

Modelling and Development of Chaff cutter machine

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Abstract - A chaff cutter is a mechanical device for cutting straw or hay into small pieces before being mixed together with other forage and fed to horses and cattle. This aids the animal's digestion and prevents animals from rejecting any part of their food. Chaff and hay play a vital role in most agricultural production as it was used for feeding horses.

Chaff cutters have evolved from the basic machines into commercial standard machines that can be driven at various speeds and can achieved various lengths of cuts of chaff with respect to animal preference type.

New chaff cutter machines include portable tractor driven chaff cutter - where chaff cutter can be in the field and load trolleys (if required).

Key Words: chaff, uniform chopping, fodder, cutter, machine.

1. INTRODUCTION

A chaff cutter is a mechanical device used to cut the straw or hay into small pieces so as to mix it together with other forage grass and fed to horses and cattle. This improves the animal's digestion and prevents animals from rejecting any part of their food. Chaff cutters have developed gradually from the simple machines to commercial standard machines that can be driven at various speeds so as to achieve various sizes of chaff with respect to animal preference type. New chaff cutter machines include portable tractor driven chaff cutters in which cutting of chaff is done in the field and loaded in trolleys. The present chaff cutter machine is less compact and having lack of safety and slow speed some compact machines having problem of blockage of grass. The population of cattle in India in 1987 was 199.7 million and in 2012, 199.9 million. Buffalo in 1987 -76.0 million but in 2012- 108.7 million. For such kind of population traditional human powered chaff 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 buffalos is drastically increased. So to increase the productivity and reduce the physical effort required for running the machine the motorized machineries came into existence it is best for dairy farmers. Presently fodder cutting machines are electric driven as well as hand operated or engine driven.

2. PROBLEM DETECTION IN CHAFF CUTTING PROCESS

The existing chaff cutting machines are observed and studied properly to detect the problems faced by the user are given below.

1. Bulky or less compact design
2. High voltage required such as 3 phase
3. Less safety while using by women
4. Noisy
5. Blockage of grass creates feed interference

By observing above limitations we manufactured and modified present chaff cutter.

2.1 Developed Work

1) New cutting technology – The research work in this domain was studied and new methods are developed to achieve desired goal.

2) Safety- Highest priority is given to safety. Because it is widely used by farmers and his family so it should be used by all of them with less skill.

3) Single phase operation – The power supplied to machine is single phase so to make it easy to operate at any location.

4) Noise- Less noise

5) Compact – Compact in design cause to install machine at limited place

6) Aesthetically pleasing and attractive design.

2.2 Procedure

1. Supply power source to electric motor- Here we are using single phase 2 H.P motor so we require single phase power supply. Input speed of our electric motor is 1425 rpm. In order to rotate chaff cutting blade we have to rotate them by using power drives.

2. Power transmission through belt-pulley drive which are mounted on shaft- For transmitting power we choose belt & pulley as power drive .This belt pulley arrangement is coupled to cutting blades by using coupling shaft. Hence rotation of cutting blades occur.

3. Feeding of food material - We feed fodder through hopper. As feed trough has large opening & high length this provides guide way to grass & other fodder material like dry corn straw, grass, soya bean, wheat stalk, with ease and thus reducing the manual work of farmer and increases the fodder production.

4. Collect fodder from output tube -After rotation of cutting blades, it causes cutting of supplied feed material like grass dry corn straw into powder form. This light weight particles thrown away by centrifugal force of cutting blade towards outlet tube .So, place container for collecting fodder.

