DESIGN AND FABRICATION OF THE DOUBLE ACTING CAN CRUSHING MACHINE

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ABSTRACT: ***Now a day in India, recycling is one of the areas. This is rapidly increasing day to day .the amount of wastage coming out increasing in a tremendous quantity. Aluminum cans and tin plates cans are one of the important products. This is being a recycling increase. That why we choose this project is about design and fabrication of double acting crushing machine is a mechanical can crusher to help people to crush the tins easily handling and installed anywhere with their compact shape and size. Now a days there is a widely usage of soft drinks tins have been increased in hotels, canteens, restaurants, shopping malls etc, for large amount of storage volume space is required. Double acting crushing machine is a device used for crushing aluminum tins for easier storage in recycling bins .While most of the recyclers don't crushing the tin. If you do recycle process a lot of wastages in environvernment to save from the pollution. Your normal bins may fill up quickly. Crusher gives you extra space by flattening either single or multiple tins .Which is being recycled an increasing scale for carrying out in industries, which is time consuming process and ultimately it leads to reduction of production rate. In order to crush the cans in a less time and reduces the transportation cost, easy to transportation. It is manufactured and transformed into a machine that would help in wastage management. It is based on slider crank mechanism. 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. To use the power most effectively by using double acting crushing machine instead of single acting crushing machine. 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 .where the design is used for guideline these project also require ensuring the human safety .methods and process in this project are joining ,drilling ,welding ,cutting ,bending ,lathe operations .this project is mainly generating a new concept of tin crusher machine . Even though there are many types of can crushers machine in the market, the completion of the new model provides a more practical usage than previous stage .The design of this machine require optimum load to crush metals and will not strain the user or operator .we have designed the double acting crushing machine using modeling software's and required dimensions of the crusher for the optimum performance have been found. Designed crusher effectively crushed the components with easily and with reduction human effort.***

KEYWORDS: ***Design Consideration, Design Calculation, Size Reduction, Slider-Crank Mechanism, Cans Hopper, Electric Motor, Reciprocating Motion***

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1. INTRODUCTION

The main purpose of the project is to get knowledge of the design and 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 the electrolysis of aluminum HYPERLINK "http://en.wikipedia.org/wiki/Aluminum_oxide" oxide (Al2O3), which must first be mined from bauxite ore and then refined using the Bayer process. Recycling scrap aluminum requires only 5% of the energy used to make new aluminum. For this reason, approximately 31% of all aluminum produced in the United States comes from recycled scrap. Existing increasing % of cans recycled in UK In today scenario our country is facing huge difficulty in recycling of soft metal like (aluminum cans).now a days it is becomes the backbone of industrial activity to delivery their product to their customer. For crushing of cans manual operation is carried out which is time consuming and also fatigue to operator. Also various machines are available like hydraulic, pneumatic, and mechanical type machines but these machines are very costly, large in size, requires attention of operator. In order to solve this problem we are designing can crusher machine by using slider-crank mechanism having multi (two sides) crushing ability. The main advantages are that even unskilled person can easily handle it and we can achieve multi crushing ability at a low cost. In order to reduce the waste, we planned to create a can crushing machine that will reduce the volume of aluminum cans by approximate 75 percent by which transportation volume will increase and transportation cost will reduce. We can crush Cold drinks can and other beverage cans by using this machine. Commercial establishments like cafeteria and bars, have to deal with leftover cans. Storage is often a problem and cans consume lot of space, thereby increasing total volume of trash. The transportation cost is also high for moving such a huge number of cans. This project is design to reduce transportation cost and human work.

2. COMPONENTS

2.1 ELECTRIC MOTOR

Fig 2.1 Motor

An electric motor is the main source of the project. Motor converts electrical energy into mechanical energy. To supply a mechanical energy through a rotary motion to the crank. SpecificationsType: single phase induction motorHorse power: 1/2 Speed: 960

2.2 CRANK DISC

Fig 2.2 Crank Disc

Crank disc is used to convert rotary motion from the source of electric motor to convert reciprocatory momentum through connecting rod. It is drilled eccentrically to connect connecting rods. It is made up mildsteel with diameter 200 mm and thickness 3mm.

2.3 PULLEYS

Fig 2.3 Pulleys

Step pulley is used to transmit power from electric motor to Crank disc through a v-belt.it is mainly used to step down (or) varying the speed for their convenient to crush cans.

2.4 ANGLE PLATE

Fig 2.4 Angle Plate

L - Angle plate is plate is used construct base of the stand. All the parts are mounted on them structure. It is made of mild steel with thickness of 3mm and width of 1(1/2) ×1(1/2) inches.

2.5 HOLLOW PIPE

Fig 2.5 Hollow Pipe

Hollow pipe is an act has a slider to move piston inside the cylinder through forward and backward motion to crush tins. It is made up of GI metal with thickness of 3 mm and diameter of 7 mm.

2.7 PISTON

Fig 2.6 Piston

Piston acts has a tool to crush the metallic tins with a constant force obtained from crank disc. It is made of aluminum with diameter of 6 mm and thickness of 5 mm.

2.7 V-BELT

Fig 2.7 Belt

V - Belt is used to transmit the power from the motor smaller pulley to the main pulley. It is strong to with stand the vibrations produced from the motor. It is made of rubber material

2.8 SHAFT

Fig 2.8 Shaft

Shaft is used to transmit power to crank disc which is welded at the one end of it. It is made up mild steel with diameter 20mm and length of 600 m.

