A Synopsis

On

"DESIGN & FABRICATION OF MULTI PURPOSE MINI FARMING MACHINE"

Submitted in the partial fulfillment of Project on BE Mechanical Engineering

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Anjuman-i-Islam's Kalsekar Technical Campus

(Approved by AICTE & DTE State & Affiliated to University of Mumbai)

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CERTIFICATE

This is to certify that the synopsis "**Multipurpose mini farming machine**"

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Submitted in the partial fulfillment of Project BE, is found to be satisfactory as per the curriculum laid down by "University of Mumbai" and is approved for the degree in

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ACKNOWLEDGEMENT

No endeavor achieves success without the help & co-operation of others. Behind the success and fruitful project of student lie the guidance, help, effort and co-operation of a number of people. We would like to seize the opportunity to thank all those people who made our project a vibrant success.

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We would also thank my institution and my faculty members without whom this project would have been a distant reality. I also extend my heartfelt thanks to my family and well-wishers.

Lastly, a word of thanks to those people who are left unmentioned here but helped us a lot during the project period and made our project a wonderful experience to remember.

Honestly,

Bade Saquib Hafizulla

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ABSTRACT

Agriculture being one of the major occupation in India, it is very essential to discover and implement new idea in this field, though lot of work has been done in this area. It is unfortunate that, these ideas are not been implemented properly in actual field. This is due to high cost and is complicated for rural people. Multipurpose Farming Machine is basic and major equipment involved in agriculture for maximum yielding. Conventional method of planting and cultivating crops is a laborious process and hence for that reason there is a scarcity of labours, this result in delayed agriculture to overcome these difficulties, multipurpose agriculture equipment is designed.

This project is intended to help small-scale grain growers meet an increased demand for diverse, locally grown grains by designing a mini farming machine. To refine our prototype and final design, we worked closely with a three person review panel, made up of grain farmers and industrial designers. With this prototype, we hope to provide farmers nationwide with a way to harvest and bind grains on small plots of land in cities and along the periphery of urban areas.

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1. INTRODUCTION

1.1 OBJECTIVE

The goal of this project is to help small-scale farmers in India and meet an increased demand for local grains, by designing a mini farming machine to harvest grains more efficiently.The Project is to design & Fabricate a Machine Which Can perform multiple operations. The objective of this project is to help Farmers which hold small lands. This machine will mechanize the process and reduce the need of labour and time. Machine will perform following operations:-

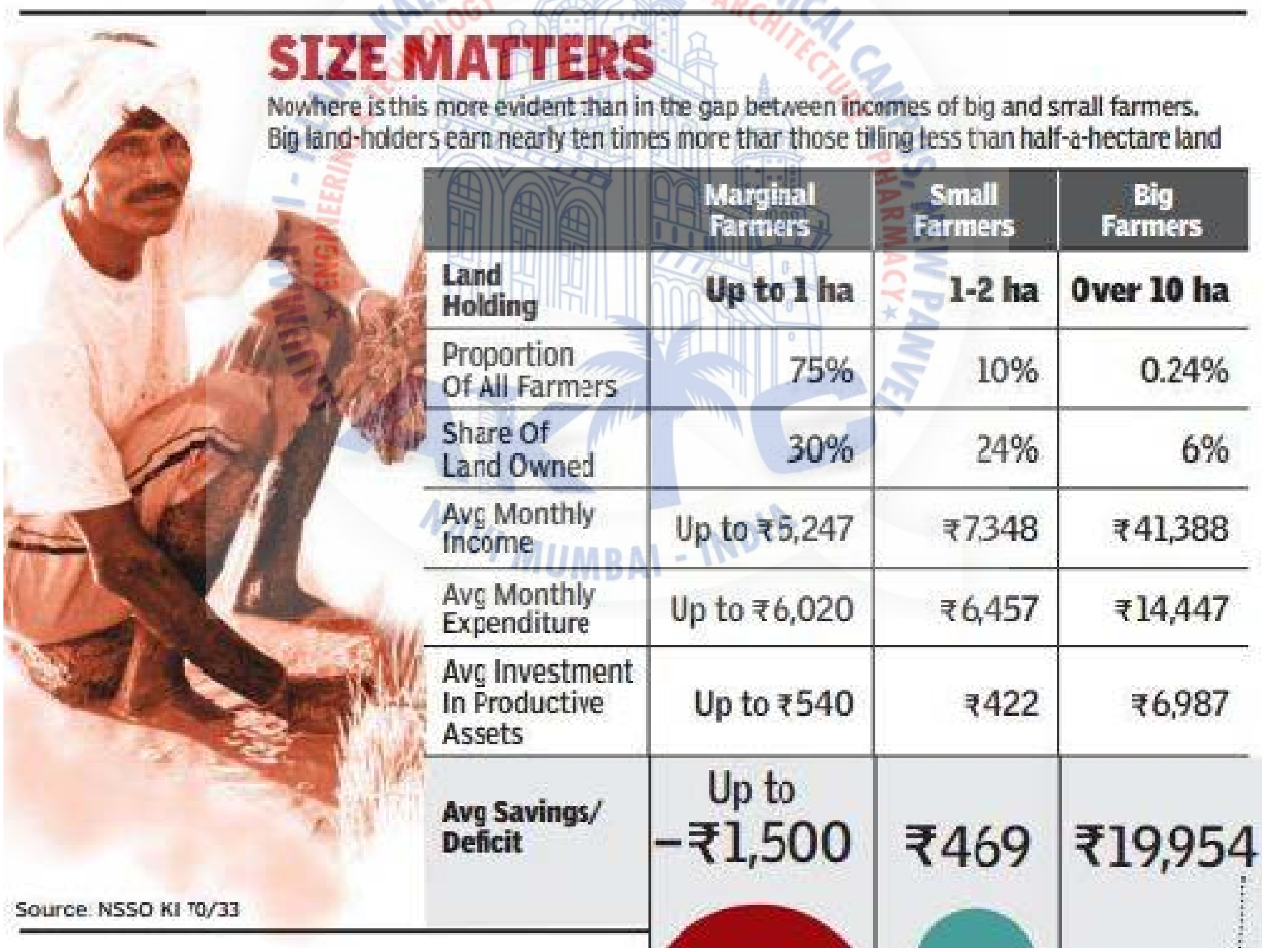
- Seed sowing
- Crop cutting
- To achieve proper distance in two seed in seeding mechanism for proper nutrition and growth of plants.
- To make this machine which operate manually for small farmer
- To provide this machine in lowest cost and light in weight.

1.2 NEED OF PROJECT

Agriculture is demographically the broadest economic sector & plays a significant role in the overall economy of India is necessary. The main purpose of mechanization in agriculture is to improve the overall productivity and production. About 83.29% of the Indian Farm families have land holdings less than 2 to 3 acres. For them it is not required nor economical to purchase a full featured existing cultivating machines. Thus there is a need for smaller efficient multipurpose cultivating machine which would be more accessible & also considerably cheaper. The idea is to create the machine which will reduce the Labour & the cost required to cultivate crops. This machine has a capability and the economic value for fulfilling the needs of farmers having small land holdings(less than 2 acres). This machine is cost effective, easy to maintain & repairs for the farmers.

1.3 PROBLEM DEFINATION

These problems gave the basic idea about what was required in the current situation. The idea was to create a machine which is cheap and will reduce the labour required to cultivate crops. This machine has the capability and the economic value for fulfilling the needs of farmers having small land holdings (less than 2 acres). This machine is cost effective and easy to maintain and repair for the farmers.



SIZE MATTERS

Nowhere is this more evident than in the gap between incomes of big and small farmers. Big land-holders earn nearly ten times more than those tilling less than half-a-hectare land

	Marginal Farmers	Small Farmers	Big Farmers
Land Holding	Up to 1 ha	1-2 ha	Over 10 ha
Proportion Of All Farmers	75%	10%	0.24%
Share Of Land Owned	30%	24%	6%
Avg Monthly Income	Up to ₹5,247	₹7,348	₹41,388
Avg Monthly Expenditure	Up to ₹6,020	₹6,457	₹14,447
Avg Investment In Productive Assets	Up to ₹540	₹422	₹6,987
Avg Savings/ Deficit	Up to −₹1,500	₹469	₹19,954

Source: NSSO KI 70/33

Fig 1.3.1 Small vs Large Scale Farmers

1.4 OUR WORK IN THE PROJECT

Our work in the project is to design and fabricate the multipurpose mini farming machine by performing various operation. We tried to design it in a simple way so that it will be easy for maintenance and use.

1.5 EXPECTED OUTCOME

This machine will help small scale farmers for easy operation and less manual work. This will help them to save time and money. It will also help to increase productivity and make more profits. This will make them to use new technology in agriculture.

