

CAN CRUSHER DESIGN IN RESPONSE TO ENVIRONMENTAL CONCERNS

Dr.Sc. Shaban A. Buza
Faculty of Mechanical Engineering

Dr.Sc. Kastriot A. Buza
Faculty of Education

BSc. Krenar Pllana
Faculty of Mechanical Engineering
Address: Agim Ramadani, nn 10000 Prishtina
Republic of Kosova

ABSTRACT

A beverage can is a metal (mainly aluminum) container designed to hold liquids. Its daily use worldwide presents high threat to environment pollution knowing that aluminum is a sustainable metal and takes from 80 to 100 years to decompose but can be easily recycled many times. Collection is the first step towards cans' recycling and for that awareness campaigns in different institutions are run.

In this paper is presented a prototype of an electric can crusher, designed to be used at schools to crush cans and store them preparing for further recycling process saving space and avoiding pollution of school environment and its surrounding.

The device consists of presser/crusher, pannier, feeding mechanisms and mechanism for synchronization.

The crusher is fed one can at a synchronized time period from the pannier where three different size cans are stored horizontally in respective storage areas.

The testing of the device at real time work has been successful presenting a good initiative for the aluminum can recycling infrastructure in response to environmental concerns.

Keywords: Can Crusher, Recycling, Environment, Pollution

1. INTRODUCTION

Growth of the human population reaching over seven billion and economy expansion strained the ecosystem bringing to environmental degradation and depletion of natural resources that may increase poverty and disease in the world. Therefore care and protection of environment is necessary always attempting to balance basic needs of population and development. Waste reduction and recycling may help alleviate this balance.

Recycling means: glass bottles become new glass bottles; aluminum cans can be turned back indefinitely into new aluminum cans; from scraped steel products (machine elements, car parts, construction materials etc.) can be produced new ones over and over again; plastic bottles can be turned into carpet, clothing, auto parts and new bottles; paper into new paper. Recycling is the final step of 3R's (Reduce-Reuse-Recycle) that emphasizes on properly collecting and separating those materials that cannot be reduced or reused, distributing to the specialized facilities so the items can be applied to the creation or production of new products and goods.

Recycling saves energy and raw materials, prevents resource destruction and pollution, saves money and creates jobs. Therefore, it brings to reduce for raw material extraction and our impact on the environment, backing the conclusion that recycling of waste is "better and healthy" for environment rather than incinerating or landfilling it, as stated and elaborated in many studies.

As for homes and work places, recycling is necessary to keep clean and reduce waste in schools also. School recycling projects will teach children and those around to collect and prepare for recycling cans, glass and paper, making them responsible for keeping clean environment.

In this paper is presented a prototype of an electric can crusher, designed to be used at schools to crush collected cans and store them as a first step of recycling process. Device that consists of four main sets of parts was tested in real time and was shown reliable.

2. CAN CRUSHER DESIGN

Eco environment can be achieved identifying, collecting, classifying /sorting and processing or destroying waste. Decision on destroying or recycling depends on type of waste material and its term of sustainability.

Can crusher was design to crush beverage cans, *figure 1.* and prepare them for further recycling process.



Figure 1. Three standard cans of different diameters and volumes

A beverage can is a metal (mainly aluminum) container designed to hold liquids with daily use worldwide presenting high threat to environment pollution knowing that aluminum is a sustainable metal and takes from 80 to 100 years to decompose but can be easily recycled over and over again. The aluminum can today is the most recycled of any beverage container, because used can be returned into new one in less than 60 days. Recycling aluminum cans saves energy and resources, reduces pollution and minimizes consumer and production waste.

There is a difference between recycling and collecting used materials. If you are gathering materials that cannot be returned in the form of new raw materials, you are not recycling.

Aluminum can is a popular material for collection for many schools because they are easily sold and sent for recycling process, which may even lead to a moderate cash flow that can be used to help fund other school projects and activities.

2.1 Design idea

This design idea is to encourage development of collecting/recycling programs to provide children and young people an opportunity to learn about conservation of resources, economics of supply and demand and important environmental issues using simple, attractive and an easy manipulative device as can crusher.

Based on the above mentioned facts on aluminum can recycling and environment concerns, especially clean schools and their surroundings, have been built an idea to design a device which would:

- Incites children to collect cans;
- Assist children to crush collected cans;
- Be easy and attractive for use;
- Enable easy transport of crashed cans.

2.2 Definition of the Design criteria for the device

To an electric can crusher decided to be design based on idea that would be able to crush cans, the following criteria have been set:

- Cans have to be horizontally put in a presser storage;
- The device must be able to crush three standard types of beverage cans as shown in figure 1. ;
- The presser would move continually and fed with cans must be synchronized;
- Presser would be driven by an electric motor through a set of gear and a mechanism;
- Pannier would be divided in three storages for each can type respectively;
- Crushed can moves out of storage to a container;
- Device is light weight and can be easily transferred to a different place.

