

Design and Fabrication of Mechanical Press for Assembly and Dismantling of Sugarcane Crusher

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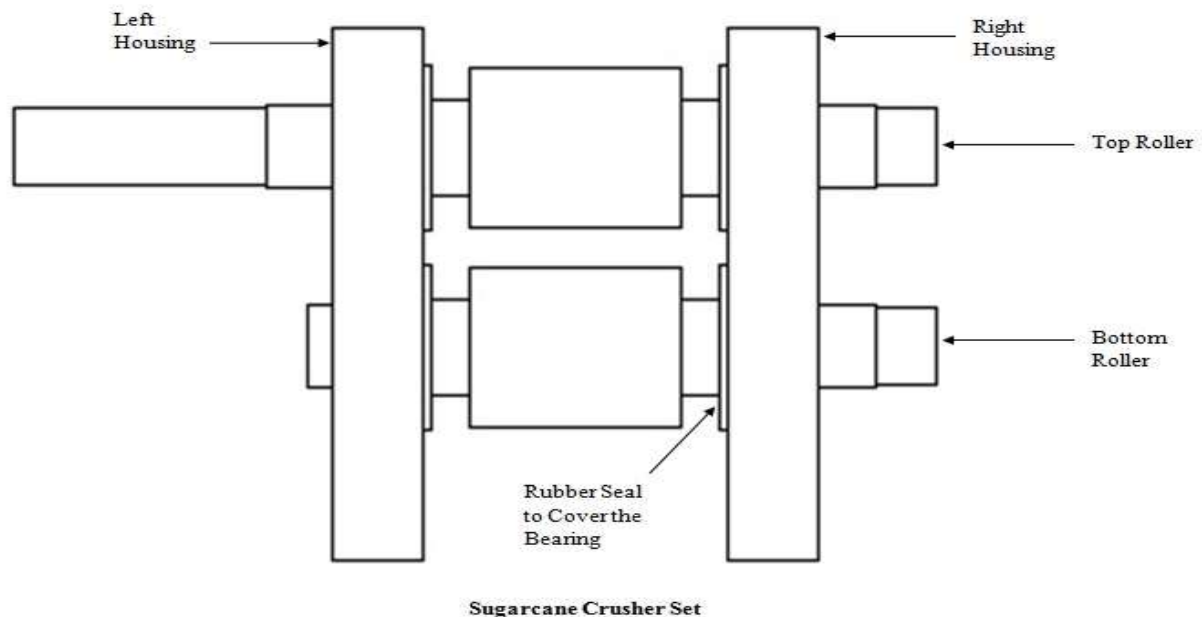
Abstract - Now days the Industries are looking forward towards reducing the production cycle time and workers efforts. The industries are giving priorities to cost effective and efficient production technologies and instruments. The problem regarding assembly and dismantling of sugarcane crusher has required lot of time and worker efforts. Currently manual hammering method is used which produces high noise and less production rate. Also it consumes much more time due to which human fatigue increases. So to overcome the above problems a mechanical press is designed which makes assembly & dismantle of that sugarcane crusher with ease. Also reduces labour fatigue, time of operation & efforts.

Keywords - sugarcane crusher, assembly, dismantle, fatigue, efforts, mechanical press.

I. INTRODUCTION

In India there are many industries that design, manufacture and assemble the sugarcane crusher and every industry face the similar problem related to assembly and dismantling of sugarcane crusher. The following fig. shows the general components or assembled view of sugarcane crusher.

It consists of two housings, two rollers, four bearings (not shown in fig.) and rubber seals. Generally hammering method is adopted for assembly and dismantling it. But it leads to uneven force application, misalignment of rollers and bearing, noise & fatigue stress on workers.



II. METHODOLOGY

The mechanical press designed to solve the problems associated with assembly & dismantling of sugarcane crusher, consists of power screw jack, frame and C clamping fixture. The photo of model is shown below.