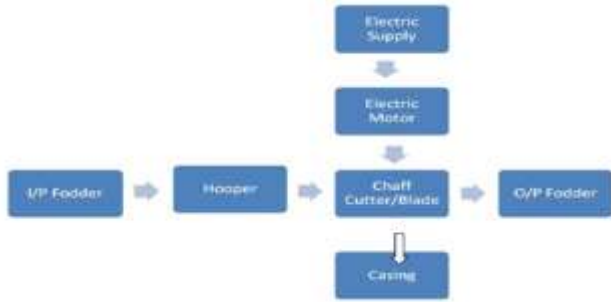


Fig -1: Flow diagram of Machine

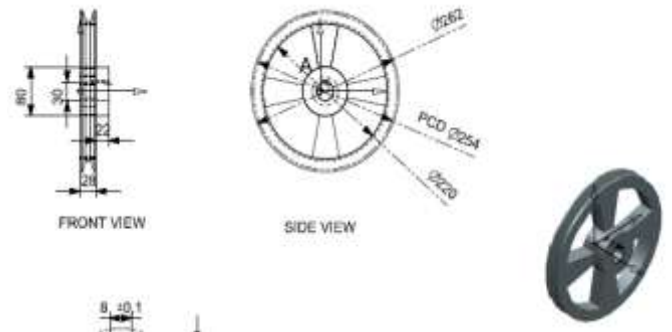


Fig.2 Upper Roller Pulley

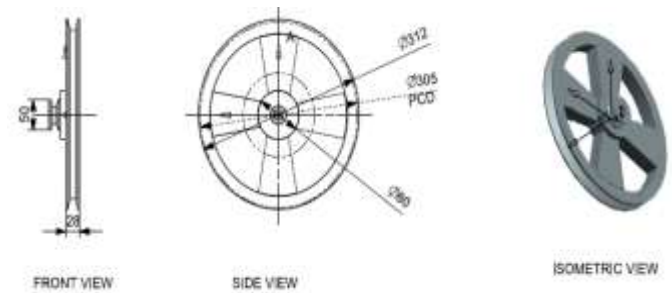


Fig.3 Blade Shaft Pulley

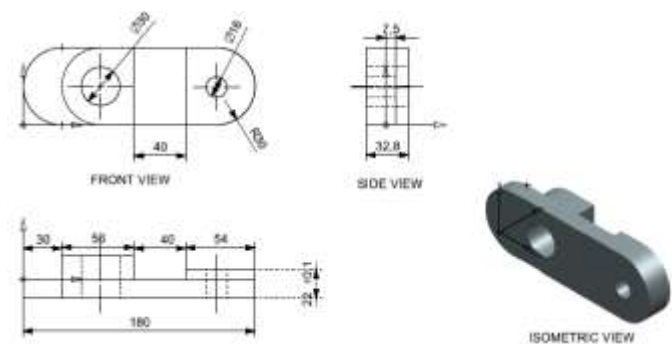


Fig.4 Lever

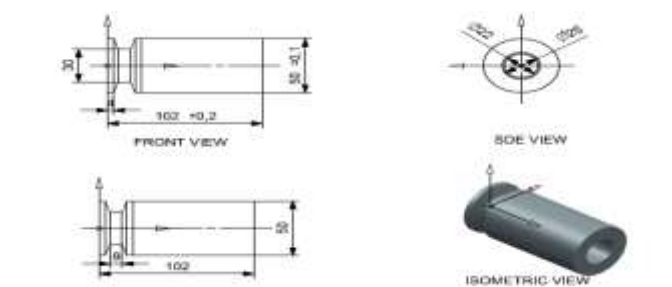


Fig.5 Riser Pulley

3. MATERIAL SELECTION

The selection of the most suitable material for a particular part is often a tedious job, partly because of the various factors to be considered and partly because of the availability of various materials. Therefore the most common method of selection of material is done by past experience. Material selection is a matter of quality and cost in such a way that the properties of material must be adequate to meet the design requirements and service conditions.

TABLE.1

NAME OF PART	MATERIAL
Frame	MILD STEEL(M.S)
Pulley 1	C.I
Pulley 2	C.I
Pulley 3	C.I
Pulley 4	C.I
Bearing	Chrome Steel
All Shafts	EN9
18 Teeth Gear	EN9
96 Teeth Gear	C.I
Stationary Blade	High Carbon Steel
Rotating Blades	WPS, Tool Steel
Hopper	M.S
Casings	M.S

