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A NOVEL DEVELOPMENT OF A MANUAL CAN CRUSHER

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ABSTRACT

Our piece of work to be done for this project is to design and create a can crusher that will reduce to the smallest possible amount of the volume of aluminum cans by 70%. The can crusher will be made up of various parts containing as part of the whole being considered a lever, base frame, can bin, piston cylinder arrangement, chain sprocket mechanism and bearing. The inspiration behind this design came from the wastage in malls, canteens of big company often the holidays involve large parties where people gather and consume a lot of canned beverages. Thus, it makes sense that there should be an easy way to dispose of cans properly during these large social gatherings. Thus this can crusher was created, with a portable and manually operated mechanism. Can crushers are primarily used to save space and recycling. Can crushers make it possible to make small stackable piles that save space. There are many designs that can crushers come in. Some of the designs are pneumatic, hydraulic and chain operated with sprockets. Recycling is wonderful way to help the environment. One device that will make our life easier, and our recycling haul much more compact, is the can crushing machine. Can crushing machine are available in a number of styles, sizes and speed, with models to suit everyone from the heavy soda drinker to the recycling center man.

1. INTRODUCTION:

The inspiration behind this design came from the festivals, wastage in malls, canteens of big company often the winter holidays involve large parties where people gather and consume a lot of canned beverages. Thus, it only makes sense that there should be an easy way to dispose of cans properly during these large social gatherings. Thus this can crusher was created, with a portable and manually operated mechanism. Can crushers are primarily used to save space and recycling. Can crushers make it possible to make small stackable piles that save space. There are many designs that can crushers come in. Some of the designs are pneumatic, hydraulic, aluminum, and wood. Jesse M. Wright was the man who invented the aluminum can crusher in 1937, but he did not get it patented until August 30, 1938. Recycling is wonderful way to help the environment, even if you think otherwise when you're hauling big,

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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 crushing machine. Can crushing machine are available in a number of styles, sizes and speed, with models to suit everyone from the heavy soda drinker to the recycling center man

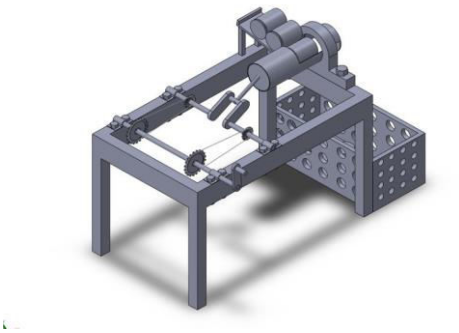

Fig 1.1 Model of Manual can crusher

2. SCOPE OF WORK:

i) Lasting artistic merit on the knowledge of mechanism design

ii) To outline the mechanical part of a tin can crusher using CAD software Solid Work.

iii) Dɐvelop the model tin can crusher using bending process, welding process, drilling process and cutting process.

iv) Fàbricate the model tin can crusher using welding skill and machining.

3. LITERATURE REVIEW:

The title development of recycle bin tin can crusher need a particular purpose and a quantity of something of good understanding on the knowledge of the sciɐnce. Therefore, put in to effect a research is imperative to obtain all the facts provided available and interconnected to the topic. The facts provided or lasting artistic merit reviews obtained are essentially valuable to assist in the construction and a stating of precise requirement of this final year project. With this ground having existed the project can proceed with guidance and assertiveness in achieving the target mark.

4. METHODOLOGY:

1. Surfing the net for information.
2. Collecting literature.
3. Market survey.
4. Analysis of the model designed.
5. Modeling as required.
6. Testing fabrication.
7. Fabrication.