2. LITERATURE REVIEW

Background Nationally, most of the food we eat is produced by large agricultural supply chains, which link farmers, seed suppliers, pesticide and fertilizer suppliers, transporters, distributors, wholesalers and retail outlets. Currently, the United States harvests about 114.8 million acres of grain per year worth some $15 billion (USDA Census of Agriculture, 2007). On a number of dimensions this scale of production is not sustainable. One of these issues is that $28 billion is spent by all the farms in the U.S. on chemical fertilizer alone, which is made primarily from nonrenewable resources including fossil fuels (USDA Census of Agriculture 2007). On an average farm in the United States, 107 gallons of fossil fuels per acre will be used, with one third of that going into the production of fertilizer (Pimental, 2006). These chemical fertilizers, pesticides, and herbicides end up either on our food or into our groundwater, posing health risks to farm workers, nearby residents, and consumers (Groundwater, 2003). An alternative to these large and distant supply chains, and reliance on chemical fertilizers and other inputs, is to grow food, such as grains, organically and closer to where it is consumed. Such interest in encouraging local and regional agricultural production is evident in a number of cities, such as Portland, Seattle, New York, Detroit and Philadelphia where community gardens are burgeoning, farmers markets are expanding, urban farmers are growing food on rooftops, vacant lots, in retrofitted warehouses, in backyards, and new value chains that connect small and medium size growers to markets are proliferating (Lovell, 2010). Even though there is a growing trend to produce local, fruits and vegetables in cities and on the periphery of urban areas, local grain production remains limited. It is rare, for example, for locally produced grains to be used even in small craft breweries since most breweries buy malted barley from large malt houses in the Midwest at commodity prices; nor is locally grown grain typically found in farmers markets since farmers typically get greater profits from selling fruit and vegetables. One barrier to expanding the market for locally produced grain is the lack of appropriate machinery to harvest grain grown on a small scale (C. Stanley, personal communication, 11/12/2011). While these small-scale grain harvesters exist in Europe and parts of Asia, farmers do not import this machinery into United States because of exorbitant transportation costs. To harvest iv grain, small-scale farms either rent a combine harvester or use hand tools, such as a scythe or sickle (Pitzer, 2010). Neither technology is suitable for small-scale grain production. Combine harvesters are too large and cumbersome for this scale, and would be next to impossible to maneuver in an urban farming environment. Hand tools may work for less than a half an acre, but if there are multiple small plots, it would be a very labor intensive and time consuming job. What is needed is an appropriately scaled machine that could be used by growers to reap and bind grain grown on a few acres. The goal of this project was to help small-scale growers meet an increased demand for local grains by designing a reaper-binder machine to harvest grains more efficiently. We interviewed small-scale growers and agricultural engineers to identify the current problems with growing grains in New England, to learn about the types of machines currently used to harvest grains, and to develop appropriate design criteria for our product. Once we designed a threedimensional computer model, we worked with a three person review panel to refine our ideas. With this design we hope to provide farmers with a means to harvest and bind grains on small plots of land and in broader terms develop urban and small-scale agriculture. Findings Our team determined that the best machine to harvest a small scale plot of grain is a reaper binder that attaches to a two-wheeled, walk behind tractor. The basic steps taken in growing grains are planting, harvesting, binding, threshing, cleaning, and milling. The machine we designed handles the harvesting and binding aspects of farming grain. Through our interviews, we found that developing an attachment for a two-wheeled tractor would be the most practical solution. This would provide farmers with a simple platform that only requires farmers to purchase the necessary attachments. Based on our interviews with our sponsor and Joel Dufour, we assumed that most commercial farmers would be willing to spend up to $8,000 dollars for a machine to harvest grains (J. Dufour, personal communications, 11/10/2011). Subtracting the cost of the base tractor, which has a minimum price of $1,587 and a maximum of $5,899, we estimated the budget for materials and labor would be about $6,500 or less for our attachment (see Appendix B: Cost Report). We came up with an initial design that used a sickle bar cutter and two channels to feed the grain back to the binder. We then sent this design to our review board that provided v feedback. This review board included Andy Pressman, who is our sponsor for this project, Dorn Cox, an innovative farmer from New Hampshire, and Joel Dufour, who owns Earth Tools Inc., and sells BCS tractors. After we received comments from our design board, it was decided that we should start our design from the beginning again. For this redesign, we used the BCS 622 reaper binder as a base for our design in order to eliminate some of the problems that we encountered when we were utilizing the existing sickle bar attachment. One of these problems was the grain had to be diverted two separate ways because the existing sickle bar mower's body was in the middle. Thus, the cut stalks of grain needed to go to the right and left of this body. For our redesign, we decided to make our own sickle bar cutter so that there would be no need for separate channels. The first step our redesigned machine will take in harvesting grains will be to cut the stalks of grain with the use of oscillating blades at the front of the machine. Once cut, the grain will be brought to the center of the machine by finger-like appendages. These feeding fingers will also be powered by the PTO output of the tractor and feed the stalks of grain into the middle of the binder to be bound. These fingers also serve the purpose of compacting the grain into the binder as well as keeping the stalks of grain upright. This way more grain will be bound in each bundle, thus increasing efficiency. The feeders were designed so that one feeder would be at its center-most position while the other would be at its furthest position away from the center of the machine. This way, they reach the center of the binder at alternating times, maximizing the amount of grain that can be brought and compacted into the main channel. With this alternating movement, any collisions would be avoided between the two feeder arms. The two wheeled tractor will be connected to the binder at the back left-hand side (viewing the machine from the front). The reason we chose this location for the placement of the tractor was so the bound grain would fall and land to the left of the driver. If the tractor had been placed in the middle, the bundles of grain would need to be diverted to one side or the other after they were bound. This could potentially cause problems if the bundles were dropped into the uncut stalks of grain. With the design we created, the bundles of grain would fall in the center of the cutting path of the machine thus reducing the chances that the bundles of grain would fall into the uncut stalks. The binder mechanism for our design is located at the end of the channel. Before any grain reaches the tying mechanism, twine will be strung across the opening. The free end of the vi twine is held on the tying side of the machine by a rotating disk. This piece of twine will hold the stalks of grain until there was enough to be bound. The rotating twine clamp will be powered by a small motor that will be timed with the rest of the tying mechanism. The location of the arm is located at a position so the grain will not fall over as it is being bound. When the bundling area is filled to capacity, an arm that has the twine running inside it moves across the channel and encompasses the stalks of grain with twine. This rod is powered by a slider and bar linkage driven by gears. At the other end, a mechanism would tie and cut the twine, thus forming a complete bundle. This mechanism consists of a hook that rotates around and creates one loop of twine. At a point along the rotation, a jaw that is hinged on the hook, opens and then closes, grabbing the two ends of twine. There is a metal loop above the hook that is used to help create the loop. At the same time, a blade cuts the twine that was brought by the arm and held in place by the disk and the hook rotates, pushing the loop of twine over the top of the two newly cut ends thus forming a knot. The tying arm would then retract back to the other side, drawing the twine back and the process would start all over again. The newly bound bundle will then be pushed off the back of the attachment by newly cut grain. Guards were placed on the undercarriage of the binder in order to protect the gears and axles. Another guard was placed in the channel to protect the rotating hook from catching any of the stalks of grain. This reduces the chances that debris will kick up and damage the gears. We determined that this design satisfied most of our parameters that we had specified. Conclusions and Recommendations From our interviews with grain farmers and distributers, we learned that while there is no suitable small-scale grain harvesting machines available to growers in the United States and there is an emerging need for a cost friendly machine that could efficiently harvest grains on a small-scale. There are a few different potential end users that could benefit from our reaperbinder. The first would be a current farmer who grows grains on one to two acre plots. This could include multiple lots in need of portable equipment like our grain binder. Our product could also be used by urban farmers collectively. They could buy the reaper-binder communally thereby reducing upfront costs. vii Even though our project only focuses on the grain bundling aspect of small-scale grain growing, we researched other aspects as well. After grain is harvested, the threshing process can begin. Threshing is done to the bundles to remove the seeds from the chaff. This process is normally done by hand, which is a very inefficient, laborious process. After talking with a few of our contacts, we recommend buying or building a small machine similar to John Howe's thresher/winnower device that he has created (Northern Grain Growers, 2011). This machine efficiently separates the seeds of the grain from the chaff by sending it over a screen with force. The seeds fall through the holes in the screen. Once separated, the seeds can be processed further towards consumption. During our design process, there were some aspects that could have been further refined if we had more time. Future research should focus on the timings for the tying mechanism and the tying arm. In our design, they are both driven off the feeder arm axle, which means the tying mechanism is moving constantly regardless of the amount of stalks ready to be bundled. The design would be improved if the timing mechanism only engaged when it was triggered by a full bundle. Another area that needs further research is the ability to cut grains at different height. Depending on the type of grains grown, the cutting height will vary. By designing a machine that can have variable cutting heights, a farmer will be able to grow a wider variety of grains. Most likely other small unknown issues would be found and fixed if a prototype were built and further time was spent on design and testing. This was not able to be done due to the time constraints of our project and lack of resources. Ideally, other designers will look at our model and determine a plan for the manufacturing of our design. After that, a prototype will be built and tested to see if there are any issues that need to be worked out. After a couple iterations, we hope, the binder could then be sold in the market. viii Contributions Christopher Boyle Chris was the primary writer of the conclusion chapter and wrote sections in the background and results. He also was one of the primary editors of the paper. Chris also provided feedback and help to the design process of our machine. Ian Jutras Ian was the designer behind both revisions of the reaper-binder design. He also wrote a large section of the results section, as well as sections in the background, methodology, and introduction. He also was a primary editor of the paper. Ian also recorded interviews as well as helped in our final presentation video. Christopher Molica Chris wrote a large section in the background and methodology. He also edited parts of the paper. Chris also contributed a lot to the development of presentations. He created and managed our website. Earl Ziegler Earl wrote section in the introduction, background, and methodology. He also edited parts of the paper. He contributed with the content for the presentations. Earl along with the rest of the team conducted personal interviews.

DIFFERENT OPERATIONS

A. Sowing and Fertilizer

It is used for line sowing and fertilizing of cereals and other crops. It is a low cost line-sowing device in which seed metering is done manually by the operator by dropping the seeds in the funnel provided for the purpose.

Fig2.1 Sowing

B. **Inter Cultivation**

It is used for levelling of beds, crushing of clods, and collection of uprooted weeds and aeration of soil. It is a long handled tool and consists of spikes, welded to a Z shaped frame made from joining two pieces of angle to connect with body by fasteners.

Fig.2.2 Harvesting

3. MATERIALS AND METHOD

3.1 MATERIALS

Following materials were used to manufacture the reaper mechanism:

- Iron strips
- Iron rods
- Bearings
- Wheels
- Nuts,Bolts & Rivets
- EN8 plates
- pulleys
- belts
- Engine

Equipment's:

- Toolkit and Measuring Equipment's
- Welding plant (Arc and Gas welding)
- Lathe machine
- Iron cutters, Benders, Drill, Grinders
- Saws (wood saw, Hacksaw)

3.2 METHODOLOGY

In view of the renewed demand for local grains, our goal is to design an affordable, mini farming machine to help small-scale farmers more efficiently harvest their grain. The objectives we identified to accomplish our goal were:

1. Identify and interview local grain farmers and grain growing associations to learn more about current production and harvesting practices, grains produced, and emerging trends in local grain production.

2. Identify and interview farm equipment manufacturers and farmers who have built grain harvesters, in order to determine the current products available for our scale and research their current designs.

3. Conduct archival research and review patents on small-scale combine harvesters, binders, and threshers from the past.

4. Design our own mini farming machine. This chapter will discuss in detail the procedures and methodologies that we used to design our product and accomplish these objectives.

