

# DESIGN AND FABRICATION OF ALUMINIUM TIN CAN CRUSHER BY USING SCOTCH YOKE MECHANISM

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**Abstract:** Nowadays in India, recycling is one of the areas which is rapidly increasing day by day. The amount of waste coming in is a tremendous quantity. Aluminium cans one of the important product which is being recycled on an increasing scale. For carrying out this recycling can crushers are used. For recycling of these cans, manual operation is being carried out in industries, which is a time consuming process and ultimately it leads to the reduction of production rate. In order to crush the cans in a less time, we are designing a can crusher machine using scotch yoke mechanism having one or two side crushing ability. A can crusher machine is used for crushing aluminium cans for recycling purpose and also for easy storage in recycling bins. The scotch yoke mechanism converts the rotating motion into reciprocating motion, this is the principle which we are using in our can crusher.

**Index Terms -Design Consideration, Calculation, Size Reduction, Cans.**

## I. INTRODUCTION

This project consists of design 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 60% volume reduction and reduces transportation costs". Generally, crusher is made up of steel. 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. Crush the can and save the space, time and energy. The earth will thank you. In order to reduce the waste, we planned to create a can crusher that will reduce the volume of aluminium cans up to sixty 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.

Can crusher is a machine that is used for crushing empty aluminum cans for easier recycling. It is a tool for everyday usage and is especially useful for those, who use a lot of cans, for example, drinking soda from aluminum cans. The most common type of cans that people use regularly are sodacans. If you are a common soda drinker, you probably have a large bag of empty cans lying on floor in your house or garage, party halls. Compressing all those cans with your hands or feet would not only take a lot of time may be injure to hand or feet, but also would be very exhausting. Uncompressed cans can take up a lot of space. Can crusher is able to compress cans by 60 percent For example, if size of an average can is approximately 6 inches than aluminum can crusher will compress 4-4.5 inches.

Aluminium can crushers can be used not only to compress soda cans, but also for other types of aluminium cans. Besides drinking soda, people also like to drink beer. Every beer drinker knows how much beer cans are left over after a party. It would be a pain to crush all these cans with your hands or feet. And if you won't crush all the cans you will have large garbage bags full of empty cans that will take up a lot of space in your trash. Can crushers do not cost lot of money, but can be a very useful machine. Can crusher can not only help to save up more space for placing, but you can also earn some bucks for aluminium recycling. As composed aluminium cans take up a lot less space than normal aluminum cans, you can collect all your empty cans for couple of months and stuff them into a large bag, and afterwards take them to a recycle center and get paid money for all those cans.

**LITERATURE SURVEY:****1. Design and Fabrication of Can Crushing Machine:By N Nagarajan, S Srinivasan, Balathilaka**

With increase in levels of technology efforts being put to increase the comfort and safety. These can be done by implementation of better design. This paper describes the implementation of Design and Fabrication of can crushing machine itself. In this paper quick return mechanism is used and it is a improved device used for crushing cans. Two cans are crushed simultaneously in one stroke i.e.; one can is crushed during the forward stroke of the piston and the other can is crushed during the return stroke of the piston.

**2. Design and Fabrication Of Can Crushing Machine: MuhammadHanis Bin Muhammad Zulkifli**

The project is to understand the fundamental knowledge of design and development of a recycle bin tin can crusher. The tin can might crush as flat and look as symmetrically as possible and inserted the bin. In this project, for Design of recycle bin tin can crusher, simple mechanism properties such as fulcrum system is used. The fabrication of recycle bin tin can crusher is implemented to reduce the cost.

**3. Design and Fabrication of Can Crusher: By R Rajesh, S Selvadurai, S Sivakumar**

The main purpose of this project is to get knowledge of design and fabrication. The Design improves the mechanism, force analysis and knowledge of design. The Single Slider Crank Mechanism is used to crush the cans, here crank shaft is used to convert the rotary motion to reciprocating motion by using connecting rod.

