

## Multipurpose Machine for CAN Crushing and Paper Cutting (Using Geneva Mechanism)



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### ABSTRACT:

Our project is to make the multi utility machine for performing can crushing processes by using rotary motion and Paper cutting using Geneva mechanism. The main of our project is to cost and energy consumption. Here our project consists of steel angular, steel square pipes, bearings, ac-motor, wood, chains and toothed wheel (pinions). Motors are used to power the mechanism creating rotary motion which is further converted into linear motion using a piston and connecting rod, then, the piston crushes the cans. Can Crusher to helps people easy to crush the Aluminum , tin and soda cans. Using the same rotary motion we perform paper cutting by using Geneva mechanism.

### INTRODUCTION

#### Can Crusher:

A can crusher is a device used for crushing aluminum soda, soft drinks and beer cans for easier storage in recycling bins. Most of the recyclers don't require you to crush cans, if you do recycle a lot, your normal bin may fill up quickly. The can crusher gives you extra space by flattening either single or multiple cans. The first can crusher was of course the human foot. People often stomped on cans to flatten them down either for recycling or for greater space in the garbage can. This could sometimes hurt if the foot did not come down properly on the can. But now there are lot of can crushers available in the market.

The simplest, usually about 10 US dollars (USD) have you crush a single can at a time, by pulling on a lever that brings weight down on the can until it is crushed nearly flat. For about 20 USD you can find can crusher devices that will flatten numerous cans at the same time. This type can save time, especially if crushing the can by hand.

#### Features of Can Crusher:

Can crushers are powered by different methods, but all share similar features. Cans are deposited or placed into a chamber outfitted with a device that crushes the cans. The device can be a disk that smashes the cans from above, a metal unit that gives the cans a two-sided "hug" to crush them, or a massive, mechanical chamber that crushes cans on an assembly line.

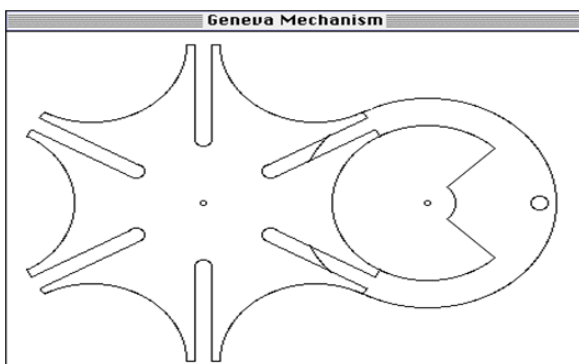
#### Automatic Paper Cutting Machine:

Paper-cutting arts have been around as long as paper. Different cultures have different names for it, and different styles of execution. In Northern Europe, it is called scherenschnitte. German for "scissor cuts," it involves cutting symmetrical shapes or silhouettes out of paper and displaying them against lighter or darker color paper for contrast. Scherenschnitte is easier to do than it is to pronounce, so it can be an enjoyable craft for children and adult paper crafters who like to scrapbook and make cards and other paper creations. With practice, a skilled paper-cutting artist can make elaborate designs.

Although paper cutting can be traced back to ancient China, credit is given to German immigrants in Pennsylvania for turning it into a popular folk art. In the 1800s, paper cutting was referred to as "scherenschnitte", which means "scissor cutting" or "scissor snipping" in German. Paper cutting involves making small cuts into paper to create designs. Artists often create visually elaborate designs that incorporate landscapes, flowers, trees, animals and hearts. Some basic techniques will get you started on paper cutting. The paper roll cutting machine the principal of paper cutting used in industrial application. Paper cut occurs when a piece of paper or other thin, sharp material. If we can use a loose paper sheet is usually too soft to cut, it can be very thin, being then able to exert high levels of pressure enough to cut.

### GENEVA MECHANISM:

The Geneva wheel, or Maltese cross, is a cam like mechanism that provides intermittent rotary motion & is widely used in both low and high-speed machinery. Although originally developed as a stop to prevent over winding of watches, it is now extensively used in automatic machinery, e.g. where a spindle, turret, or worktable must be indexed. It is also used in motion picture projectors to provide the intermittent advance of the film.



