

Design and Different Components of Multipurpose Kutty Cutter Machine

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ABSTRACT: Chaff Cutter Machine is hay or straw cutting machine which is used for uniform chopping of fodder for livestock to agro industries. In this paper, design and development of Chaff Cutter Machine is presented. The machine is developed gradually from basic machines into commercial standard machine that can be electrical driven to achieve various length of cut of chaff as per the preference. The new chaff cutter machine is modified for its compactness and to avoid blockage of grass.

KEYWORDS: Chaff, Uniform Chopping, Fodder, Cutter, Machine

I. INTRODUCTION

A Chaff cutter is mechanical device used to cut the straw or hay into small pieces so as to mix it together and fed to cattle. This improves animal digestion and prevents animal from rejecting any part of their food. 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.

II. OBJECTIVE

- To ensure safety and make it compact.
- To provide good fodder for animal
- To save work time
- To save electricity consumption
- To provide pleasing/aesthetic look
- To get protection from dust
- To reduce noise
- To increase corrosion resistance of machine
- To Make Portable easily

III. LITERATURE SURVEY

The literature survey reveals that several attempts have been already made to develop

1. Design of experimentation for establishing empirical relationship of chaff cutting phenomenon energized by human powered flywheel motor (HPFM) (P.B. Khope J.P. Modak 2013) Copyright to IJIRSET DOI:10.15680/IJIRSET.2017.0604126 5676 2. Modak and his associates had developed Human powered process machines, which could energize process units needing 3 to 6 HP. These units had intermittent power requirement. In the present work human powered flywheel motor chaff cutting process has been studied. 3. Design & develop chaff cutter by using different types of blades (Sanjay Patil, Harshkumar Jain, Raut, Kalikat, Gandhi)

IV. METHODOLOGY

- 1. Detection of problem in chaff cutter**– The existing machines are observed and studied properly to detect the problems faced by the user.
- 2. New cutting technology** – The research work in this part was studied and new methods were developed to achieve desired goal.
- 3. Impelementation of mechanism** - Instead of using electric motor we were using torsion spring to rotate the flywheel by using chain drive.
- 4. Performance testing**- After implementation of mechanism trials was taken to check the performance of machine. we were detect the errors and correct it

V.NEED OF NEW CHAFF CUTTER MACHINE

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

1. 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

VI. USED MATERIALS AND THEIR PROPERTIES

The materials used in this project are detailed as follows

FERROUS MATERIALS

A) Mild steel

– EN – 4 to EN – 6
Carbon – 0.15% to 0.35%
Tensile strength – 1200/1420MPA
Yield strength – 750/1170 MPA

B) C30

Carbon – 0.25% to 0.35%
Tensile strength – 620 MPA
Yield strength – 400 MPA
Izod Impact Value – 55 Nm
% Minimum Elongation – 21
Typical composition — Carbon – 0.25% to 0.35%
Manganese – 0.60% to 0.90%
BHN – 207

C30 material is generally used for cold formed levers, hardened and tempered tie rods, Cables, Sprockets, Hubs and Bushes –Steel Tubes.

C) 40C8

Carbon – 0.25% to 0.35%
Tensile strength – 620 MPA
Yield strength – 400 MPA
Izod Impact Value – 55 Nm

5.1 NON METALLIC MATERIALS

The non-metallic materials are used in engineering practice due to their low density, low cost, flexibility, resistance to heat and electricity. Though there are many non-metallic materials, important materials used in our project are listed below:

- **PLASTIC (NYLON)**

Tensile strength – 82 N/mm²
Compressive strength – 35 N/mm²
Yield strength – 8500 psi
Rockwell Hardness Number – R112-120

The plastics are synthetic materials which are moulded into shape under pressure with or without the application of heat. These can also be cast, rolled, extruded, laminated, and machined. Following are the two types of plastics;

(a) Thermosetting plastics

(b) Thermoplastics.

The thermosetting plastics are those which are formed into shape under heat and pressure is applied, it becomes hard by a chemical change known as phenol formaldehyde(Bakelite), phenol-furfural(Durite), urea-formaldehyde(Plaskon), etc. The thermoplastic materials do not become hard with the application of heat and pressure and no chemical change occurs. They remain soft at elevated temperatures until they are hardened by cooling. These can be remelted repeatedly by successive application of heat. Some of the common thermoplastics are cellulose nitrate (Celluloid), polythene, NYLON, polyvinyl acetate, polyvinyl chloride(P.V.C.), etc. The plastics are extremely resistant to corrosion and have high dimensional stability. They are mostly used in manufacture of aero plane and automobile parts. They are also used for making safety glasses, laminated gears, pulleys, self lubricating bearings, etc. due to their resilience and strength.

