction were successfully implemented. Overall, the project was very enriching in terms of technical fabrication and design process. The current prototype reduces the volume of cans by 65 %. Auto feed mechanism have trouble due to speed which needs some improvement in near future.

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