This project mainly about generating a new concept of can crusher that would make easier to bring anywhere and easier to crush cans. This project involves the process of designing the different parts of the crusher machine considering the force.

**4. Design and Fabrication of Automatic Can Crusher: By KunalSontakke, Harshil Yadav, Chetan Wakchaure, Pradeep Samere , Prof. K.P Agte**

In this report, the pneumatic system is used, the pressurized gas in pneumatic system gives the mechanical motion. The main purpose of the project is to study the complete design of Automatic can crusher machine. the design uses 5/2 DCV's , FCV, Two single acting cylinders one for pushing and other for crushing, a frame, hoses & connectors. in this Hopper is used for collecting all the cans thrown at the top and can holder is provided to hold cans while crushing. Here the cans are crushed in vertical position and 6 stages of working takes place. Methods and process involve in this project are joining using bending, welding, drilling, and cutting process. This project involves the process of designing the crusher considering forces and ergonomic factors for easier handling.

**5. Design and Fabrication Of Plastic Bottle And Can Crusher For Recycling Purpose: By SonaliDevmane, S.N. Aloni**

The plastic bottle or cans are hold between two parallel solid surfaces, and apply sufficient force by single slide mechanism driven by electric motor to bring the surfaces together to generate enough energy within the material being crushed so that its molecules separate from or change alignment in relation to deformation. The Design procedure is been adopted for the fabrication of Automatic Can/Plastic Bottle Crusher machine which can crush both can as well as bottle. Thus, with help of this design and some other electronic components we can fabricate an automatic can/plastic bottle crusher machine to simply reduce the volume of cans/plastic bottles as well as to reduce the human fatigue.

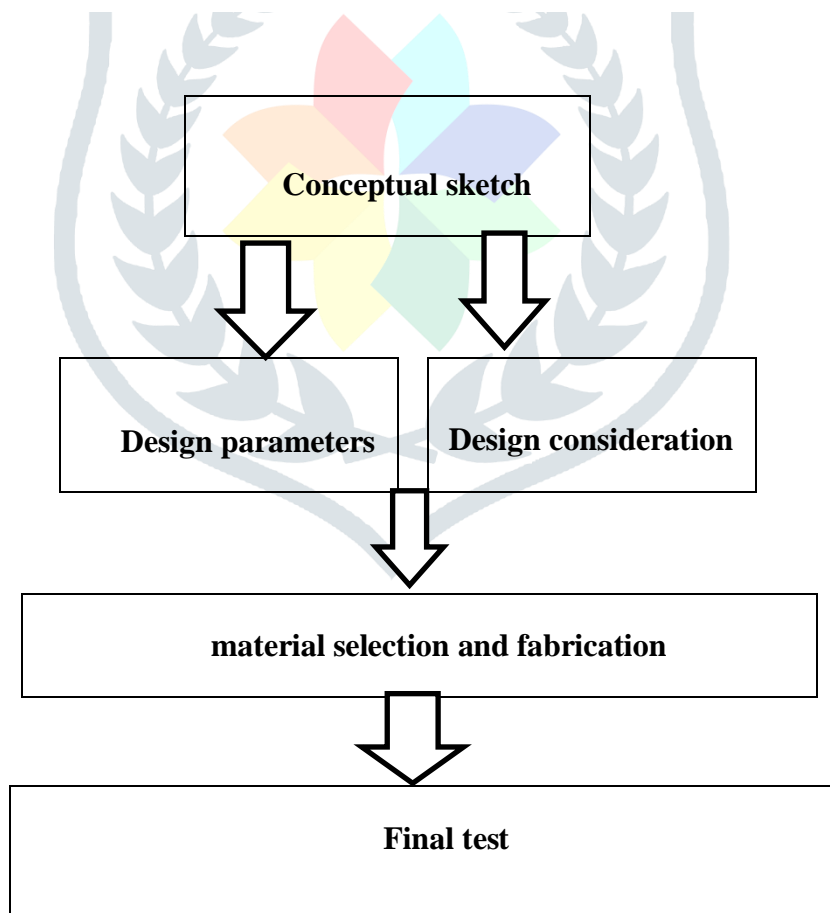
## 6. Design and Fabrication of Can Crusher M. P. Nawathe, Ghanshyam Ingle, PranjaliKharode, SnehaPradha, DnyaneshwarRathod

