FABRICATION OF DUAL ACTING CAN CRUSHER

[1]P.Veeraraju, [2]K. Varahala Raju, [3]S. Santosh Kumar, [4]R. V. S Narayan, [5]K. Naveen Kumar

Assistant Professor, Department of Mechanical Engineering, Godavari Institute of Engineering and Technology, Rajahmundry, India[1].

U.G. student, Department of Mechanical Engineering, Godavari Institute of Engineering and Technology, Rajahmundry, India [2345].

Abstract*:* Now a days, recycling is rapidly increasing day to day. The amount of wastes coming out is increasing in tremendous quantity. Aluminium cans and tin plates cans are one of the important products. That why we choose this project is about fabrication of double acting can crushing machine. It is a mechanical can crusher to help the people to crush the cans easily. Normally in single acting crushing machine the required work (crush) is done one time only at a rotation of crank. But, in the double acting crushing machine the work (crush) is done two times at a rotation of cycle. When the rotary motion from the motor is converted into reciprocating motion by the crank which is in turn connecting to the piston that crushes materials.

Keywords: Aluminium can, Can crusher, Slider crank mechanism.

I. INTRODUCTION

The main purpose of the project is to get knowledge of the fabrication of the double acting can crushing machine. Aluminum can recycling is the process by which scrap aluminum can be reused in products after its initial production. The process involves simply re-melting the metal, which is far less expensive and energy intensive than creating new aluminum through electrolysis of aluminum which must first be mined from bauxite ore and then refined using the Bayer process. Since cans are best way to preserve food therefore there use in preservation of food is in creating day by day. The other fact is that these cans can be recycled easily and does not affect the environment like politeness. But at the time of waste handling and its transportation these cans must occupy minimum space or possible so as to store and transport them in large quantity and here comes our can crusher.

II. SLIDER CRANK MECHANISM

It is a arrangement of mechanical parts designed to convert straight-line motion to rotary motion, as in a reciprocating piston engine, or to convert rotary motion to straight-line motion, as in a reciprocating piston pump. The slider-crank mechanism is a particular four-bar linkage configuration that exhibits both linear and rotational motion simultaneously. This mechanism is frequently utilized in undergraduate engineering courses 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. Certain factors are often neglected from analytical calculations, causing results to differ from experimental data. The study of these slight variances produces useful insight. The following report details the successful design, fabrication and testing of a pneumatically powered slider crank mechanism for the purpose of classroom demonstration and experimentation. Transducers mounted to the mechanism record kinematic and dynamic force data during operation, which can then be compared to analytical values. The mechanism is capable of operating in balanced and unbalanced configurations so that the magnitude of shaking forces can be compared. The engine was successfully manufactured and operates as intended. Data recorded by the device's accelerometers is comparable to calculated values of acceleration and shaking force.

III. COMPONENTS OF CAN CRUSHER AND CONSTRUCTION

1. Base frame:

Base frames are used to support mechanical equipment and provide rigid platforms for attachment of vibration isolators, without allowing excessive differential movement between driving and driven members. The bases provide a means by which the equipment can be stabilized and motion reduced by lowering the equipment center of gravity.

2. Connecting rod:

A connecting rod is a rigid member which connects a piston to a crank or crankshaft in a reciprocating engine. Together with the crank, it forms a simple mechanism that converts reciprocating motion into rotating motion.

3. DC motor:

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

4. Bolts and Nuts:

Bolts and nuts are used in several applications, with a primary function to hold things or components together. A bolt, also known as a screw, does not always have to be used together with a nut; however, a nut is always used together with a bolt. Nuts and bolts serve as the fundamental components in several construction projects as they provide strong bonds that do not break even under great amounts of pressure.

5. Shaft:

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft.

6. Chain:

A chain is a serial assembly of connected pieces, called links, typically made of metal, with an overall character similar to that of a rope in that it is flexible and curved in compression but linear, rigid, and load-bearing in tension.

7. Sprocket:

A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it.

8. Crankshaft:

A crankshaft—related to crank—is a mechanical part able to perform a conversion between reciprocating motion and rotational motion. In a reciprocating engine, it translates reciprocating motion of the piston into rotational motion.

9. Piston:

A piston is a component of reciprocating engines, reciprocating pumps, gas compressors and pneumatic cylinder, among other similar mechanisms. It is the moving component that is contained by a cylinder and is made gas-tight by piston rings. In an engine, its purpose is to transfer force from expanding gas in the cylinder to the crankshaft via a piston rod and/or connecting rod.

10. Gears:

A gear or cogwheel is a rotating machine part having cut teeth, or in the case of a cogwheel, inserted teeth (called cogs), which mesh with another toothed part to transmit. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine

11 Disk:

The disk is that rotating element of the mechanism which converts the rotating motion into sliding motion. The disk is the main part of the mechanism. It also works as fly wheel which store energy in power stock & provide energy in returns stock. It is also made up o mild steel.

12 Bearing:

A bearing is a device that is used to enable rotational or linear movement, while reducing friction and handling stress. Resembling wheels, bearings literally enable devices to roll, which reduces the friction between the surface of the bearing and the surface it's rolling over.