3. WORKING PRINCIPLE

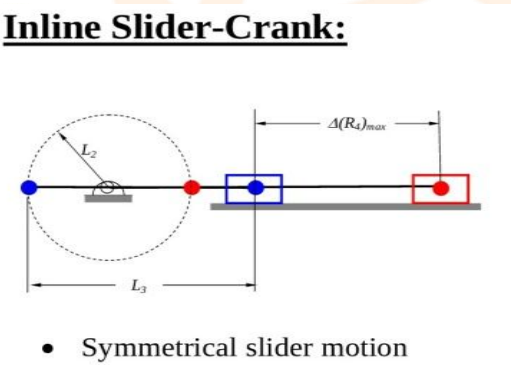

Fig 3.1 Experimental Setup

One of the most important mechanisms in our lives is the slider-crank mechanism. It is used in reciprocating engines for automobiles, reciprocating compressors, and piston pumps. In this mechanism which converts rotary motion into reciprocatory momentum. Calculate the force in the connecting rod that causes the piston to accelerate over its cycle. Forces due to motor pressures are not included in this analysis. A schematic of the mechanism is shown below. The link labeled L is the connecting rod. R represents the crank arm. W represents the weight of the piston. The distance of the piston from the crankshaft bearings is given by r. The crank angle isθ. The angle of the connecting rod as measured from the horizontal is denoted byϕ.

3.1 WORKING

Fig 3.1 working method

When the motor starts rotates the motor shaft is having a smaller pulley connected to its shaft, the smaller pulley through the belt is connected to secondary pulley. Which is connected to the main pulley. As the main pulley rotates it also rotates the main shaft which in turn rotates the disk and the whole mechanism starts working. When the disc rotates the connecting rods also moves with in the circular hollow pipe acts has slotter in horizontal direction to moves the piston forward and backward direction through connecting rods which are connected to the piston also start to reciprocates in both directions at the one end (TDC) of circular hollow pipe a strong material is welded to crush the cans with effectively. Two circular hollow pipes are welded on the horizontal frame one is at the left side and another one is at the right side. When the cans comes in the slotter top dead end on the two extreme corners of the both circular hollow pipe. Left side part piston is at the top dead end (TDC) angle of the cycle is 0^0 and another right part piston (P_2) is at the bottom dead end (BDC) angle of the cycle is 180^0 at initial position. When crank rotates the connecting rods also rotates first half cycle angle reaches to 180^0. When the left side piston (P_1) moves backward direction and the right side piston (P_2) moves forward direction. To crush the cans reciprocating towards the top dead end (TDC) in the forward direction and right side part piston (P_2) moves towards the bottom dead end (BDC) in backward direction. Once crushed will pass through the hollow space is provided between top dead end and go into the waste bins directly. Another half cycle takes angle reaches 360^0. In these each cycle of rotation of disc crush two cans one by one. Therefore process is repeatedly continuous to crush the cans on both the cylinders one by one. From our project we conclude that it crushes the cans satisfactorily in very less time and that is why it can be used in mass production.

4. DESIGN AND CALCULATIONS:

Main Pulley speed:

N1= 960 R.P.M
N2=?

D1= 75 mm
D2= 50 mm

N2/N1 = D1/D2
N2=640 R.P.M

Secondary Pulley Torque:

Power = 368 watts
$P = 2*\pi*N_1*T_1/60*10^3$
$T1=3.66*10^3$ N-mm
$T1 = \pi/16*f_s*d_1^3$
F_s (Ind) =0.044 N/mm2< f_s (perm) = 34 N/mm^2
Therefore, Design is Safe

Main Pulley Torque:

Power = 368 watts
$P = 2*\pi*N_2*T_2/60*10^3$
$T2= 5.49*10^3 N/mm^2$
$T2= \pi/16*f_s*d_2^3$
F_s (Ind) =0.22 N/mm^2< f_s (perm) = 34 N/mm^2
Therefore, Design is Safe

For Load Calculation:

$F_t = 4P/\pi d^2$
P = 704 KN

Belt calculation:

Centre distance of pulley = 2 (D_1 + D2)
C= 112.5
$S = V = (\pi*D_{1*}N_1)/60000 = 3.76$ m/s
Arc of contact (α) = $180^0–(D_1-D_2)/C * 60^0= 163^033^0= 2.85$ radian
$L=2*C+ \pi (D_1+D_2)/2+ (D_1-D_2)/4*c$
L=422 mm

Motor specifications:

Power HP =1/2
R.P.M. =960
Cycle=50
Voltage=230 volt

4. FUTURE SCOPE

By placing the micro controller and sensor instead of manual operated gives more result and for future it can be handful for cans crushing. This model can also be made with hydraulic.

5. RESULTS AND DISCUSSIONS

The crushing machine was successfully fabricated and the machine was tested. The machine crushed multiple cans simultaneously with ease both during electrical as well as during mechanical modes of operation. While crushing the cans manually, the cans got crushed with minimal human effort and reduced the fatigue factor of the worker

6. CONCLUSION

The above design procedure is been adopted for the design and fabrication of double acting can crusher machine which will make the product durable for the long time as well as make it efficient and also helps to understand the concept of design. Thus with the help of this design we can fabricate an automatic can crusher machine to simply reduce the volume of cans as well as to reduce the human fatigue. The design of the can crusher is based on a compilation of vertical crushing machines. Accordingly, the vertical force will be much less; besides, can is compacted to a very small size. Several tests were carried out to validate the crushing machine and its components. The tests covered both of particular elements and the overall device, using cans without defects such as independent and crumple. Results show that the machine and its particular elements work property. In conclusion, this small, inexpensive and autonomous can crusher machine may help to prevent aluminum cans from land fills but diverting them to the recycling centers like they should be. By this new design, cans crushers able to be placed into break rooms, hallways, and offices.

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