An Automatic CAN or Plastic Bottle Crusher Machine - A Review

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Abstract--- Crushers are major size reduction equipment used in mechanical and allied industries which crushes different types of soft and hard materials. The can or bottle crusher machine is widely used in beverage industries or in scrap dealers shop (Bhangarwala) to reduce the volume of the cans/bottles solely to increase the transportation volume and thus to reduce the transportation cost. Hence in this design and analysis of various parts are necessary. This paper focuses on review of a work carried out by researchers on analysis and design of various parts due to which the design quality of that parts will be improved. 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. The Electric Motor and a microcontroller make up the backbone for this project. Overall, 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 this new model provides a more practical usage than previous one.

Keywords: Slider Crank Mechanism, Size Reduction, Beverage Cans or Plastic Bottles, Electric Motor, Sensors.

I. INTRODUCTION

The sole purpose of this project is to understand the fundamental knowledge of design and mechanism by using fulcrum system and a simple mechanism property. A mechanical tin can crusher is basically one of the most aid able machines. It helps to reduce the pollute environment of this world. Thus helps create a better place to live in. apart from that, this tin can crusher can actually be the future mode of recycles apart from the recycle bins. It can be placed everywhere, in the park, houses, even in cars. The designs are an environment friendly and use simple mechanism properties such as fulcrum system, single slider crank mechanism and automation properties etc. The design is so done that the knowledge of designing, mechanism and forces are increased. This project consists of designing and fabrication of an automatic can crusher machine. In order to reduce the waste, we planned to create a can crusher machine that will reduce the volume of aluminum cans by approximately eighty percent. Can crushers are primarily used to save space and for recycling. It can be placed everywhere, in the park, restaurants, canteens etc. In today's times, most of the food items available in the market are canned. Cold drinks and other beverages are also packed in cans. Commercial establishments like cafeterias and bars, have to deal with these empty or leftover cans as well as empty bisleri bottles etc. Storage is often a problem as these cans consume too much space, thereby increasing the total volume of the trash. As canned beverages and foods are frequently consumed even in homes, these cans can take up a lot of storage space. The transportation cost is also high for moving such huge no of cans.In 2004, 55 billion aluminum cans were land filled, littered or incinerated, that's 9 billion more than were wasted in 2000. This is enough cans to fill the Empire State Building twenty times. It is also a quantity equivalent to the annual production of three to four major primary aluminum smelters. Because so many of them are recycled, aluminum cans account for less than 1% of the total U.S. waste stream, even though, the energy required to replace just these aluminum cans wasted in 2001 was equivalent to 16 million barrels of crude oil, enough to meet the electricity needs of all homes in Chicago, Dallas, Detroit, San Francisco and Seattle etc .During the time it takes you to read this sentence, 50,000 more 12-ounce aluminum cans are made. Let's recycle them. Although recycling is the most common method of plastic waste pollution prevention, less than one percent of all plastics products are recycled in the U.S. Americans throw away 25,000,000 plastic beverage bottles every hour. Thus this crusher machine will help to recycle them and maintain an eco-friendly environment also.

II. REVIEW WORK CARRIED OUT

Mr. Ramkrushna S. More, Sunil J. Rajpal [1] publishes a review paper on "Study of Jaw Plates of Jaw Crusher" which tells us that Crushers are major size reduction equipment used in mechanical , metallurgical and allied industries which crushes different types of soft and hard materials swing jaw plates are takes direct part into this operations hence the design and analysis are very important . This paper focuses on review of a work carried out by researchers on analysis of swing jaw plate i.e. kinematic & dynamic analysis of the jaw crusher due to which the design quality of jaw crusher are improved.

Mr. Shadab Husain, Mohammad Shadab Sheikh[2] presents paper on " Can crusher machine using scotch yoke mechanism" in which we got new ideas about my Can crusher Machine. According to this for carrying out recycling aluminum cans and Tin Cans 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 They have designed a can crusher machine using scotch yoke mechanism having multi or two side crushing ability. A can crusher machine is used for crushing aluminum soda 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 their can crusher.

Mr. Shoichi Kitani, Keiichiro Hayashi,mitsuhiro Yamashina And Keiko Takei [3] Presents a papre on "An Automatic Sorting System For Glass Bottles, Cans and Plastic Bottles" in which we got an information about the

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sorting system of different materials like Glass, Cans, Plastic Bottles in Crusher Machine. The IHI Company is one of the pioneer in developing automatic sorting system used for glass bottles and has delivered first to the Izumo recycling Center. In this collecting resource like glass bottles, metal cans and plastic bottles are separately sorted.