Toggle mechanism is used in this project to crush cans for where large resistances are to be overcome through short distances. Toggle mechanism is a combination of solid, usually metallic links (bars), connected by pin (hinge) joints that are so arranged that a small force applied at one point can create a much larger force at another point. The machine completely works on the toggle mechanism with solid shaft, hollow square pipe, bearing and crank disc are provided to work in a good condition. Toggle mechanism gives larger output for smaller input. Also the fabrication with toggle mechanism is easy and of low cost. It does not require any electric power source. compare to hydraulic and pneumatic can crusher, toggle mechanism is more convenient to use and more applicable.

## 7. Cam Follower Can Crusher Vending Machine:Byakshay Patel, akashWagh, nitinTilekar, Suryakant Thakur

In this, the single slider crank mechanism is used and it converts rotary motion into a reciprocating machine to crush the Cans/Plastic bottles. The desired objectives were achieved with maximum elimination of the drawbacks of the system. The cam follower gives precious and good result in this paper and it also saves time and less effort needed to work. The single slider is implemented to get better design and fabrication. In this paper we studied different mechanical motion transmission mechanism for crusher. They are implemented programming for controlling the crushing and vending operations where we got to know the programming software. Along with the crushing mechanism there will be a card vending mechanism that will dispense gift coupons each time a can is recycled thus promoting people towards recycling.

### Methodology:



## Components Description:

### ➤ Half HP electrical motor

Electric motor is the electro-mechanical machine which converts the electrical energy into mechanical energy. In other words, the devices which produce rotational force is known as the motor. The working principle of the electric motor mainly depends on the interaction of magnetic and electric field. The electric motor is mainly classified into two types. They are the AC motor and the DC motor. The AC motor takes alternating current as an input, whereas the DC motor takes direct current.

### ➤ Bevel gear

The straight bevel gears are the simplest types of bevel gears. They are the important gears to transmit power between intersecting shafts. The teeth are cut straight, have a taper, and if extended inward, would intersect each other on the axis of shaft. The meshing gears have line contact. Hence, they are not smooth in operation; generate more vibrations and noise at high-speed. They produce thrust load on shaft bearings. Straight bevel gears are used for speed ratio 1:1. Their precision is as good as parallel helical gears, but higher than crossed helical gears, spiral bevel gears, hypoid bevel gears and worm gears.

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### ➤ Smaller pulley

Smaller pulley is used to connect the handle and the larger pulley. V-belt is used to transfer the power from the handle to the larger pulley. This pulley is connected to the handle through bearing. The handle joint is used to transfer the power from the handle and the larger pulley without any power loss. This part is mainly used for the purpose of power transmission from the handle to the belt to the pulley for the effective reciprocating motion of the piston to crush the cans during the forward and the return stroke

### ➤ Larger pulley

Larger pulley (Fig 2) is operated by the power which is transferred from the smaller pulley by using handle from belt these two pulleys are connected by the V-belt. The power transferred from this pulley used to crush the can by using the SCOTCH YOKE MECHANISM. This pulley is connected to the slot by which the cylinder is operated to crush the can. This part is used to maintain the tension between the belt and the pulley to prevent the power loss due to the slipping of the belt.

### ➤ V belt

The V belts are the probably the most common means of transmitting power between fractional horse power motors to machines. Mostly, the driver and driven pulleys lie in the same vertical plane. There is an upper limit on the center distance or belt length. Long center distances are not recommended, because the excessive vibration of slack side flutters and shorten the belt life. In general the center distance should not be greater than 3 times the sum of diameters of input and output pulleys. Since the V belt is short, it is subjected to the action of load and fatigue a greater number of times. Further, its ability in absorbing the shocks is poor.

