Review Paper on Design & Development of Chaff Cutting Machine
Chinmay Bandiwadekar1 Ajinkya Kamble2 Vivek Garala3 Zuber Shaikh4
1,2,3,4Dr D Y Patil College of Engineering Ambi

Abstract— In recent past a human powered processing machine has been developed for fodder cutting. Machine consists of a human powered flywheel or a bicycle drive with speed variation mechanism. Hence, the effort for the process was extensive and unsafe. To overcome these obstacles we have designed a new cutting mechanism which is safer and effort reducing with minimum power consumption.

Key words: Kadha Kutti, Chaff cutter, V blade, 0.5 hp single phase motor, Compact design, Portable, Durable blade design

I. INTRODUCTION
The population of cattle in India in 1987 was 274 million. For such kind of population traditional human powered fodder cutting machines were used, but due to this the efforts for running the machine was physically demanding. And as per today’s scenario the population of cattle is drastically increased. So to increase the productivity and reduce the physical effort required for running the machine the motorized machineries came into existence. But these motorized machineries were more power consuming, bulky, unsafe and less reliable, so to over come this problem we have de-signed new improved motorized cutting machine which consumes less power without effecting the productivity. In our machine we are focusing on cutting blade design which is more wearable and maintenance free.

In this machine the hay is cut into small pieces for feeding cattle (approx. 10mm to 25mm). This is done with less power consumption motor which is of 0.5 hp single phase motor. Due to this, the machine can be used for domestic purposes, and can also be operated by unskilled workers. To ensure safety we have designed our machine blade in such a way that it can be fully covered.

II. LITERATURE REVIEW
Dinesh Mohan [2] has represented paper on safety features in fodder cutting machine. An epidemiological study done in north India showed that all age groups suffer fodder-cutter injuries while operating the machine. Adarsh Kumar [2] has presented paper on safety procedures for running the fodder cutting machines. A detailed study of injuries and machine characteristics resulted in a safer

- Chinmay Bandiwadekar is currently pursuing bachelors degree program in mechanical engineering in University of Pune.
  E-mail: classicchinmay@gmail.com
- Ajinkya Kamble is currently pursuing bachelors degree program in me-chanical engineering in University of Pune.
  E-mail: ajinkya.kamble41@live.com
- Vivek Garala is currently pursuing bachelors degree program in me-chanical engineering in University of Pune.
  E-mail: vgarala123@gmail.com
- Zuber Shaikh is currently pursuing bachelors degree program in me-chanical engineering in University of Pune.
  E-mail: mzuber.shaikh@gmail.com

Jayant P. Modak [1] The machine is economically viable, can be used by unskilled workers, save time otherwise spent in traditional mixing and can be adopted for human-powered process units which could have intermittent opera-tion without affecting the end-product.

Patent no. CN2560200Y [4] The utility model provides a machine-attached agricultural crop cutter, and the struc-ture thereof is that the utility model comprises a crop cutter body, a hay cutter roll and an inclined chopper, wherein, the inclined chopper is arranged on the hay cutter roll, and the hay cutter roll is arranged in the crop cutter body. Compared with the prior art, the machine-attached agricultural crop cutter of the utility model is characterized by reasonable design, simple structure, easy processing, small volume, con-venient use, high production efficiency, long service life of the blade and little power consumption, etc., thus having good popularizing use-value. Fodder-cutter design. The design changes are cost effective and can be incorporated, in both existing and new fodder-cutter machines.

Patent no. CN 202799729 U [5] The utility model dis-closes a chaff cutter, comprising a machine frame (1), an electric motor (2), a drive axle (11), a cutter dish (8) and a feed box (12), wherein the feed box (12) is arranged on one side of the machine frame (1), the electric motor (2) and the drive axle (11) are arranged on the other side of the machine frame (1), one end of the drive axle extends into the feed box and is provided with the cutter dish (8), a group of cutters (7) is arranged on the cutter dish (8) and locked by a capping (9), the electric motor drives the drive axle and makes the cutter rotate following the cutter dish, chopped chaff flows out from the discharge door of the feed box, and an adjusting plate (13) controls the cutting length of the chaff, which satisfies different requirements of cultiva-tion. The utility model has the advantages of simple structure, cheap cost, mechanized operation, obvi-ous cutting effect, high work efficiency, and low intensity of labor.

III. METHODOLOGY
- Detection of problems in cutting.
- To check torque and power requirement.
- New cutting technology.
- Single phase operation.
- Safety.