3.3 MATERIAL SELECTION

The proper selection of material for the different part of a machine is the main objective in the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors:

1. Availability of the materials.
2. Suitability of materials for the working condition in service.
3. The cost of materials.
4. Physical and chemical properties of material.
5. Mechanical properties of material.

The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows:

1. Strength : It is the ability of a material to resist the externally applied Forces
2. Stress: Without breaking or yielding. The internal resistance offered by a part to an externally applied force is called stress.
3. Stiffness: It is the ability of material to resist deformation under stresses. The modules of elasticity of the measure of stiffness.
4. Elasticity: It is the property of a material to regain its original shape after deformation when the external forces are removed. This property is desirable for material used in tools and machines. It may be noted that steel is more elastic than rubber.
5. Plasticity: It is the property of a material, which retain the deformation produced under load permanently. This property of material is necessary for forging, in stamping images on coins and in ornamental work.
6. Ductility: It is the property of a material enabling it to be drawn into wire with the application of a tensile force. A ductile material must be both strong and plastic. The ductility is usually measured by the terms, percentage elongation and percent reduction in area. The ductile materials commonly used in engineering practice are mild steel, copper, aluminum, nickel, zinc, tin and lead.
7. Brittleness: It is the property of material opposite to ductile. It is the Property of breaking of a material with little permanent distortion. Brittle materials when subjected to tensile loads snap off without giving any sensible elongation. Cast iron is a brittle material.

8. Malleability: It is a special case of ductility, which permits material to be rolled or hammered into thin sheets, a malleable material should be plastic but it is not essential to be so strong. The malleable materials commonly used in engineering practice are lead, soft steel, wrought iron, copper and aluminum.
9. Toughness: It is the property of a material to resist the fracture due to high impact loads like hammer blows. The toughness of the material decreases when it is heated. It is measured by the amount of absorbed after being stressed up to the point of fracture. This property is desirable in parts subjected to shock an impact loads.
10. Resilience: It is the property of a material to absorb energy and to resist rock and impact loads. It is measured by amount of energy absorbed per unit volume within elastic limit. This property is essential for spring material.
11. Creep: When a part is subjected to a constant stress at high temperature for long period of time, it will undergo a slow and permanent deformation called creep. This property is considered in designing internal combustion engines, boilers and turbines.
12. Hardness: It is a very important property of the metals and has a wide verity of meanings. It embraces many different properties such as resistance to wear scratching, deformation and much inability etc. It also means the ability of the metal to cut another metal. The hardness is usually expressed in numbers, which are dependent on the method of making the test. The hardness of a metal may be determined by the following test.
    a) Brinell hardness test
    b) Rockwell hardness test
    c) Vickers hardness (also called diamond pyramid) test and
    d) Share Scaleroscope.

The science of the metal is a specialized and although it overflows in to realms of knowledge it tends to shut away from the general reader. The knowledge of materials and their properties is of great significance for a design engineer. The machine elements should be made of such a material which has properties suitable for the conditions of operations. In addition to this a design engineer must be familiar with the manufacturing processes and the heat treatments have on the properties of the materials. In designing the various part of the machine it is necessary to know how the material will function in service. For this certain characteristics or mechanical properties mostly used in mechanical engineering practice are commonly determined from standard tensile tests. In engineering practice, the machine parts are subjected to various forces, which may be due to either one or more of the following.

1. Energy transmitted
2. Weight of machine
3. Frictional resistance
4. Inertia of reciprocating parts
5. Change of temperature
6. Lack of balance of moving parts

The selection of the materials depends upon the various types of stresses that are set up during operation. The material selected should with stand it. Another criteria for selection of metal depend upon the type of load because a machine part resist load more easily than a live load and live load more easily than a shock load.

Selection of the material depends upon factor of safety, which in turn depends upon the following factors.

1. Reliabilities of properties
2. Reliability of applied load
3. The certainty as to exact mode of failure
4. The extent of simplifying assumptions
5. The extent of localized
6. The extent of initial stresses set up during manufacturing
7. The extent loss of life if failure occurs
8. The extent of loss of property if failure occurs

Materials selected in m/c:

- Base plate, motor support, sleeve and shaft

Material used:

- Mild steel

Reasons:

1. Mild steel is readily available in market
2. It is economical to use
3. It is available in standard sizes
4. It has good mechanical properties i.e. it is easily machinable
5. It has moderate factor of safety, because factor of safety results in unnecessary wastage of material and heavy selection. Low factor of safety results in unnecessary risk of failure
6. It has high tensile strength
7. Low co-efficient of thermal expansion

Properties of Mild Steel:

- M.S. has a carbon content from 0.15% to 0.30%. They are easily wieldable thus can be hardened only. T
- They are similar to wrought iron in properties. Both ultimate tensile and compressive strength of these steel increases with increasing carbon content. They can be easily gas welded or electric or arc welded. With increase in the carbon percentage weld ability decreases.
- Mild steel serve the purpose and was hence was selected because of the above purpose.

3.4 FACILITES REQUIRED FOR PROPOSED WORK

- Mechanical workshop
- Lathe machine
- Welding machine
- Milling machine
- Drilling machine
- Hacksaw machine
- Tool kit

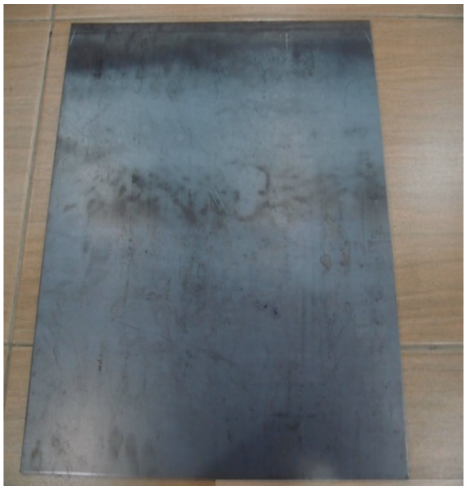


Fig.3.4.1

Mild Steel plate

Fig.3.4.2

Steel plate cutter

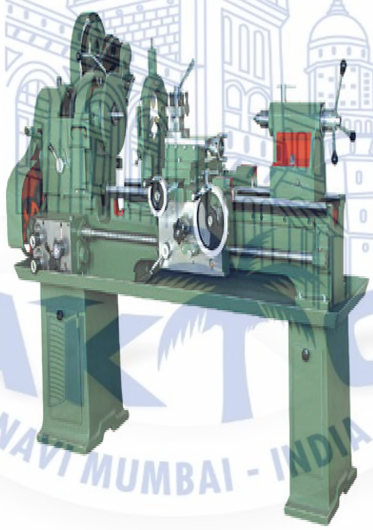


Fig.3.4.3

Welding machine

Fig3.4.4

Lathe Machine

Fig.3.4.5

Drill machine

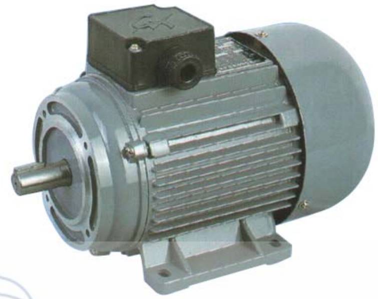


Fig.3.4.6

Electric motor

Fig.3.4.7

Iron angles

Fig.3.4.8 Fig.3.4.9

Steel file tool measuring tape

Fig.3.4.10 Fig.3.4.11

Vices Cutting shearing pliers

4. MACHINE DESIGN

4.1 INTRODUCTION

The subject of MACHINE DESIGN deals with the art of designing machine of structure. A machine is a combination of resistance bodies with successfully constrained relative motions which is used for transforming other forms of energy into mechanical energy or transmitting and modifying available design is to create new and better machines or structures and improving the existing ones such that it will convert and control motions either with or without transmitting power. It is the practical application of machinery to the design and construction of machine and structure. In order to design simple component satisfactorily, a sound knowledge of applied science is essential. In addition, strength and properties of materials including some metrological are of prime importance. Knowledge of theory of machine and other branch of applied mechanics is also required in order to know the velocity. Acceleration and inertia force of the various links in motion, mechanics of machinery involve the design.

4.2 CONCEPT IN M.D.P.

Consideration in Machine Design:

When a machine is to be designed the following points to be considered: -

i) Types of load and stresses caused by the load.

ii) Motion of the parts and kinematics of machine. This deals with the Type of motion i.e. reciprocating. Rotary and oscillatory.

iii) Selection of material & factors like strength, durability, weight, corrosion resistant, weld ability, machine ability are considered.

iv) Form and size of the components.

v) Frictional resistances and ease of lubrication.

vi) Convenience and economy in operation.

vii) Use of standard parts.

viii) Facilities available for manufacturing.

ix) Cost of making the machine.

x) Number of machine or product to be manufactured.

4.3 GENERAL PROCEDURE IN MACHINE DESIGN

The general steps to be followed in designing the machine are as followed.

i) Preparation of a statement of the problem indicating the purpose of the machine.

ii) Selection of groups of mechanism for the desire motion.

iii) Calculation of the force and energy on each machine member.

iv) Selection of material.

v) Determining the size of component drawing and sending for Manufacture.

vi) Preparation of component drawing and sending for manufacture.

vii) Manufacturing and assembling the machine.

viii) Testing of the machine and for functioning.

4.4 EN 10083 C45 steel carbon steel

C45 steel sheet Physio-chemical testing items for products of the plant include tensile test, hardnesstest, impacttest, flatteningtest, and chemical composition analysis, etc. C20, C45 steel pipes are manufactured by cold drawn process.

C45 is a medium carbon steel is used when greater strength and hardness is desired than in the "as rolled" condition. Extreme size accuracy, straightness and concentricity combine to minimize wear in high speed applications. Turned, ground and polished. Heat to 680-710oC, cool slowly in furnace. This will produce a maximum Brinell hardness of 207.

Normalizing
Normalizing temperature: 840-880oC/air.

Hardening
Harden from a temperature of 820-860oC followed by water or oil quenching.

Tempering
Tempering temperature: 550-660oC/air.

C45 steel plate, EN 10083C45 steel plate, under EN 10083 standard, we can regard C45 steel plate as high carbon steel.

C45 steel plate is one mainly of high carbon steel, EN 10083C45 steel plate is for quenching and tempering. Technical delivery conditions for non-alloysteels, these steels are for general engineering purposes.