## ➤ Pulley

A **pulley** is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave. A pulley may have a groove or grooves between flanges around its circumference to locate the cable or belt. The drive element of a pulley system can be a rope, cable, belt, or chain.

## ➤ Scotch yoke mechanism

The Scotch Yoke (also known as slotted link mechanism) is a reciprocating motion mechanism, converting the linear motion of a slider into rotational motion, or vice versa. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part.

## ➤ Connecting rod

Connecting rod (Fig 4) is used to transfer the load from the slider to the piston and it should bear the high load so it should be very strong. This part plays an important role in transferring the load. Construction of each part is mainly depend upon this component this part plays an important role in the transfer of load from the slider to the piston. The connecting rod is connected to the crank which facilitates the working of the can crushing machine. The connecting rod is essential as it forms the backbone of this device.

## ➤ Piston

Piston component is used to crush the can with the help of load transferred from the connecting rod. The piston slides over the block and it travels from the one end to the other end of the block. The block is mounted on the frame through welding



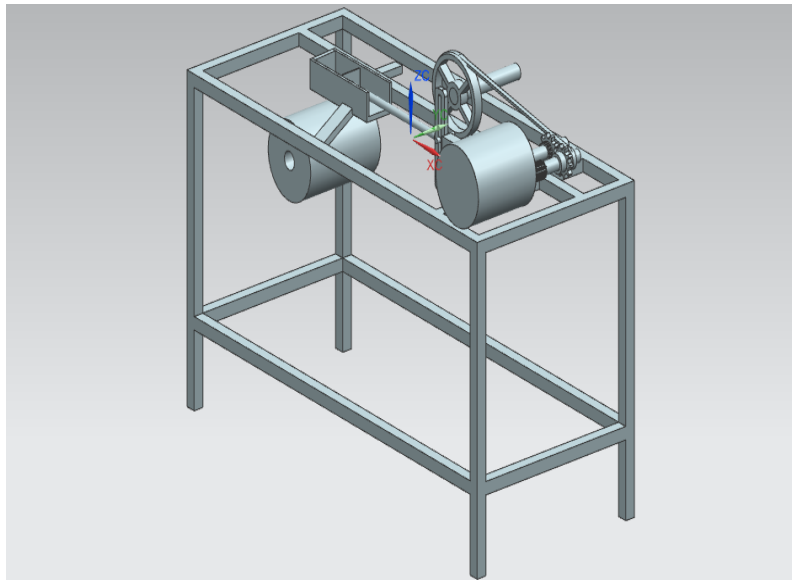


Fig.: 3D view

**Result:**

The crushing machine was successfully fabricated and the machine was tested. The machine crushed with ease both during electrical as well as during mechanical modes of operation. While crushing the cans, the cans got crushed with minimal human effort and reduced the fatigue factor of the worker.

**Conclusion:**

The crusher is constructed in such a way that even a layman can operate it without much effort. It is made efficient and the cost of production of this crusher is very less. The crusher has been designed accordingly keeping in mind about the minimum power requirements and minimum effort to the operator. This crusher upon fabrication would serve its purpose the small scale recycling plants and does not require power for operation and can also be operated manually without much physical effort. Using this project we can dispose more number of cans in less space. Also energy required for recycling the crushed can will be less as compared to cans which are not crushed. The transportation cost for this will also be less.

**Scope for Future work:**

- The crusher can be further modified to accept plastic bottles. Can also make use of other power source like electric motor, hydraulic cylinder, and pneumatic cylinder.
- Can also use both stroke of piston and adjustable mechanism to accommodate varying can and bottle sizes.
- Can make foot operating and can make automatic can feeding mechanism

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