A paper published in Woodworker's Journal **[4]** **(**America's leading woodworking authority**)** in the year 2007 entitled "Can-Do Can Crusher" give a brief idea about small can crusher machine and also a design of it. The author and several of his buddies tested the prototype extensively. One of his friends owns a gas station where they all gather every night to play cards. Since installing this homemade crusher more than two thousand cases' worth of beer cans have been crushed. This can crusher is made from simple parts, most of which you probably have around the shop. Also various explode views are given in this paper along with varied material list and technical drawing of crusher machine which will help to take idea for this project.

Mr. Che Mohd Akhairil Akasyah B Che Anuar **[5]** Faculty of Mechanical Engineering in University Malaysia Pahang in the year Nov.2008 in his project report entitled "Development of the Can Crusher Machine**"** he exploded about different can crusher machines that are present in the market. According to his report study about the current design is important in order to determine what the product function really are and find out how it perform and getting out it advantages for each and then compare with other product that have been reviewed already. In this process, it is decided to study about three current designs in market now in order to gain information that could help to create new design. In this project, it needs lot of knowledge such as CAD, Solid works software, using shearing machine, bending machine vertical bendsaw, bench work and welding process etc.

Mr. Aman Baviskar, Vihar Doshi, Taher Parekh [6] submitted a project report entitled as "Automatic Can Crusher" in which they have briefly explained about recycling of Can, soft-wares that have to be used in his project, along with these material selection factors etc. Also the technical drawing and design of various components like pneumatic cylinder, foundation can basher and guide ways etc i.e. the assembly design. This project uses many materials such as sheet metal, hollow steel bar and others. The pneumatic system and a microcontroller make up the backbone for this project. Overall, this project involves processes like design, fabrication and assembling procedures.

Mr. Patel Ronak A.**[7]** presents a paper on "Slider Crank Mechanism for Four bar linkage" in which he describes the slider crank mechanism is a particular four bar linkage configuration that exhibits both linear and rotational motion simultaneously. This mechanism is frequently utilized to investigate machine kinematics and resulting dynamic forces. The position, velocity, acceleration and shaking forces generated by a slider crank mechanism during operation can be determined analytically. The purpose of the slider-crank mechanism is to convert the linear motion of the piston to rotational motion of the crankshaft. One common application of this mechanism is in internal combustion engines. Cao Jinxi, Qin Zhiyu, Rong Xingfu, Yang Shichun**[8]** presents a paper on " Experimntal Research on Crushing Force and it's Distribution Feature in Jaw Crusher " in which describes about the crushing parameters. The breakage process due to the point contact loading that occurs between the liners of a jaw crusher and a particle is illustrated in figure. The forces exerted on a particle during the crushing process etc. The crushing parameters consisted of the resistance against crushing; such as likelihood of breakage (breakage as the first step if crushing) maximum crushing force etc.

Rob Legtenberg, Erwin Berenschot, Miko Elwenspoek and Jan Fluitman [9] presents a paper on "Electrostatic Microactuators With Integrated Gear Linkages For Mechanical Power Transmission" in which they have described about the integrated gear linkages which are used to fabricate electrostatic micro-actuators that are interconnected with each other and linked to other movable microstructures**.** These actuators loaded with various mechanisms have successfully been driven by Electrostatic actuation. The work is first step towards mechanical power transmission in micro-mechanical systems. Figure below shows that different arrangements.

C. LAROUCI(*), G.FELD (**), JP.DIDIER(*)[10] presents a paper on "Modeling and control of the vehicle transmission chain using electric actuators" describes about the transmission system in the vehicle using Electric Actuator. This simulator uses electric actuators with a dedicated torque control laws deduced from an energy study. It proposes an equivalent electric system to the vehicle transmission chain. This equivalent system is easily exploited and can operate under a reduced power scale. It allows carrying out various tests on heat engine, on manual, automatic or robotized gearboxes. Moreover, it allows carrying out a vehicle test benches by optimizing the cost and the time of the development phases of the vehicle transmission system.

Tiehong GaoJunyi Cao, Dunyu Zhu, Jinzhang Zhi [11] presents a paper on "Study on Kinematics Analysis and Mechanism Realization of a Novel Robot Walking on Water Surface" describes about the driving mechanism of its legs that is designed based on slider-crank mechanism and parallel mechanism, and the robot with six-legs is designed in simulation to the structure of water strider. Also tells about the materials that have to be used for the linkage. Thus design and analysis of the mechanism (i.e. of the robot) has been done, and the results can achieve walking on water surface.

III. PROJECT SCHEME METHODOLOGY

From the above literature reviews, the proposed methodology for the project is that we can combine some of the features to make our project much better and fatigue free for human being.

IV. CONCLUSION

From the above study, it was found that single slider mechanism can be used instead of jaw plates and scotch yoke mechanism as well as we can implement plastic bottles, soda can etc. sorting system to separate the bottles and cans to reduce the human fatigue. Also the automatic operation can be possible using the mechanical power transmission operated by electric motor or electric actuator

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etc. This solely will reduce the volume of the cans or bottles to reduce the transportation cost by reducing its volume.

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