	Comparison of steel grades	
C45 EN 10083-2 Number:1.0503	JIS G 4051	S 45 C
	DIN 17200	C 45
	NFA 33-101	AF65-C 45
	UNI 7846	C 45
	BS 970	070 M 46
	UNE 36011	C 45 k
	SAE J 403-AISI	1042/1045

Table 4.4.1 Comparison of steel grades

* **Chemical Composition of EN C45 steel**

Grade	C(%)min-max	Si(%)min-max	Mn(%)min-max	P(%)max	S(%)max	Cr(%) min-max
C45	0.42-0.50	0.15-0.35	0.50-0.80	0.025	0.025	0.20-0.40

Table 4.4.2 Chemical Composition

* **Mechanical Properties of EN C45 steel**

Grade	Condition	Yield Strength R°(Mpa)	Tensile Strength Rm (Mpa)	Elon-gation A5 (%)	Hardness HRC	Quenching Temperature (℃)	Benda-bility	Nominal Thickness(t) 1.95mm≤t≤ 10.0mm	
								Rolled	Annealed
C45	Rolled	460	750	18	58	820	Min. recommended Bending radius (≤90°)	2.0 ×t	1.0×t
	Annealed	330	540	30	55	860			
	Water-quenched		2270						
	Oil quenched		1980						

Table 4.4.3 Mechanical Properties

4.5 Properties of steel C45 (1.0503)

❖ **Weldability**: Due to the medium-high carbon content it can be welded with some precautions.

❖ **Hardenability**: It has a low hardenability in water or oil; fit for surface hardening that gives this steel grade a high hardness of the hardened shell.

Product Information

ITEMS INFO

SPECIFICATION FOR OPTION:

Round bar	Diameter: 4mm~800mm or as required
Steel plate	Thick:8mm~300mm, Width:100mm~2300mm
Angle bar	Size:3mm*20mm*20mm~12mm*800mm*800mm
Square bar	Size: 4mm*4mm~100mm*100mm
	Width:10mm~2000mm
Hexagonal	Size: 4mm~800mm
Length: 2m,4m,5.8m,6m,11.8m,12m or as required	

MECHANICAL PROPERTY:

Annealing	Forging	Tempering and Hardening	Normalization
Subcritical annealing: 650~700	1100~850	Tempering: 550~660	840~880
Isothermal annealing: 820~860		Hardening : 820~860 water	

CHEMICAL COMPOSITION:

NO.	C	Mn	Si	Cr	Cu	Ni	P	S
Aisi 1045	0.43~0.50	0.6~0.9	0.10~0.60				⩽0.040	⩽ 0.050
DIN1.1191	0.42~0.48	0.6~0.9	0.15~0.35	≤0.15	≤0.3	≤0.2		
JIS S45C	0.42~0.50	0.5~0.8	≤0.40	≤0.40		≤ 0.4		
C45	0.42-0.50	0.5~0.8	0.4~0.8				⩽0.035	⩽0.035
GB45	0.42~0.50	0.5~0.8	0.17~0.37	⩽0.25	≤0.25	≤0.3	≤0.035	≤0.035
EN8	0.42~0.48	0.6~0.9	0.15~0.35	⩽0.20	⩽0.30	⩽0.20	⩽0.030	⩽0.030

CCSI CCS INDUSTRIAL CORP. CE SGS

Fig.4.5 Shaft Material Information

Why Mild steel C-45 is selected in our project.

1. Easily available in all sections.
2. Welding ability
3. Machinability
4. Cuttingablity
5. Cheapest in all other metals.

Material = C 45 (mild steel)

Take fos 2

$\sigma_t = \sigma_b = 540/fos = 270$ N/mm²

$\sigma_s = 0.5\ \sigma_t$

$= 0.5 \times 270$

$= 135\ N/mm^2$

5. DESIGN

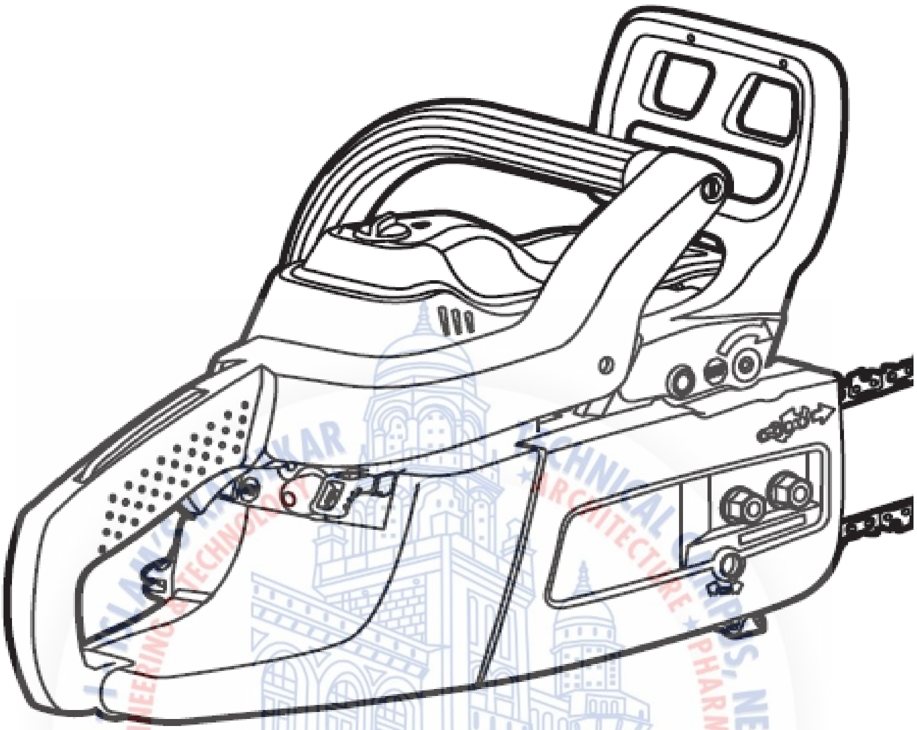


Fig 5.1 Design of motor

5.1 DESIGN OF MOTOR:-

Power of motor = 2 kw= 2000 watt

Rpm of motor = 2650 rpm

5.1.1CALCULATION FOR FINAL SPEED & TORQUE

Power of motor= P = 2000 watt.

$$P = \frac{2\pi N T}{60}$$

Where,

N→ Rpm of motor = 3400 rpm

T →Torque transmitted

$$2000 = \frac{2\pi \times 2650 \times T}{60}$$

T = 7.2 N-m

T = 7207 N-mm

T_1 = 7207 N-mm

- Now, pulley of 100 and 50 diameter is mounted.

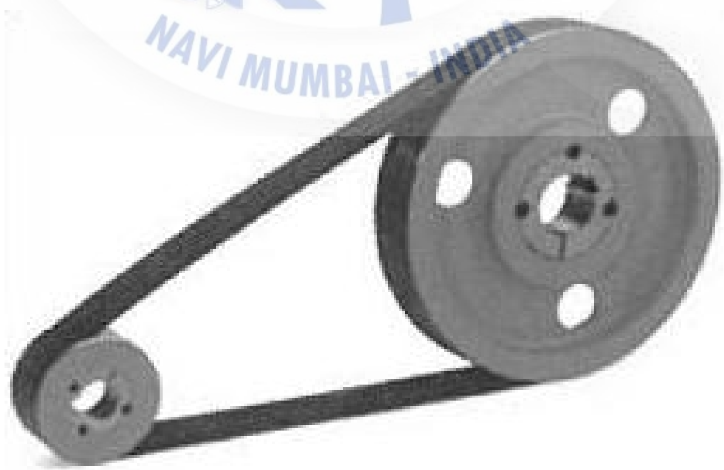


Fig.5.2.1 Pulley

So, ratio is 1:2

[T2 = 14414 N-mm]

[N2 = 1325 rpm]

Now, T2 is the maximum torque among all shafts, so we will check shaft for failure here.

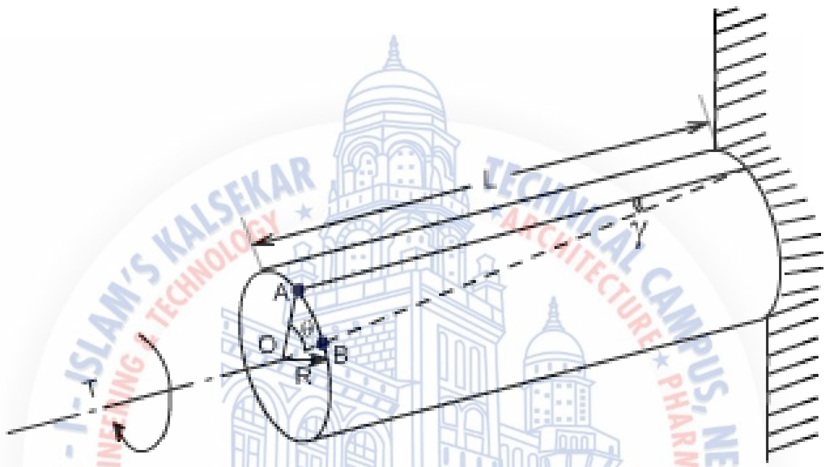


Fig 5.2.2 Torque on Shaft

$T2=\pi/16 \times 135 \times d^3$

$d^3=14414 \times 16/ 3.142 \times 135$

$d=3\sqrt{543.7}=8.16$

Say, d = 9 mm

But we are using- 20 mm shaft so design is safe.

For 20mm Shaft diameter we take standard bearing no. P204

Fig 5.2.3 Pedestal Bearing

P=pedestal bearing

2=spherical ball or deep groove ball bearing

=04=5 * 4 = 20mm

Bore diameter of bearing.

Fig.5.2.4 Pedestal Bearing Used

5.2Design of V- belt:

NUMBER OF V-BELTS

We know that the power transmitted per belt

P = (T1-T2) x V

As we know maximum torque on shaft = T_{max} =T2 = 14414 N-mm

Where,

T1 = Tension in tight side

T2 = Tension in slack side

O1, O2 = center distance between two shaft

From fig.