B) RUBBER

It is one of the most important natural plastics. It resists abrasion, heat, strong alkalis, and fairly strong acids. Soft rubber is used for electrical insulations. It is also used for power transmission belting, being applied to woven cotton as a base. The hard rubber is used for piping and as lining for pickling tanks.

VII. WORKING PRINCIPLE

In our project we are using the multi agricultural cutter for cutting the crops, sugarcane, wooden materials and etc. It consists of simple manner and the used components are motor and rotating disc arrangement. Here the motor is working using with the help of electric power supply; on the motor shaft we have fixing the arrangement of rotating disc. The rotating disc arrangements are running like a cam. The cutters are fixed on the top of the ram arrangements. When we switch ON the machine the motor start to rotate the cam arrangements which is shown in the figure. Here the rotary motion is converted in to the linear motion by using simple mechanisms. The linear motion ram is connected to the cutters as shown in fig, so that the cutter moves upward and downward direction the cutting process is carrying out through this machine



Fig no -1

VIII. DESIGN

Design consists of application of scientific, principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific with maximum economy & efficiency.

Hence a careful design approach has to be adopted. The total design work has been split up into two parts;

- System design
- Mechanical Design

System design mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on main frame at system, man + machine interaction, No. of controls, position of controls, working environment of machine, chances of failure, safety, measures to be provided, servicing aids, ease of maintenance, scope of Improvement, weight of machine from ground level, total weight of machine and a lot more. In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely,

- Designed Parts
- Parts to be purchased

For designed parts detached design is done & distinctions thus obtained are compared to next highest dimensions which are readily available in market. This amplifies the assembly as well as postproduction servicing work. The various tolerances on the works are specified. The process charts are prepared and passed on to the manufacturing stage. The parts which are to be purchased directly are selected from various catalogues & specified so that any body can purchase the same from the retails shop with given specifications.

IX. SYSTEM DESIGN

In system design we mainly concentrated on the following parameters:-

8.1 System Selection Based on Physical Constraints

While selecting any machine it must be checked whether it is going to be used in a large – scale industry or a small –scale industry. In our case it is to be used by a small scale industry .So space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room. The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that.

8.2 Arrangements of Various Components

Keeping into view the space restrictions the components should be laid such that their easy Removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in components arrangements.

8.3 Components of System

As already stated the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired. Man Machine Interaction The friendliness of a machine with the operator that is an important criterion of design. It is the application of anatomical & psychological principles to solve problems arising from Man – Machine relationship. Following are some of the topics included in this section. Lighting condition of machine.

8.4 Chances of Failure

The losses incurred by owner in case of any failure are important criteria of design. Factor safety while doing mechanical design is kept high so that there are Less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

8.5 Servicing Facility

The layout of components should be such that easy servicing is possible. Especially those components which require frequents servicing can be easily disassembled. Scope of Future Improvement Arrangement should be provided to expand the scope of work in future. Such as to convert the machine motor operated; the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

8.6 Height of Machine from Ground

For ease and comfort of operator the height of machine should be properly decided so that he may not get tired during operation. The machine should be slightly higher than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

8.7 Weight of Machine

The total weight depends upon the selection of material components as well as the dimension of components. A higher weighted machine is difficult in Transportation & in case of major breakdown; it is difficult to take it to workshop because of more weight.

X. MECHANICAL DESIGN

Mechanical design phase is very important from the view of designer as whole success of the project depends on the correct design analysis of the problem. Many preliminary alternatives are eliminated during this phase Designer should have adequate knowledge above physical properties of material, loads stresses, deformation, and failure. Theories and wear analysis. He should identify the external and internal force acting on the machine parts.

This force may be classified as;

- 1] Dead weigh forces
- 2] Friction forces
- 3] Inertia forces
- 4] Centrifugal forces
- 5] Forces generated during power transmission etc.

Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions. This will almost satisfy the functional needs. Assumptions must always be on the safer side. Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The corrections in the theoretical stress value are to be made according in the kinds of loads, shape of parts & service requirements. Selection of material should be made according to the condition of loading shapes of products environments conditions & desirable properties of material Provision should be made to minimize nearly adopting proper lubrications methods.

In, mechanical design the components are listed down & stored on the basis of their procurement in two categories.

- 1] Design parts
- 2] Parts to be purchased

For design parts a detailed design is done & designation thus obtain are compared to the next highest dimension which is ready available in market. This simplification the assembly as well as post production service work. The various tolerances on the work are specified. The processes charts are prepared & passed on to the work are specified. The parts to be purchased directly are selected from various catalogues & specification so that any body can purchase the same from retail shop with the given specifications.

XI. CONCLUSION AND RESULTS

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 determining measuring number of teeth on gears, p.c.d 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 operators 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

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