IV. MATERIAL PROPERTIES

<table>
<thead>
<tr>
<th>Sr no</th>
<th>Element</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>carbon</td>
<td>0.75-0.9</td>
</tr>
<tr>
<td>2</td>
<td>Manganese</td>
<td>0.50-0.90</td>
</tr>
<tr>
<td>3</td>
<td>Silicon</td>
<td>0.1-0.35</td>
</tr>
<tr>
<td>4</td>
<td>Sulphur and phosphorus</td>
<td>0.04 max</td>
</tr>
<tr>
<td>5</td>
<td>iron</td>
<td>Remaining</td>
</tr>
</tbody>
</table>

Table 1: Spring Steel

<table>
<thead>
<tr>
<th>Standard Specification: ASTM A682</th>
</tr>
</thead>
</table>

All rights reserved by www.ijsr.com
Standard specification – ASTM A36

<table>
<thead>
<tr>
<th>Sr no</th>
<th>Element %</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carbon</td>
<td>0.25-0.29</td>
</tr>
<tr>
<td>2</td>
<td>Copper</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>Iron</td>
<td>98</td>
</tr>
<tr>
<td>4</td>
<td>Manganese</td>
<td>1.03</td>
</tr>
<tr>
<td>5</td>
<td>Phosphorus</td>
<td>0.04</td>
</tr>
<tr>
<td>6</td>
<td>Silicon</td>
<td>0.28</td>
</tr>
<tr>
<td>7</td>
<td>sulphur</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table 2:

V. SOFTWARE
1) Autocad – it is used for making 2-d design for laser cutting.
2) Catia – used for 3D modelling.

VI. EXPERIMENTAL VALIDATION
A. At Stage 1: Motor To Cutter:
   - Pulley diameter = 50 mm-200 mm
   - Stage reduction ratio = 4
   - Rpm reduction = 1425-356.25
   - Power (hp) = 0.5
   - Torque (lbt-ft) = Power in Horsepower x 33000 / 2π x Rotational speed
     = 0.5 x 33000 / 2π x (1425-325.25)
     ≈ 2.5-9.99 Nm

B. At Stage 2: Cutter To Intermediate Shaft:
   - Pulley diameter = 70 mm-500 mm
   - Stage reduction ratio = 7.1
   - Rpm reduction = 356.25-49.87
   - Power (hp) = 0.5
   - Torque (lbt-ft) = Power in Horsepower x 33000 / 2π x Rotational speed
     = 0.5 x 33000 / 2π x (356.25-49.87)
     ≈ 9.99-71.39 Nm

C. At Stage 3: Intermediate Shaft To Input Feeder:
   - Pulley diameter = 70 mm-300 mm
   - Stage reduction ratio = 4.28
   - Rpm reduction = 49.87-11.63
   - Power (hp) = 0.5
   - Torque (lbt-ft) = Power in Horsepower x 33000 / 2π x Rotational speed
     = 0.5 x 33000 / 2π x (71.39-306.13)
     ≈ 71.39-306.13 Nm

VII. COMPARISON WITH CONVENTIONAL MACHINE

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Parameters</th>
<th>Our machine</th>
<th>Conventional machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power</td>
<td>0.5 hp</td>
<td>3hp</td>
</tr>
<tr>
<td>2</td>
<td>Electricity</td>
<td>240V, 1 phase</td>
<td>440V, 3 phase</td>
</tr>
<tr>
<td>3</td>
<td>Mouth width</td>
<td>100mm</td>
<td>200mm</td>
</tr>
<tr>
<td>4</td>
<td>Output per hr</td>
<td>175kg – 200kg</td>
<td>200kg – 250kg</td>
</tr>
</tbody>
</table>

Table 3:

VIII. DESIGN COMPARISON

IX. CONCLUSION
The new machine designed is a special purpose small scale machine, targeted at small scale farmers who have requirement to feed their cattle on daily basis in small to medium basis.

The machine has small dimensions compared to traditional ‘kadba kutti’ machine, the energy required for our machine is less & works on single phase, the moving parts of the machine are completely covered so operation of machine is safe.

Due to new cutting technology the wear and tear of the blades is negligible on the other hand conventional machine requires frequent sharpening of blades. The cost would also be less once it is mass produced.

REFERENCES
[2] Elsevier, By Dinesh Mohana, Adarsh Kumar, Rajesh Patel, Mathew Varghese, Development of safer fodder-
cutter machines: a case Study from north India. 2004, Pg. 44 – 55.