Sin ∝= R1 - R2= 25 -50

280 280

Sin ∝ = 0.08

∝ = 5.12

TO FIND θ

θ = (180 –2∝) x 3.14/180

θ = (180 –2*5.12) x 3.14/180

θ =2.96 rad

We know that,

$T1/T2 = e^{\mu\theta \text{ Cosec } \beta}$

$T1/T2 = e^{0.25 \times 2.96 \text{ cosec } 20}$

T1 = 8.7*T2

Wa have,

T = (T1 – T2) x R

14414 = (8.7*T2 – T2) x50

T2 = 37.42 N

T1 = 325.61 N

So tension in tight side = T1

V = πDN/60

= 3.142 x 0.100 x 1325/60

[V = 6.93 m/sec.]

POWER :

P = (T1-T2) x V

P = (325.6 –37.42) x 6.93

[P = 1997 W (N-m/s)]

Number of V-Belts:-

$$N = \frac{\text{Total Power transmitted}}{\text{Power transmitted per belt}}$$

$$= \frac{2000}{1997}$$ (power of motor 373 watts)

[N = 1.001]

Say 1 belt,

So 1 belt is sufficient for transmission of power

5.2.1 CALCULATION OF LENGTH OF BELT1:-

We know that radius of pulley on shaft

$r1 = 25mm$

Radius of pulley on motor shaft

$r2 = 50$ mm

Center distance between two pulley = 280 mm

We know length of belt

$$L = \Pi\ (r2+r1) + 2\ x + (r2-r1)^2/x$$

$$= \Pi\ (50 + 25) + (2\ x280) + (50-25)^2/280$$

L = 797 mm = 31 inch

So standardA-30 inch belt is used

5.3DESIGN OF BEVEL GEARS

Inthis machine bevel gears are used to transmit the power from horizontal shaft to vertical shaft.

GEAR DATA:

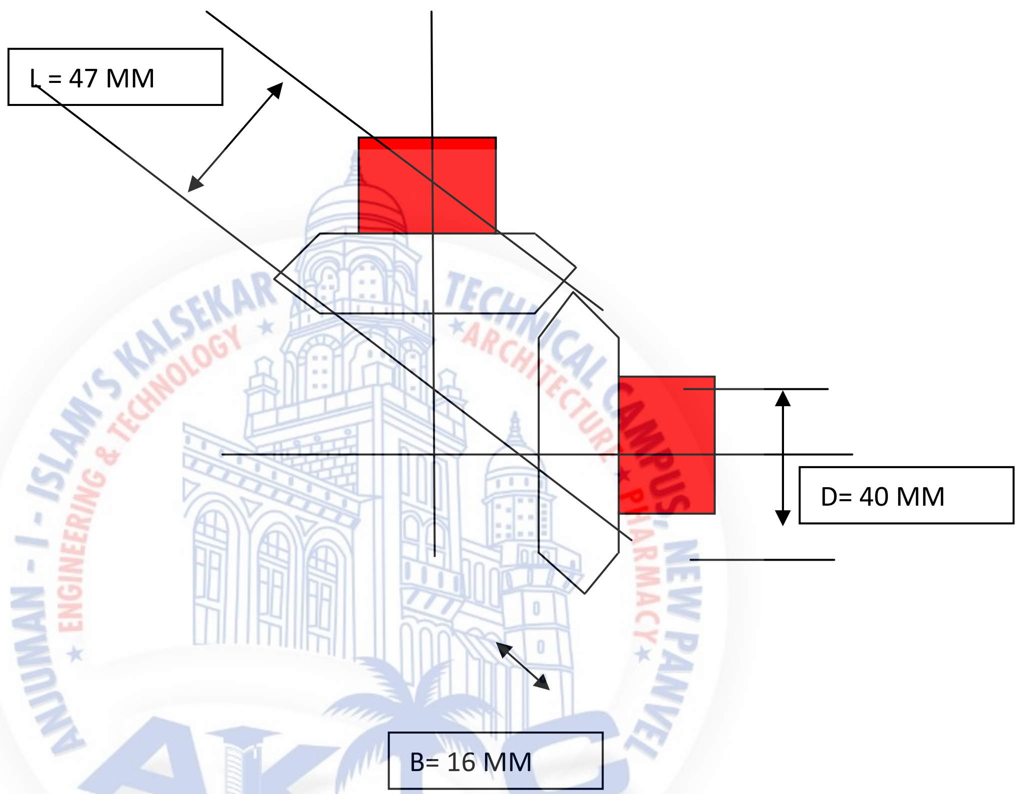


Fig.5.4.1 Bevel Gear

Proportion of bevel gear

Addendum = a = 1 x m = 1 x 2.5 = 2.5mm

Dedendum = d = 1.2 x m = 1.2 x 2.5 = 3mm

Clearance = c = 0.2 x m = 0.2 x 2.5 = 0.5 mm

Working depth = w = 1.5708 x m = 1.5708 x 2.5 =3.927 mm

A pair of teeth of bevel gears mounted, which are interesting at right angles, consists of 16 teeth on both the pinion gears.

Wt = (fo x Cv) b x 3.14 x m x y' (L – B / L)

(REFER MACHINE DESIGN BY R.S. KHURMI & J.K.GUPTA pg.no 880)

Fog = Fop = Allowable static stress = 85 N /mm^2

v = Peripheral speed in m/sec.

v = 3.14 x D x N / 60

v = 3.14 x m x T x N / 60

v = 3.14 x m x 16 x 1325 / 60

v = 837 m mm/sec

v = 0.837 m m/sec

Cv = velocity factor

Cv = 6 / (6 + v)

Cv = 6 / (6 + 2 m)

b = face width = 16 mm

m = module

L = slant height of pitch cone. = 47 mm

y' = tooth form factor

$\theta p1 = \tan^{-1}$ (1/V.R) = $\tan^{-1}$ (Tp/Tg) = $\tan^{-1}$(16/16) = 45

θp2 = θps- θp1 =90 – 45 = 45

So formative number of teeth for the gear

Teg = Tg . sec θp2 = 16 x 1 = 16

y'G = 0.124 – 0.684 / Teg

y'G = 0.124 – 0.684 / 16

y'G = 0.08125

Fog x y'G = 85 x 0.08125 = 6.90

Also for pinion

Fop x y'P = 85 x 0.08125 = 6.90

Since the product of Fog x y'G & Fop x y'P is same so design should be based on gear which is same for pinion.

Mean Radius (Rm):-

Rm = (L-b/2) Sin θp

θp = 45^0

L = 47mm

b = 16 mm

Rm = (47-16/2) sin 45

= 27.57 mm.

Tangential force applied at bevel gear shaft end is 14414N-mm

Torque T = 14414N- mm

T= FxR

14414 = F x

Tangential Force bearing capacity of bevel gear

Wt = (fo x Cv) b x 3.14 x m x y' (L – B / L)

Wt = (85 x 6/ (6+2x 2.5)) 16 x 3.14 x 2.5 x 0.08125 (47 – 16 / 47)

Wt = 341.83 N

Wt = 34.84 kg

As Tangential Force bearing capacity of bevel gear is more than applied force thus design of bevel gear is safe.

Now, on bevel gear shaft pulley of 75mm dia is mounted, so pulley of 100 and 75 dia is mounted.

So, ratio:1.33

T3 = 10837.6 N-mm

N3 = 1762.25 rpm

Two pulley of 75mm dia is mounted 650 mm apart

5.4 CALCULATION OF LENGTH OF BELT2:-

We know that radius of pulley on shaft

r1 = 37.5 mm

Radius of pulley on motor shaft

r2 = 37.5 mm

Center distance between two pulley = 650 mm

We know length of belt

$$L = \Pi\ (r2+r1) + 2\ x + (r2-r1)^2/x$$

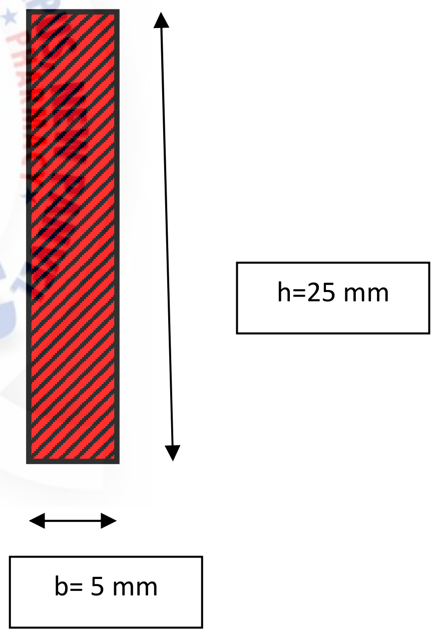
$$= \Pi\ (37.5 + 37.5) + (2\ x650) + (37.5–37.5)^2/650$$

L = 1535.6 mm = 60.45 inch

So standard B-60 inch belt is used

Fig.5.4.1 Belts Used

❖ Link used for sowing seeds may fail under bending



F = maximum force applied = 30 N

For cantilever, M = F x L

M = 30 x 300 = 9000 N-mm

And section modulous = $Z = 1/6\ bh^2$

$Z = 1/6 \times 5 \times 25^2$

$Z = 1/6 \times 3125$

$Z = 520.8\ mm^3$.