In designing and fabricating this tin can crusher, a flow of methods had to be used the outline and crusher the tin. First of all, a process planning had to be charted out. This acts as a guideline to be followed so that, the final model meets the requirement and time could be mànaged. This would determine the quality of being efficient of the project to be done. Modulating and ànalyzing these steps are very great significance as each of it has its own criteria to be followed. The diagram of the sequence of movements starts with the introduction. Here, the act of introducing is the first plan to start this project. The supervisor request for comprehension of the project and make some research about the project title. Student makes project synopsis, objective, and scope of work, problem statement and planning. Once the action of

introducing something is done, the supervisor request for the understànding of this project. Thus, literature review on the title is done thoroughly covering all the aspect of the project. The medium for this research are via internet and books. Essential information related to the project is gathered for referencing. In conceptualization, few designs are done using the sketching which is then saved to be reviewed. Sketch four concepts suitable for the project with a 3-dimensional and understànding. The outlining is first step for designer used of the time. The outlines and concepts are than assessed and recalculated to fit the best dimensions and act of presenting of recycle bin tin can crusher. After four design sketched, design consideration has been made and one design have been most appropriate. The selected design sketched is then transfer to solid modeling and drawing using solid work application. Software is used because it gives a better an aspect of recycle bin tin can crusher compared to manual draw and is much easier to use. However, the drawing using software is just a guideline to be followed to improve the recycle bin tin can crusher.

4.1 Design and drawing

This drawing will explain about the design and sketching that had been chosen to be as the end of a series idea to be produce or fabricate. All the design process in this project is going to be explained in details.

4.1.1 Design concept

The design of manual can crusher must have based on much aspect actually. The design careful thought must be done carefully so that the plan can be fabricate easily and the system functioning. Then the material used in each design influence the selection thing because absolutely we need a lightweight material suitable with product size. The design is separated into three phases, firstly choose as many proposed design can be brought out then choose 4 designs and try to become better it functionality and the last one is a new design with detail thing including dimension by using Solid Work software. Beside that the cost to design and fabricate must reasonable mustn't exceeded the budget given try to reduce waste. The criteria that must be considered in designing this machine are:

Material: The material that will be used must be suitable to fabricate the manual can crusher and easy to get.

Cost: It depends on material and manufacturing processes. It should reduce the cost to the minimum.

4.1.2 Drawing

The drawings are divided into two categories, which are:

I.Sketching-all the ideas for this machine fabrication are sketched on the paper first to be the case that idea selection to be made after this.

ii.Solıd Work Drawing-the final idea is drawn into the solid works drawing

format with details features.

4.1.3 Concept selection method

This machine must trough process of concept selection method. It includes sketching manual can crusher that has certain characteristic and advantages. The sketches designs of this machine are:

4.1.4 Analysis of Material for Construction

The choice of material for construction requires carefully consideration. It obviously affects the capital and operating requirement of the equipment and also influences the choice of particles coming in contact with the equipment. After draw is done, the project course of action to next step that is fabrication process. The accomplished drawing and sketching is used as a reference by following the action of measuring and the type of material needed. The fabrication series of actions that involved is cutting, welding, drilling, bending and other. After every process was finish, the parts are check to make sure that the output of the process obeys the product requirement.If all the parts had been made series of actions, the parts are joined together to produce full-scale converted reusable material bin tin can crusher. Here come the analysis series of actions. The recycle bin tin can crusher will be try-out to see if it fulfills that is needed such as easy to crusher the tin, easy to bring anywhere, strength and recycling. During the testing, if problem occur such as cant crusher the tin, the converted reusable bin tin can crusher will step back to previous process to fix back the matter. The recycle bin tin can crusher is regarded to have an error that may cause the part to be redesigned again. The recycle tin can crusher is finished by doing some finishing process such as grinding and spraying.

After all parts had been joined together and detailed examination of the elements, the last phase of process that is result and discussion. In result and discussion, the draft report and the entire related article are gathered and hand over to the supervises person for misconception checking.

For the conclusion, the finish product will be noted the similarity with the report to make sure that there is no mistake on both project and the written account that has observed. After the product and report had been approve by the supervises person, the written account is rearrange and print out to submit at supervises person, the project coordinator and faculty of Mechanical Engineering. In this stage, the final presentation was also being prepared and waited to be present.

5. CONSTRUCTION & PRINCIPLE OF SINGLE SLIDER CRANK MECHANISM PRINCIPLE

The slider-crank mechanism is a peculiar four-bar linkage configuration that manifests clearly both linear and rotational motion simultaneously. The crank rotational process of moving is converted into linear motion at the piston through a mutual link, referred to as the connecting rod.A solitary slider crank chain is a change made of the basic four bar chain. This type of mechanism changes

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the form of rotary motion into reciprocating motion and vice versa.