4. CAD DRAWINGS OF CHAFF CUTTER MACHINE

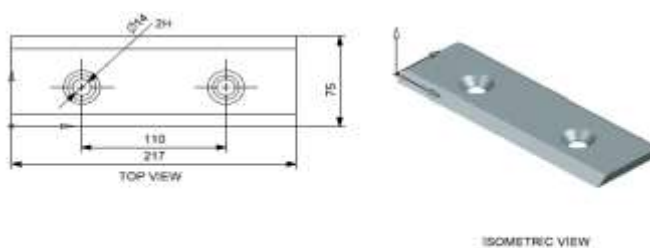


Fig.2 Rotary Blade

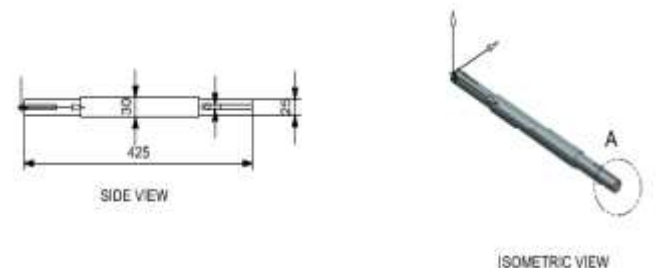


Fig.6 Main Shaft

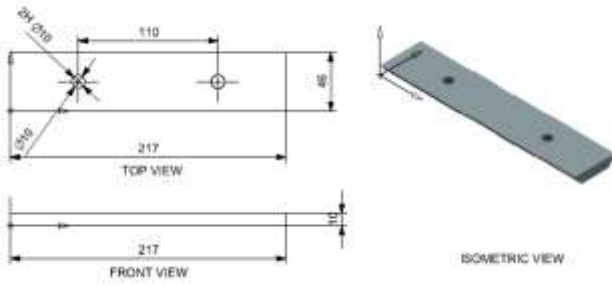


Fig.7 Stationary Shaft

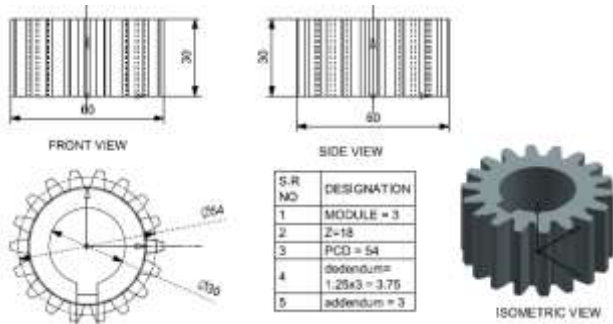


Fig.8 Spur Pinion



Fig.5 Assembly of Chaff Cutter Machine

5. CONCLUSIONS

1. The machine is simple in construction as there is not so much complication in design. It is also important that velocity ratio can easily be determine measuring number of teeth on gears PCD of pulleys.

2. The machine is designed in such a way that it will require minimum space to install. As the motor is placed inside the machine stand not outside the machine, the space is considerably saved.

3. As there are no sharp edges in the m/c for m/c frame and machine stand, it can be handled safely without injury. Blades are provided with double sharpening edges.

4. The m/c is provided with motor sliding arrangement and the cutting blades can be easily detached by operator for sharpening purpose.

5. We provided the powder coating casing to whole assembly of m/c for safety and aesthetic look. And for corrosion resistance.

6. Machine has reduced noise and weight due to gears arrangement and compact design.

7. Machine has casters for portability.

8. Machine has 300kg/hr fodder cutting rate

9. Fodder size is 20mm in length

10. Forward and reversed rotation arrangements for blades

11. Lastly, as we know man has always been known for his haste towards new and creative ideas, further improvement can still be carried out on this project. But one thing is sure we have learned the difference between theoretical knowledge and actual practice as well as lot of technical knowledge.

REFERENCES

[1] P.B.Khobe, J.P.Modak, Establishing empirical relationship to predict the chaff cutting phenomenon energized by human power flywheel motor (hpfm). Volume 3, Issue 2 (May- June 2013) Page 158-164

[2] P. B. Khobe, J. P. Modak, Development and Performance Evaluation of a Human Powered Flywheel Motor Operated Forge Cutter, International Journal of Scientific & Technology Research, Volume 2, Issue 3, (March 2013). Page 35-39

[3] M. V. Gudadhe, J. P. Modak, Design of Experimentation for the Formulation of an Approximate Experimental Model for HPFM driven Kadba Cutter, International Journal of Research in Engineering Science and Technologies, Volume 1, Issue 1, (May 2015). Page 1-8

[4] K. S. Zakiuddin, J. P. Modak, Formulation of Data Based Ann Model For The Human Powered Fodder-Chopper, Journal of Theoretical and Applied Information Technology, Volume 15, Issue 2, (May 2010). Page 104-108.

[5] "Machine Design", V.B. Bhandari, Tata MCgraw Hill, Third Edition.

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