Now using the relation,

Fb = M / Z

Fb= 9000/ 520.8 = 17.28 N/mm^2

✓ Induced stress is less then allowable 260 N/mm^2 so design is safe

- **BOX PIPE USED UNDER BELT IS SUBJECTED TO FAIL UNDER BENDING**

  - Consider weight of machine 80 kg, so 25 kg on each box pipe= 800 N

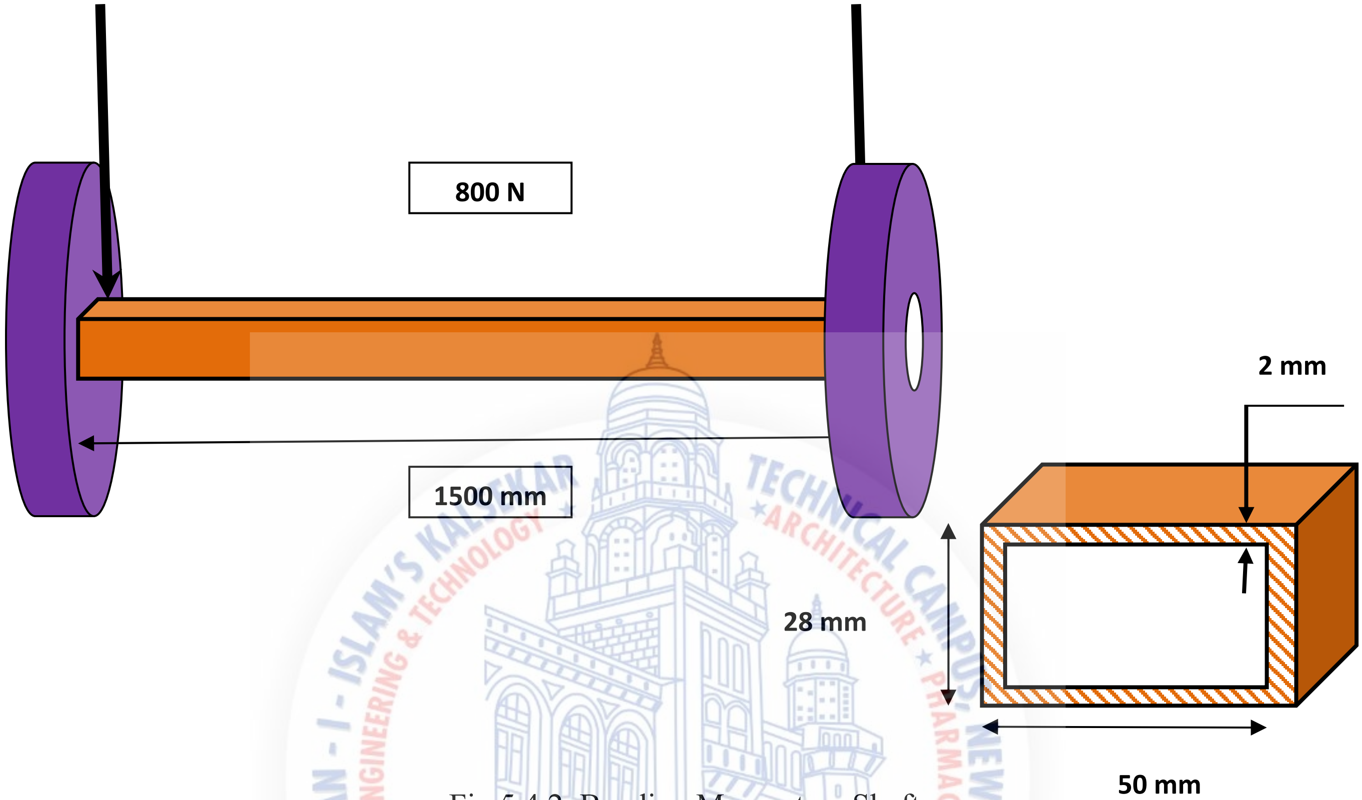


Fig 5.4.2. Bending Moment on Shaft

$M = W L / 4 = 800 \text{ X } 1500 / 4 = 300000$ N/mm

$Z_1 = BT^2 / 6 = 50 \text{ x } 28^2 / 6 = 6533.3 \text{ mm}^3$

$Z_2 = bt^2 / 6 = 46 \text{ x } 24^2 / 6 = 4416 \text{ mm}^3$

$Z = Z_1 – Z_2 = 6533.3 – 4416 = 2117.3 \text{ mm}^3$

$\sigma_b = M / Z$

$\sigma_b = 300000 / 2117.3 = 141.22 \text{ N/mm}^2$

$\sigma_{b \text{ INDUCED}} < \sigma_{b \text{ ALLOWED}}$

$141.22 \text{ N/mm}^2 < 270 \text{ N/mm}^2$

- Hence our design is safe.

5.5Design of transverse fillet welded joint.

Fig.5.5.1 Welded joint

Hence, selecting weld size = 3.2mm

Area of Weld = 0.707 x Weld Size x l

= 0.707 x 3.2 x π x 20

= 142.150 mm^2

Force Exerted = 30 x 9.81

= 300 N

Stress induced = Force Exerted / Area of Weld

= 300 / 142.15

= 2.11 N/mm^2

For filler weld:

Maximum Allowable Stress for Welded Joints = 210 Kgf/ cm^2

= 21 N/mm^2

Hence safe.

6. FABRICATION

Fig. Fabrication

Following different components we have fabricated in our workshop Using available resources:

6.1 PROCESS PLANNING

Process planning is an important function, which takes place directly after the design of a product. It takes the information received and creates a plan for manufacture. The process planning involves an application of systematic procedures, which involves following steps.

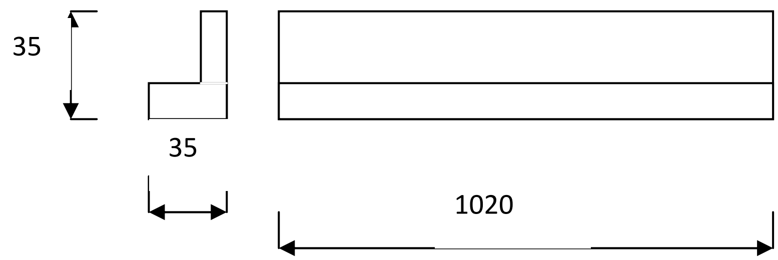
A) **PRELIMINARY PART PRINT ANALYSIS**

1) Size configuration
2) Material
3) Dimensional relationships an identification of various reference surfaces.
4) Implicit and explicit remarks regarding from error and finish.

B) **DETERMINATION LOGICAL SEQUENCE OF OPERATION**

1) Identification of surface to be machined, selection of machine tool.
2) Supporting accessories, pictures, gauges etc.

OPERATION SHEET NO: 1



COMPONENT: Frame

MATERIAL: - M.S. angel

MATERIAL SPECIFICATION:-I.S.L.C. 35X.35 X 4 mm

SR. NO	DESCRIPTION OF OPERATION	MACHINE USED	CUTTING	MEASUREMENT	TIME
1	Cutting the angle in to length as per dwg	Gas cutting machine	Gas cutter	Steel rule	15min.
2	Cutting the number of pieces of angle in to length as per dwg	Gas cutting machine	Gas cutter	Steel rule	15min.
3	Filing operation can be performed on cutting side and bring it in perpendicular C.S.	Bench vice	File	Try square	15 min.
4	Weld the angel to the required size as per the drawing	Electric arc welding machine	-------	Try square	20 min
5	Drilling the frame at required points as per the drawing.	Radial drill machine	Twist drill	Vernier calliper	10 min.
6	Welding as per dwg	Arc welding		Steel rule, Try square	240 hrs

OPERATION SHEET NO: 2

COMPONENT: Shaft

MATERIAL: - M.S.

MATERIAL SPECIFICATION:-120 x 20 mm

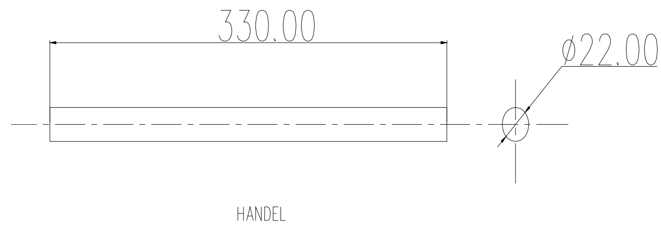
Sr. No.	Operation	Machine Use	Description of operation	Tool Use	Time
1.	Cutting	Power Hacksaw	Cutting raw material of required length	Saw blade	15min.
2.	Facing	Lathe	Cutting excessive material to required length	Single point cutting tool	15min.
3.	Turning	Lathe	As per specification	Single point cutting tool	15 min.
4.	Finishing & Inspection	Lathe	Finish as per tolerance	File & polish paper	20 min

OPERATION SHEET NO: 3

COMPONENT: HANDEL

MATERIAL: - M.S.

MATERIAL SPECIFICATION:-330 x 22 mm



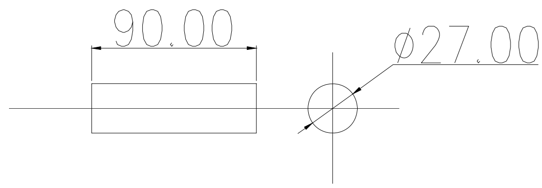
Sr. No.	Operation	Machine Use	Description of operation	Tool Use	Time
1.	Cutting	Power Hacksaw	Cutting raw material of required length	Saw blade	15min.
2.	Facing	Lathe	Cutting excessive material to required length	Single point cutting tool	15min.
3.	Turning	Lathe	As per specification	Single point cutting tool	15 min.
4.	Finishing & Inspection	Lathe	Finish as per tolerance	File & polish paper	20 min

OPERATION SHEET NO: 4

COMPONENT: SEAT SHAFT

MATERIAL: - M.S

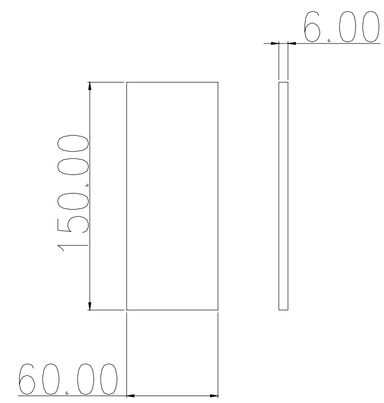
MATERIAL SPECIFICATION:-90 X 27 mm



SEAT SHAFT

Sr. No.	Operation	Machine Use	Description of operation	Tool Use	Time
1.	Cutting	Power Hacksaw	Cutting raw material of required length	Saw blade	15min.
2.	Facing	Lathe	Cutting excessive material to required length	Single point cutting tool	15min.
3.	Turning	Lathe	As per specification	Single point cutting tool	15 min.
4.	Finishing & Inspection	Lathe	Finish as per tolerance	File & polish paper	20 min