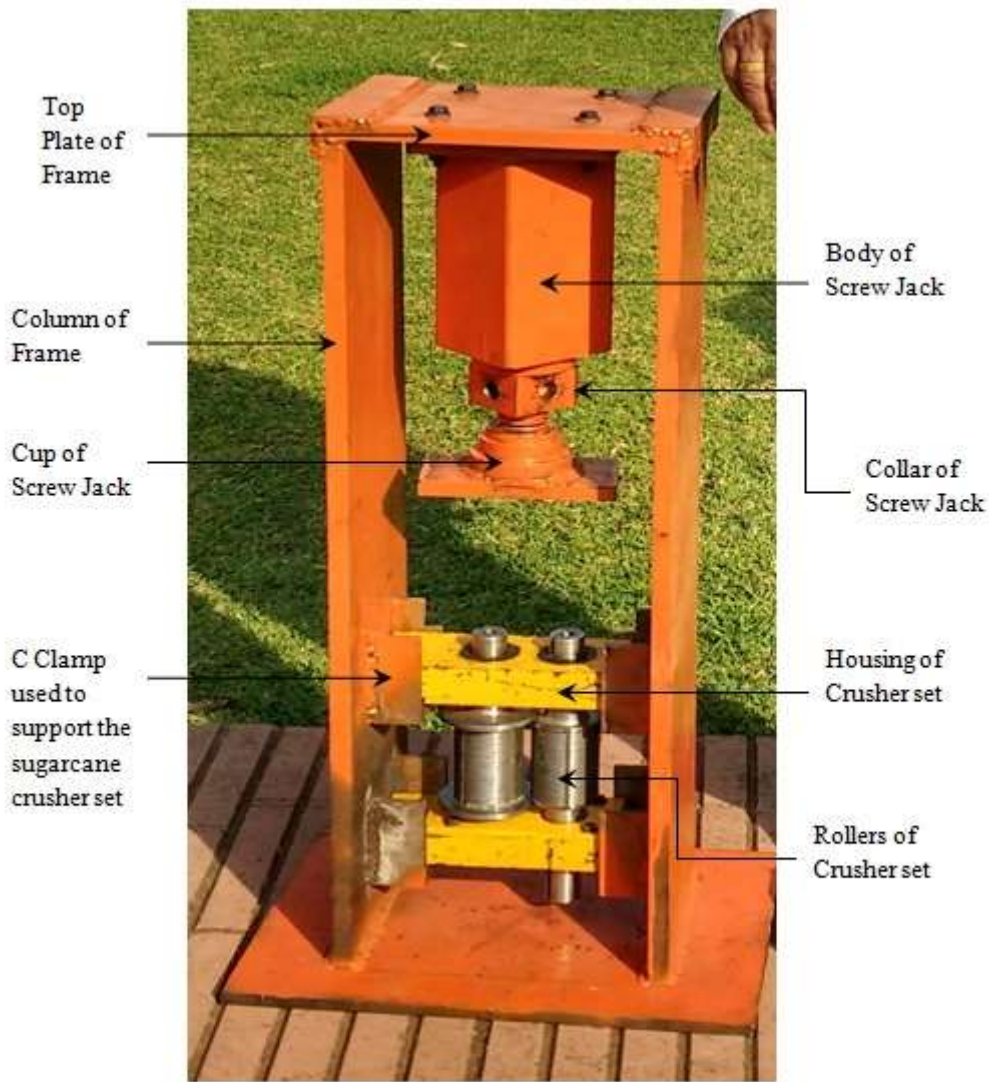


Photo: Model of Mechanical Press

While assembling the rollers of the sugarcane crusher in the housing, the bottom plate of the sugar cane crusher is placed in the bottom clamps. Then rollers are inserted in the respective holes, after that the upper housing plate is placed above the rollers as shown in above photo.