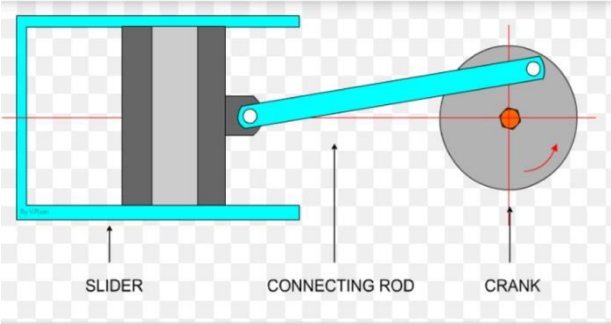

Fig 5.1. Single slider crank mechanism

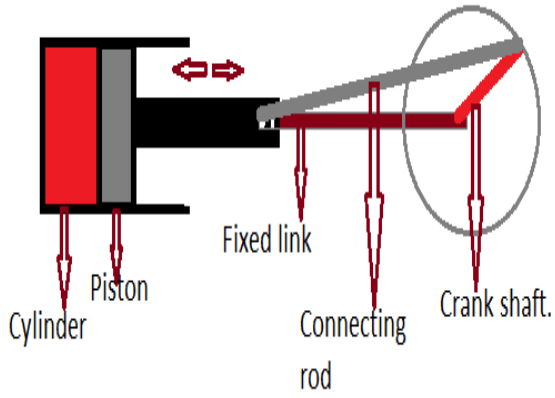

Fig 5.2. Working of single slider crank mechanism

5.1CONSTRUCTION

It is made up of cranks which have some length, a connecting rod and a piston that moves in a cylinder. One end of the crank is connected to the connecting rod and the other end is connected to the shaft which gives the rotating motion. The other end of the connecting rod is connected to the piston which reciprocates in the cylinder. Thus rotary motion of the crank is converted to reciprocating motion of the cylinder with the help of connecting rod.

5.2WORKING PRINCIPLE

The basic principle of this mechanism is that as the crank rotates it pushes the connecting rod links which then transfer the force to the slider and the slider exhibit a linear reciprocating motion due to the movement applied by the slider.

5.3 METHOD OF RESEARCH

The research was done by sourcing information from the library, internet textbooks and from previous or related subject's projects. Empirical research was also conducted by performing a standard construction of a saw compartment in the workshop. The apparatus for the construction was set up and carried out with all the precautions strictly adhered to.

5.4 SIGNIFICANCE OF THE STUDY

Construction of industrial saw compartment has played a significance role to mankind and industries. The construction of this work helps to carry out effective separation without many problems. It reduces the physical effort required by operators; free him from tediously repeated work. After that, this project continuing with some literature review about the project. In this literature review, need or to gather all the facts provided related with this project. Find the type, design, and the system used on the development of manual can crusher. It is also comprise the differences for each design in market. All the facts provided gathers from internet, journal, reference

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book and people. The project continued with design the concept of manual can crusher. The designs come out using from all data collection, Pugh concept and relating to this link before. Try to evaluate or analysis the mechanical part of machine and the system for each design come out. From the all source, develop (engineering drawing) the end series concept. Once again make an analysis to the final design body set-up.After all the facts provided, data and detail drawing are been made better, the fabrication process stage start. As the action of mentioning, we look at detail drawing to fabricate. The dimension and the material are already list on the outline. In the fabrication of the manual can crusher, it's need us to apply many knowledge and skills such as welding, drilling and cutting the material. Lastly, the final report writing and prepare the final presentation. This takes about one week to arrange and accomplish.

6. WORKING PRINCIPLE OF MANUAL CAN CRUSHER

Manual can crusher works on the principle of SINGLE SLIDER CRANK MECHANISM. In this the rotary motion of the shaft is have been adopted to reciprocating motion of the piston with the help of crank and connecting rod. When the lever is operated the power is transmitted from the driver sprocket to driven sprocket with the help of chain, this causes the rotation of the crank and force is applied on the connecting rod which forces the piston to move forward and the previously inserted can in the cylinder is being crushed. In the next rotation of the crank the piston moves back and it is idle. So that a reciprocating movement is obtained in the piston which helps in crushing the can in the forward stroke of the piston.