OPERATION SHEET NO: 5



PANDEL SUPPORT

COMPONENT: PANDEL SUPPORT

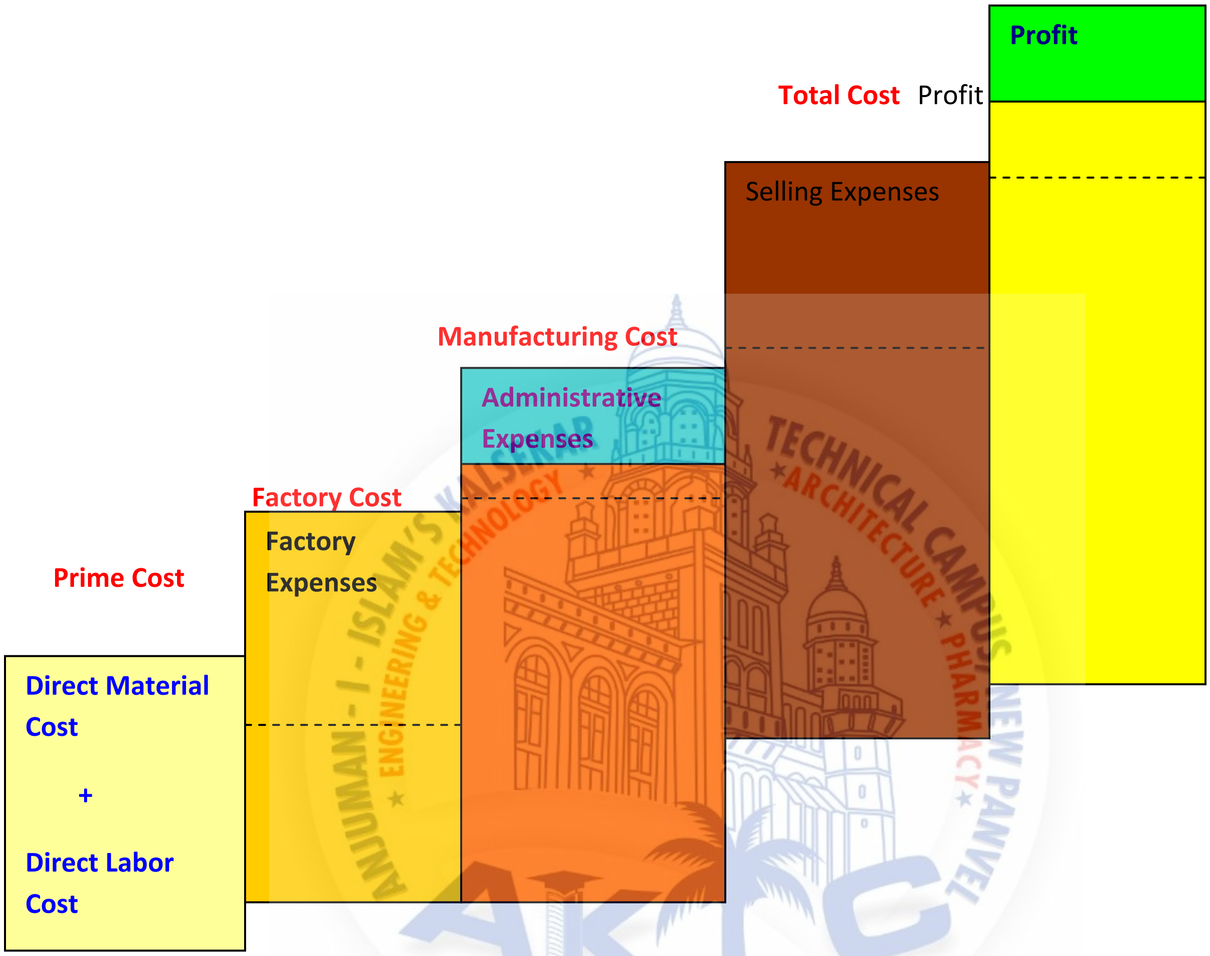
MATERIAL: - M.S

MATERIAL SPECIFICATION:- 150 X 60 X 6 mm

Sr. No.	Operation	Machine Use	Description of operation	Tool Use	Time
1.	Cutting	Gas welding	Cutting raw material of required length	Welding torch	15min.
2.	Filing burrs	File	Removing burr at cutting edge	Flat file	10min.
3.	Finishing & Inspection	Vice	Finish as per tolerance	File & polish paper	20 min

7. COST ESTIMSTION

7.1 SELLING PRICE:



7.2 COST STRUCTURE

Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involved in a design and manufacturing with all related services facilities such as pattern making, tool, making as well as a portion of the general administrative and selling costs.

7.3 PURPOSE OF COST ESTIMATING

1. To determine the selling price of a product for a quotation or contract so as to ensure a reasonable profit to the company.

1. Check the quotation supplied by vendors.
2. Determine the most economical process or material to manufacture the product.
3. To determine standards of production performance that may be used to control the cost.

BASICALLY THE COST ESTIMATION OF TWO TYPES:

1. Material cost
2. Machining cost

1. MATERIAL COST ESTIMATION:

Material cost estimation gives the total amount required to collect the raw material which has to be processed or fabricated to desired size and functioning of the components.

These materials are divided into two categories.

1. Material for fabrication:

In this the material in obtained in raw condition and is manufactured or processed to finished size for proper functioning of the component.

2.Standard purchased parts:

This includes the parts which was readily available in the market like allen screws etc. A list in forchart by the estimation stating the quality, size and standard parts, the weight of raw material and cost per kg. For the fabricated parts.

2. MACHINING COST ESTIMATION:

This cost estimation is an attempt to forecast the total expenses that may include to manufacture apart from material cost. Cost estimation of manufactured parts can be considered as judgment on and after careful consideration which includes labour, material and factory services required to produce the required part.

7.4 Cost Analysis

7.4.1Material Cost

The general procedure for calculation of material cost estimation is

1. After designing a project a bill of material is prepared which is divided Into two categories.
    a. Fabricated components
    b. Standard purchased components
2. The rates of all standard items are taken and added up.
3. Cost of raw material purchased taken and added up.

7.4.2 LABOUR COST:

It is the cost of remuneration (wages, salaries, commission, bonus etc.) Of the employees of a concern or enterprise.

Labour cost is classifies as:

1. Direct labour cost
2. Indirect labour cost

Direct labour cost:

The direct labour cost is the cost of labour that can be indentified directly with the manufacture of the product and allocated to cost centers or cost units. The direct labour is one who counters the direct material into saleable product the wages etc. of such employees constitute direct labour cost. Direct labour cost may be apportioned to the unit cost of job or either on the basis of time spend by a worker on the job or as a price for some physical measurement of product.

Indirect labour cost:

It is that labour cost which cannot be allocated but which can be apportioned to or absorbed by cost centers or cost units. This is the cost of labour that doesn't alters the construction, confirmation, composition or condition of direct material but is necessary for the progressive movement and handling of product to the point of dispatch e.g. maintenance, men, helpers, machine setters, supervisors and foremen etc.

The total labour cost is calculated on the basis of wages paid to the labour for 8

Hours per day.

Cost estimation is done as under

7.4.3 Total Cost of Project

Cost of project = (A) material cost + (B) Machining cost + (C) labour cost

The total labour cost is calculated on the basis of wages paid to the labour for 8 hours per day.

Cost estimation is done as under

Cost of project = (A) material cost + (B) Machining cost + (C) labour Cost

(A) Material cost is calculated as under :-

i) Raw material cost

ii) Finished product cost

i) Raw material cost: -It includes the material in the form of the Material supplied by the "Steel authority of India limited" and 'Indian aluminum co.,' as the round bars, angles, square rods, plates along with the strip material form. We have to search for the suitable available material as per the requirement of designed safe values. Hence the cost of the raw material is as follows:-

RAW MATERIAL & STANDARD MATERIAL

SR NO	PART NAME	MAT	QTY	COST
1	MS PLATE 5 mm	MS	10 KG	600
2	BOX PIPE	MS	10 KG	600
3	SHAFT DIA 20 MM	MS	3 KG	200
4	V-BELT	RU	2 NOS	900
5	PULLEY	CI	4 NOS	1600
6	BEVEL GEAR	MS	2 NOS	900
7	WHEEL	MS	4 NOS	1800
8	BEARING	CI	7 NOS	2800
9	MS PLATE 5 mm	MS	1 SQM	300
10	NUT BOLT WASHER M 10	MS	20 NOS	275
11	PETROL ENGINE	STD	1 NO	4000
12	OIL, PETROL	STD	1 L	200

13	**EN 8 PLATE**	**EN-8**	**10 KG**	**900**
14	**COLOUR**	**STD**	**0.5 L**	**100**
15	**MISCELLINOUS**	**-**	**-**	**1000**
			TOTAL	**12440**

Table 7.4.1 Cost of Raw materials

B) DIRECT LABOUR COST:-

SR. NO.	OPERATION	HOURS	RATE / LABOUR	AMOUNT
1.	Turning	10	150	1500
3.	Drilling	7	100	700
4.	Welding	16	175	2800
5.	Grinding	3	60	180
6.	Tapping	3	40	120
7.	Cutting	8	40	320
8.	Gas cutting	8	50	400

9.	Assembly	2	100	200
10.	Painting	2	100	200
			TOTAL	6720/-

Table 7.4.2 Labour Cost

INDIRECT COST

Transportation cost = ₹500/-

Coolant& lubricant = ₹100/-

Drawing cost = ₹500/-

Project report cost = ₹2000/-

TOTAL INDIRECT COST = ₹ 2100/-

TOTAL COST

= (Raw Material Cost + STD Parts Cost) + Direct Labour Cost +Indirect Cost

Total cost of project = 12440+ 6720 +2100

Total cost of project = ₹ 21260/-

8. MAINTENANCE

No machine in the universe is 100% maintenance free machine. Due to its continuous use it is undergoing wear and tear of the mating and sliding components. Also due to the chemical reaction takes place when the material comes in the contact with water, makes its corrosion and corrosion. Hence it is required to replace or repair. This process of repairing and replacing is called as maintenance work.

8.1 AUTONOMOUS MAINTAINENCE ACTIVITY:-

1) Conduct initial cleaning & inspection.
2) Eliminate sources of dirt debris excess lubricants.
3) Improve cleaning maintainability.
4) Understand equipment functioning.
5) Develop inspection skills.
6) Develop standard checklists
7) Institute autonomous inspection
8) Organize and manage the work environment
9) Manage equipment reliability.