The basic design criteria of a Geneva wheel is that the centerlines of the slot and crank are mutually perpendicular at engagement and at disengagement. The crank, which usually rotates at a uniform angular velocity, carries a roller to engage with the slots. During one revolution of the crank the Geneva

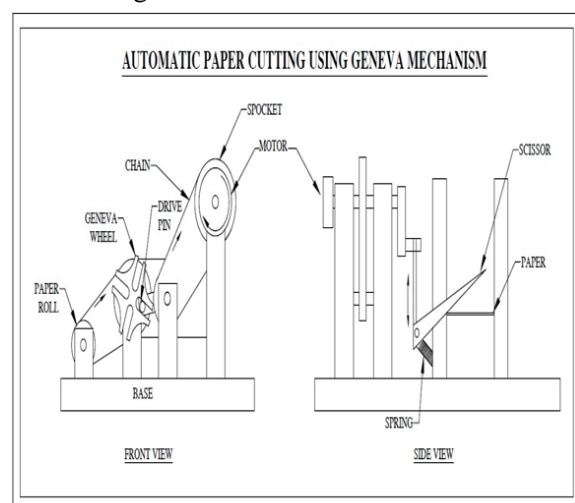
wheel rotates a fractional part of the revolution, the amount of which is dependent upon the number of slots. The circular segment attached to the crank effectively locks the wheel against rotation when the roller is not in engagement and also positions the wheel for correct engagement of the roller with the next slot. The design of the Geneva mechanism is initiated by specifying the crank radius, the roller diameter and the number of slots. At least 3 slots are necessary but most problems can be solved with wheels having from 4 to 12 slots. The angle ( $\beta$ ) is half the angle subtended by adjacent slots i.e.

$$\beta = \frac{360}{2N}$$

Where n is the number of slots in the wheel. Then, defining  $r_2$  as the crank radius we have,

$$c = \frac{r_2}{\sin \beta}$$

Where c is the center distance. Note that the actual Geneva wheel radius is more than that which would be obtained by a zero-diameter roller. This is due to the difference between the sin and the tangent of the angle subtended by the roller, measured from the wheel center. The final step in the design process is to choose a convenient radius for the circular part of the Geneva wheel, which meshes with the input wheel locking the Geneva wheel.



### Working Principle:

This project is works on the principle of reciprocating engine i.e. the rotary motion of the handle is converted into to and fro motion of the piston but the difference is, the engine converts heat energy into mechanical energy with the help of fuel but in this can crusher human effort gives a to and fro motion to the piston with the help of crank shaft and connecting rod. Crank shaft converts rotary motion into reciprocating motion of the piston with suitable leverage or gear system. The hopper hold the cans. This can crusher reduces the size of can up to 85-90%. There is a ejection space in front of sleeve from which crushed can is ejected by the reciprocating motion of the piston.

**Force required to crush a can:**

In this project (Can crusher)

Mass of the object(m)= 18kg

Distance travel by the piston in the sleeve or cylinder(d)= 12inch or 0.3048m

Time(t)= 4sec

Then,

velocity(V)= distance/time

Velocity(V)= 0.3048/4

**V= 0.0762m/sec.**

Hence,

acceleration(a)= velocity/time

acceleration(a)=0.0762/4

**acceleration(a)= 0.01905m/sec<sup>2</sup>**

we know,

Force(F)=ma {according to newton's second law}

Therefore,

Force(F)=(18)\*(0.01905)

**F=0.3429N or (342.9)\*10<sup>-3</sup>N**

Hence

**Force required to crush a can is 0.3429N or 342.9mN(approx.)**

**Crushing Rate:**

Crushing rate may be defined as the number of cans crushed per unit time 'or' the rate at which cans are crushed.

In this project,

Time taken to crush a single can= 4sec.

Then,

Number of cans crushed in one hour=3600/4

Number of cans crushed in one hour= 900Cans.

Therefore,

Total can crushed in one hour is 900 with manual operation.

Hence,

**The Crushing Rate is 900cans/hr.(approx.)**

**CONCLUSION:**

From the observation, I conclude that there are lots of type of Can crusher available in the market. I notice that there are different design. Out of all the Can crushers I take hand operated reciprocating can crusher and analyze the design, and makes its drawing in solid works. After this by using suitable manufacturing process assemble the can crusher and paper cutter. We manufactured a multi purpose machine for can crushing and paper cutting. This project provides the knowledge about the manufacturing process and different designs of leverage and power transmission with the use of chain drive or gear mechanism. This project is quite successful and able to meet the all requirements.

**REFERENCES AND BIBLOGRAPHY:**

1. <https://en.wikipedia.org/wiki/Crusher>
2. [https://en.wikipedia.org/wiki/Paper\\_cutter](https://en.wikipedia.org/wiki/Paper_cutter)
3. [https://en.wikipedia.org/wiki/Cast\\_iron](https://en.wikipedia.org/wiki/Cast_iron)
4. <https://en.wikipedia.org/wiki/Steel>
5. [https://en.wikipedia.org/wiki/Metal\\_fabrication](https://en.wikipedia.org/wiki/Metal_fabrication)