2.3 Design solutions

Different solutions for device design have been discussed, collected and grouped, analyzed, modified etc. Thus some of the steps during these phases include:

- Concept solutions;
- Presentation of ideas through sketches;
- Drawing on the computer (software like AutoCad, Inventor etc.);
- Definition and design of the parts; find and supply with parts;
- Modification of existing parts and/or design of new parts;
- Assembling and simulation/testing

2.4 From design to prototype

After clearly defined design was accepted, the needed elements were manufactured or modified and assembled constructing the prototype of an electric can crusher was constructed assembling elements in four main parts:

1. Presser or crusher, composed by presser in housing, couple of gears driven by a DC motor that drive mechanism for presser movement, *figure 2.*;

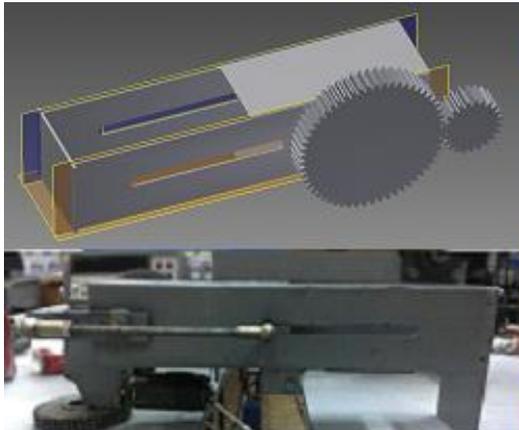


Figure 2. Presser/crusher (model and system)

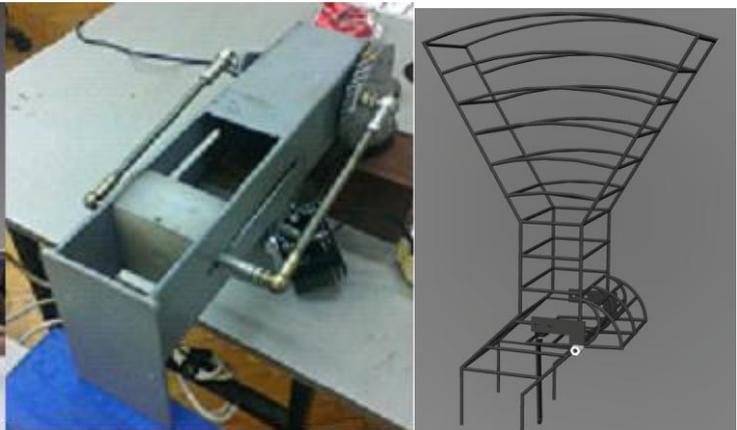


Figure 3. Pannier and feeding mechanism

2. Pannier, which consists of three storages for different type of can respectively figure 3.;
3. Feeding mechanism, which feeds presser/crusher with can one by one, figure 3.;
4. Mechanism that synchronizes feeding of the crusher with cans one by one from pannier, *figure 4.*

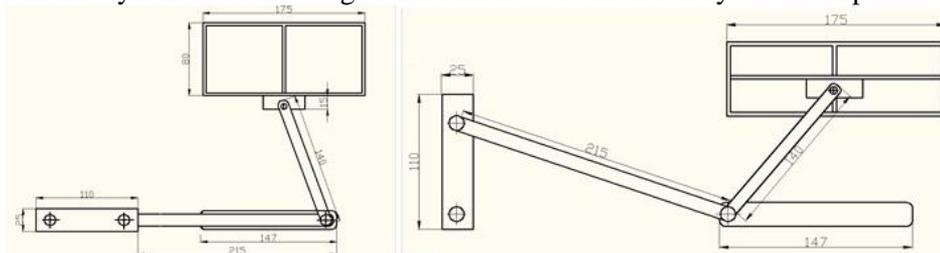


Figure 4. Mechanism for synchronization in two end-positions

The device is driven by one DC motor 12V 30W, enough powerful to crush beverage cans selected to be put in.

3. CONCLUSIONS

Prototype of an electric crusher, *figure 5*, built at laboratories of Faculty of Mechanical Engineering in Prishtina, Kosovo (with courtesy to Astrit Ibruka's working facilities in Gjakova and workers of company "Ylli Term" near Prishtina) as the result of well-defined design process, tested in real-time resulted successful and satisfactory, fulfilling driving, feeding, crushing and synchronization criteria.

The device attempts to:

- Facilitate children at schools to crush collected beverage cans as one of mostly daily used products;
- Attract collection as a first step towards recycling of cans;
- Contribute maintain clear school facilities and its surrounding, as well as their homes and neighborhood.

All this will help address from early age one of the most concerns in today's life – environment protection preventing pollution.

Prototype of electric can crusher is a good start for further development towards more automated device with more sensors and actuators to avoid 'challenges for device' with strong or hard materials.

4. REFERENCES

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Figure 5