(a)

(b)

(a) Frame (b) Connecting rod (c) Hopper

IV. ASSEMBLY

Working of dual acting can crusher machine

V. WORKING

The ram slides through the guide way provided and the cans are loaded through the hopper. As the large amount of force is gathered at the ram, the ram compresses the can to make it flat and reduce its volume to a very small amount. A small opening is provided at the end of guide way so that the compressed cans are easily dropped in the bin provided at the bottom. The first input for our design was the speed of the small sprocket and the force required to crush the empty beverage can which will be discussed in the design section in the report. The most important part and objective of our design is to provide a device for compacting empty beverage cans of aluminum requiring minimum of power and yielding a low noise level. The main component in the project is the ram which is going to interact / crush the can.

VI. DESIGN CALCULATION

A. Base frame: The material used for the base frame is mild steel. In this, we are using the square pipe to manufacture frame.

The specifications of the base frame are:
Length of the frame = 670 mm
Breadth of the frame = 500 mm
Height of the frame = 690 mm
Thickness of pipe = 2 mm
Internal diameter of pipe = 28 mm
Outer diameter of pipe = 30 mm

B. Connecting rod:

Length of connecting rod = 300 mm
Thickness of connecting rod = 4 mm
Distance between the holes = 270 mm

C. Eccentric disc:

Diameter of disk =220 mm
Thickness of disk = 4 mm

D. Piston:

Length of the piston = 250 mm
Thickness of the piston = 25 mm
Width of the piston = 150 mm

E. Gear:

Diameter of pinion = 50 mm
No of teeth of pinion = 14
Outer diameter of gear = 178 mm
Inner diameter of gear = 158 mm
No of teeth of gear = 55

F. Guide ways:

Thickness of guide ways = 25 mm
Length of guide ways = 240 mm
Height of guide ways = 150mm
Breadth of each plate = 250 mm

G. Sprocket:

Diameter of small sprocket = 50 mm
Diameter of large sprocket = 178 mm
No. of teeth on small sprocket = 13
No. of teeth on big sprocket = 42

H. Bearing:

Internal diameter = 20 mm

Outer diameter = 60 mm

I. Crushing rate:

Let T_1 be the number of teeth of pinion

Let T_2 be the number teeth of gear

Let N_1 be the speed of pinion

Let N_2 be the speed of gear

Since the pinion is connected to the motor. The pinion speed is same to the speed of the motor.

We know that the speed of motor is 150 rpm.

Therefore the speed of pinion is also 150 rpm.

We also know that

$T_1 = 14$

$T_2 = 55$

We have to find out the speed of the gear "N_2"

$T_1 \times N_1 = T_2 \times N_2$

$14 \times 150 = 55 \times N_2$

Therefore $N_2 = 38.18$ rpm

$= 38$ rpm (approximately).

Let T_3 be the number of teeth on first sprocket

Let T_4 be the number of teeth on second sprocket

Let N_3 be the speed of the first sprocket

Let N_4 be the speed of the second sprocket

Since the first sprocket is connected to the gear.

The speed of the first sprocket is almost equal to the speed of the gear

Therefore $N_3 = 38$ rpm

We know that the no. of teeth on the first sprocket is 13

The no. of teeth on second sprocket is 42

Therefore

$T_3 \times N_3 = T_4 \times N_4$

$13 \times 38 = 42 \times N_4$

$N_4 = 11.76$ rpm

$= 11$ rpm(approximately)

Since the speed of the second sprocket is same to the speed of the crank.

Hence the speed of the crank is 11 rpm.

For one rotation of crank with the connection of connecting road the slider will make two rotations.

So, for the single rotation of crank the slider will crush two cans.

Number of cans crushed by slider for the single rotation of crank = 2

Total no of cans crushed by slider per minute = 2×11

$= 22$ cans

Therefore 22 cans are crushed by the slider per minute.

J. Force required to crush cans:

In this can crusher

Mass of the object (m) = 30 kg

Distance travel by the slider = 180 mm

Time (t) = 3 sec (approximately)

Then,

Velocity (v) = distance/time

= 180/3

= 60 mm/sec

= 6 m/sec

Hence,

Acceleration (a) = velocity/time

= 6/3

= 2 m/sec^2,

Force (F) = ma

Therefore,

Force (F) = (30) × (2)

= 60 kgm / sec^2

Force required for crushing the cans (F) = 60 N

VII. ADVANTAGES

- Time saving as compared to single acting cans crushers.
- Easy machinery used.
- Dual acting can be done in very short time.
- For single rotation of crank two cans crush.
- It reduces labour men.
- It reduces labour cost.

IX. CONCLUSION

After completing the project, conclude that our project is simple in construction and compact in size for use. Manufacturing of machine is easy and cost of the machine is less. We can crush the both cans with the single rotation of crank. It will be very successful method of crushing cans in large scale by small labour cost**.** This can crusher is helpful to overcome the problems of single acting can crusher with high efficiency it's easy to operate. By increasing the motor power and dimensions of guide ways the size of material to be crush can be increased. The proposed machine will aim on the limitations of single acting crushing of cans at a instant of time by introducing dual acting can crusher of two cans simultaneously. It is so compact that will be occupy less space, cost effective so usable in mini and large industries. As in crushing it will take less time of crushing, so machine idle time is also reduced which also encounters on improved efficiency, reliability. Also, the machine works on minimizing vibrations and jerks produced during crushing operation.