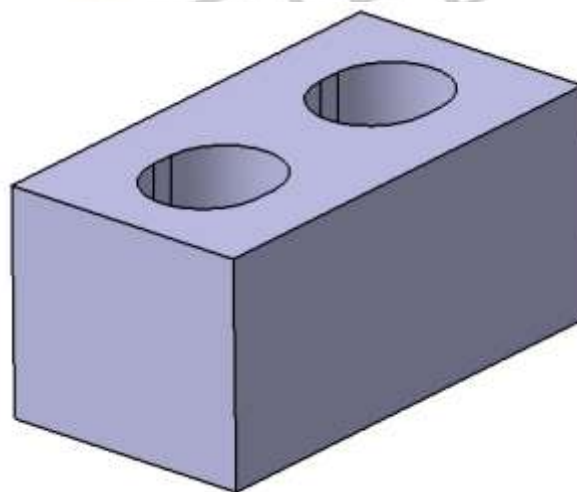


Fig. Hollow Block

Hollow block as shown in fig is placed in between the upper housing plate and the screw jack. By lifting the power screw jack with tomy bar, force is applied on the hollow block. Now the force causes assembling of rollers into the housing plates. With the help of hollow block the upper plate is subjected to applied force, as the bottom plate is restricted to move, the roller gets fitted in the plates. The use of hollow block is to apply the force on the housing and to accommodate free movement of the roller ends.

While dismantling, small metal square blocks are inserted in between the upper housing plate and the clamps holding it which raises the height of whole assembly (including top and bottom housing plate and rollers) from the C clamp. The applied force causes dismantling of the upper housing plate as the top housing plate is restricted to move & as the force is totally applied on the rollers. Similarly, the second housing is also removed from rollers.

III. DESIGN

The force required to assemble the sugarcane crusher, $W=15000$ N
For design of screw jack power screw, MS material is selected.

$S_{yt} = 400$ N/mm² & Factor of Safety = 3

Therefore

$\sigma_c = S_{yt}/FS = 133.33$ N/mm²

But $\sigma_c = W/A$

The core diameter of screw $d_c = 11.96$ mm

As per **IS: 4694-1968**, take **$d_c = 17$ mm**

Pitch = 5 mm

Outer dia. of screw, **$d_o = 22$ mm.**

Mean diameter, **$d_m = 19.5$ mm.**

The screw has **single start thread**

So, **Lead = Pitch = 5 mm.**

Helix Angle, $\alpha = \tan^{-1} \frac{1}{\pi d_m} = 4.66^\circ$

The maximum coefficient of friction between steel screw and bronze nut is, $\mu = 0.2$

Friction Angle, $\phi = \tan^{-1} \mu = 11.31^\circ$

Since $\phi > \alpha$, the screw is self-locking.

Similarly the all other components of screw jack are designed.

By considering the load factors and design parameters, the top plate of frame, supporting columns and C Clamp welding are designed.

Bill of Material

Item No.	Part Name	Material	Qty.
1	Structure	30C8	1
2	Nut	Bronze	1
3	Cup	30C8	1
4	Power Screw	30C8	1
5	Collar	30C8	1
6	Thrust Bearing	-	1
7	Handle Rod	30C8	1
8	Top plate	MS	1
9	Column Plate	MS	2
10	Bottom Plate	MS	1
11	C Clamps	MS	4

Table. Bill of Material

IV. RESULTS AND DISCUSSION

- Initially hammering method was used to assemble and dismantle the sugarcane crusher. Hammering has greater disadvantage of fatigue stress on the worker. Also uneven stress distribution due to varying force and large amount of noise.

In the designed project model of mechanical press, noise generation is almost eliminated and small amount of force is required to rotate the power screw. Hence fatigue stresses are not generated on workers.

- The avg. time required for assembly and dismantling of the sugarcane crusher is reduced 50 % by mechanical press.
- While hammering process, the lack of proper holding device results to misalignment of rollers and bearings in the housing of sugarcane crusher.

In mechanical press, C-clamps itself acts as a fixture for proper holding of rollers and housing, which avoids misalignment of bearings and rollers in housing while application of force by Screw Jack and maintain the required distance between two housings of crusher.

- As compared to the current available machines in market like hydraulic press which costs very high, but the cost of mechanical press is about Rs. 20,000 only.

V. REFERENCES

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