6.1 ASSEMBLY OF MANUAL CAN CRUSHER

First fabricate the frame. Mount the driver and driven shafts with previously attached sprockets on the frame at the required centre distance. Connect them with chains. Now connect the driven shaft with the one end crank levers and the other end to one end of the connecting rod. Now this connecting rod is connected to the piston which slides in the cylinder. Attach a lever to the driver shaft with a required length.

Fig 6.1. Assembled manual can crusher

7. CALCULATIONS:

Stroke length = 190 mm
Cylinder dia = 82mm
Piston dia = 80 mm
Clearance = 2 mm
Crank radius = 102 mm
Connecting rod length= 178 mm
Piston mass = 3.4 kg
Crank speed N = 2 RPS
Hence crank speed N = 120 RPM

Assume pressure on the piston = 1 n/mm^2

Omega w = 2 x π x n/60
= 2 x π x (120/60)
= 1.56 rad / s

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Shaft design

Length of lever = 228 mm

Torque = force x length of the lever

= 250 x 228

= 57150 N/MM

Speed n = 180 rpm

Power p = 2 π n t /60

= (2 π x 180 x 57.15)/60

= 1.07 kw

Driver teeth t1 = 44

Driven teeth t2 = 19

Speed of driver n1 = 180 rpm

Speed of driven n2 =?

N1/n2 = t2/t1

180/n2 = 19 /44

N2 = 180 / (19/44)

N2 = 417rpm

POWER P = 2 π N T/60

= 2 x 3.14 x 417 x 57.15 /(60 x 60)

= 0.45 KW

Chain design

D1 = 222 mm

N1 = 180 rpm

Chain velocity V = π d1 N1 / 6000

= 3.14 x 222 x 180 / 6000

= 20.91 mm / s

Bolt design

Bolt material = plain carbon steel

Tensile stress = 350 N / mm^2

Cw = 0.5 x tensile stress

= 0.5 x 350

= 175 N / mm^2

Lever design

Width = 50.8 mm

Thickness = 5mm

Length = 230

Ultimate tensile stress = 570 N / mm^2

Fos = 2

Shear stress = (0.5 x uts x FOS)

= 0.5 x (570/2)

= 142 N / mm^2

Twisting moment of shaft = force x distance = 200 x 272

= 54400 N-mm

Now the twisting moment on lever is given by

T = (π/16) x d^3

= (π/16) x 35^3

=6.46 N / mm^2

8. ADVANTAGES & APPLICATIONS

8.1ADVANTAGES:

- Easy maintenance and maintenance cost is less.
- Easy to make because of simple operation
- Cost is less.
- It reduces the work of labour.

8.2APPLICATIONS:

- It can be used in canteens.
- It can be used at beaches.
- It can be used at theatres, malls and hotels.

9. CONCLUSION AND FORTH COMING SCOPE

9.1 CONCLUSION:

As per the above process of talking it in order to reach a decision, we come to an end that to overcome problems in typical can crushers, due to high efficiency, easy to control the functioning and affordable price the put forward for consideration model of manual can crusher is ready to give help and completes all the expectations necessitate in the disposal of cans. Future scope of proposed fact founded work to decrease the pollution

rate, crush the cans without difficulty. It can withstand the vibrations, no hazards from jerk, no special type of instruction required to operate it. In the time following studying this report we will be aware of through observation that, how the manual can crusher will work, and knowing the construction and how a system of parts working together work in the machine. We gain an understanding how the area of study rather than its practical design is possible in experiment. Other can crusher can only crush one can at one time, but this crusher crushes without interruption by automatic feeding of cans from the tray. The cost of machine is less and easy to operate so it affordable for all industry.

9.2 FORTH COMING SCOPE:

The number of piston cylinders can be increased by introducing a motor to give the power to the shaft. Self regulating feeding mechanism for cans can be bring in to use by using sensors.

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