<u>CLAIR</u>→CLEANING,LUBRICATING, ADJUSTMENT, INSPECTION

CLEANING

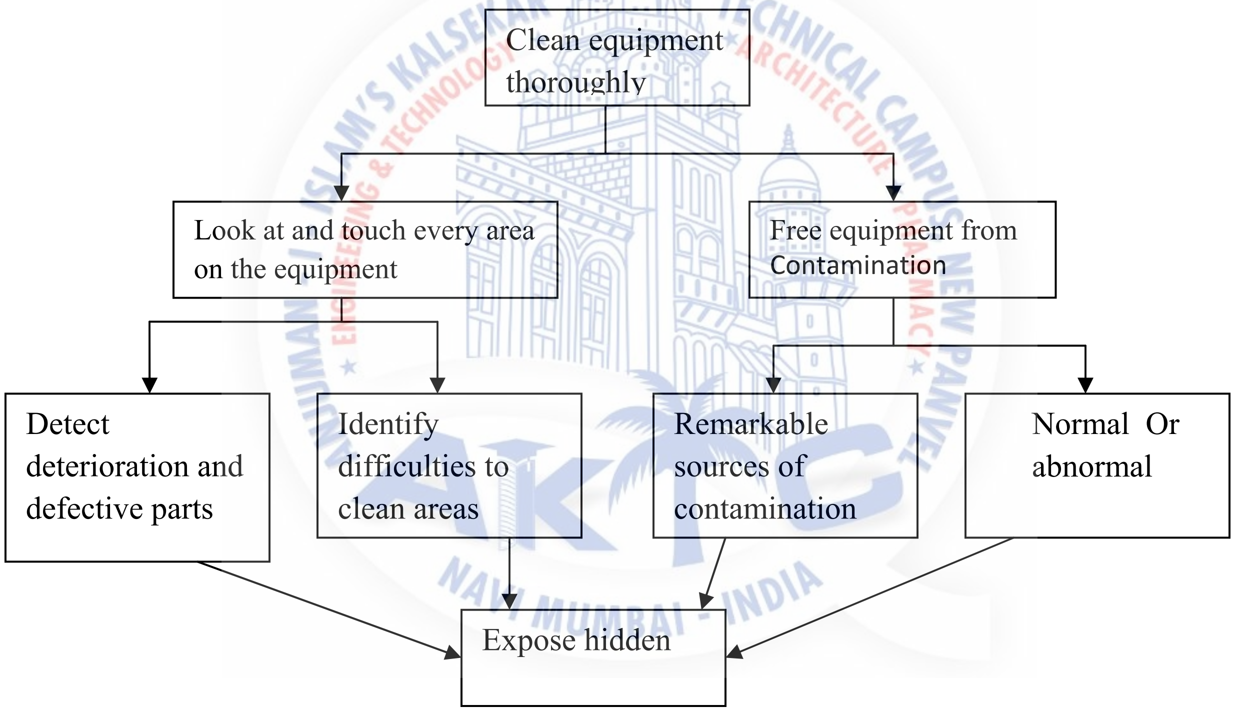
Why cleaning?

Prevent or eliminate contamination.

Find ways to simplify the cleaning process.

Facilitates through inspection when done by knowledgeable operators and \ or maintainers.

CLEANING IS INSPECTION….



CLEANING PROCESS

- What to look for when cleaning.
  - Missing part
  - Wear
  - Rust and corrosion
  - Noise
  - Cracks
  - Proper alignment
  - Leaks
  - Play or sloppiness

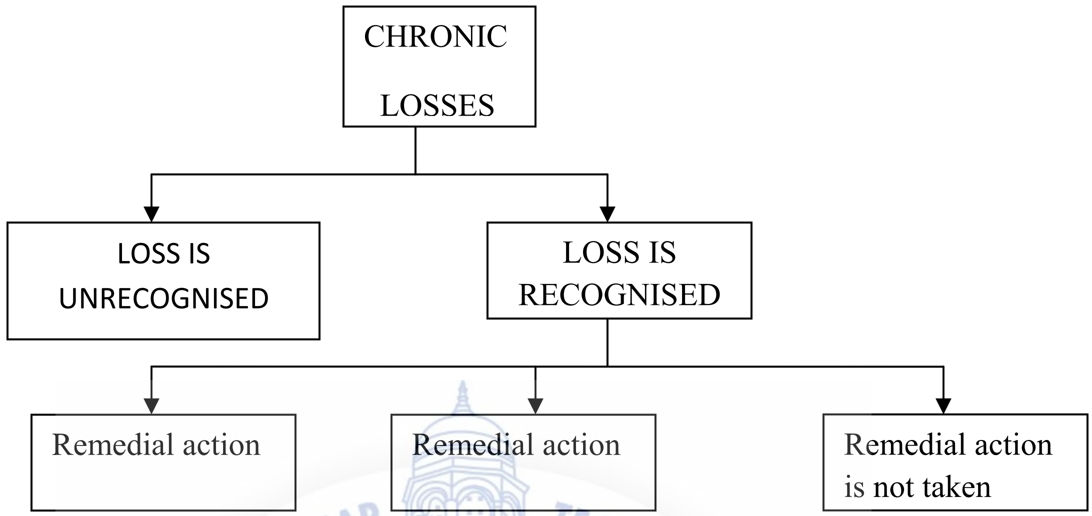
8.2 VISUAL AIDS TO MAINTAIN CORRECT EQUIPMENT CONDITION

- Match marks on nut and bolts
- Color marking of permissible operating ranges on dials and gauges
- Marking of fluid type and flow direction of pipes
- Marking at open / closed position on valves
- Labeling at lubrication inlets and tube type
- Marking minimum / maximum fluid levels
- Label inspection sequences

8.3 ADJUST & MINOR REPAIR

Minor repairs if

- Trained
- Experienced
- Performs safety
- Simple tool required
- No longer than 20/30 minutes



CRONIC DEFECTS

8.4 EQUIPMENT IMPROVEMENT

1. Restore obvious deterioration throughout.
2. Establish plan select pilot area, determine bottleneck.
3. Study and understand the production process.
4. Establish goals for improvement.
5. Clarify the problem, collect the reference manuals contact resources.
6. Conduct evaluation through such techniques as RCM analysis, FMECA, FTA (Root cause failure analysis).
7. Determine improvement priorities, costs and benefits.
8. Execute improvement in pilot area standardize technique and document what you have done.
9. Monitor results and optimize based on those results.
10. Implement plant wide

8.5 EQUIPMENT RESPONSIBILITIES OF OPERATOR

- Operation with the proper standard procedure.
- Failure prevention.
- Failure resolution.
- Inspection.
- Equipment up keep.
- Cleaning.
- Lubricating.
- Lightning fasteners.

Minor repairs.

Trouble shooting.

9. RESULTS AND DISCUSSION

Prototype mechanism was evaluated in the field, and it worked. There were some points to be redesigned. Tray mechanism worked but the design should be altered or improved. The tray move to both left and right directions while the tray on a grove. That resulted high friction. Therefore it is better to have nylon bushes and iron or Aluminum rods to reduce the friction. Tray moving mechanism made using nylon Sprocket wheel. As the tension is high in that chain the nylon sprocket get damaged easily. It's better to use iron sprocket with same diameter and number of teeth to reduce the damage when tension is high. The sprocket and chain used for the machine Was foot cycle chains and sprockets. When machine is operated the sprockets get damaged by bending the teeth. So it is better to have motorcycle chains and sprockets to power transmission. But that will result an increase in weight. Therefore, instead of chain and sprocket speed reducing mechanism, a gear system should be used.

In this machine ground wheel supplies the power to operate transplanting arm and tray mechanism. Pulling the machine will rotate the ground wheel. Increasing the size and number of lugs (fins) around ground wheels will increase contact area of the ground wheel with the field and make it easy to operate. The machine has to pull to operate. Ergonomically it is better to push weight rather than to pull. So it is better to turn the handle and the power supplying mechanism to push the machine instead of pulling it. Use of aluminum and alloy for construction will help to reduce the weight of the machine. The machine used to plant 2 rows simultaneously. Number of plants per one hill can be increased while altering the tray moving distance and adding engine to power the operation. The dapog mat was compacted due to high tray angle. Tray angle should be reduced to avoid the problem. Suitable dapog for the machine must have amid layer 1cm or less thick. Increased thickness of the mud layer increases the power requirement to the planting arm.

Diameter of the ground wheel axel should be increased to have better power supply and stability of the machine. Axel of the sprocket wheel must be constructed using 25 shafting iron to reduce the friction and play. Instead of iron bushes for sprocket wheel axel nylon bushes must be used.

More Tools such as Fertilizer tool, can be attached where Space is Available on the Mini Farming Machine. Ploughing Tool can also be fixed when machine is Engine driven and not Man Driven.

10. CONCLUSION

The Mini Farming machine worked satisfactorily. But, there were some improvements to be done before introducing to the farmers. The machine is driven by man power but engine can be coupled to enhance the performances. Machine can be developed to transplant several rows simultaneously. Weight of the machine should be reduced by removing sprocket, chains and adding small gears. The dapog must have thin mud layer for easy removal of seedlings.

Economics of transplanting methods:

The annual fixed cost and variable costs were calculated by depreciation method by taking the purchase cost, annual uses of transplanter and life of machine. The daily wage of workers was taken to be Rs.150 with ten minutes break in every half an hour. The cost of operation per hectare were found to be Rs.2550 for local practice whereas Rs.2484 for 2 row transplanter, Rs.2346 for 3 row transplanter and Rs.2237 for 4 row paddy transplanter. It was observed that while transplanting manually in bending posture the average area transplanted is 0.03 ha/day. But maximum 0.10 ha/day in case of 4 row paddy transplanter followed by 0.08 ha/day in 3 row and 0.065 ha/day in case of 2 row paddy transplanter.

The ergo-economic analysis of different paddy transplanting methods revealed that the physiological response reduced in 2 row paddy transplanter from that of 3 row & 4 row paddy transplanter. The HRwork ,ΔHR,OCR,RCWL were reduced from 137.4 beats/min to 127.7 beats/min,67 beats/min to 58.2 beats/min,1.10 l/min to 0.9 l/min,64.3 percent to 57.8 percent from 4 row transplanter to 2 row transplanter. More force in pulling the transplanter in forward direction by female worker was obtained which was 183 N (18.6 kgf) in 4 row and lowest 104 N (11 kgf) in 2 row paddy transplanter. The average transplanting area was recorded minimum 0.03 ha/day in manual method of transplanting & 0.10 ha/day in 4 row transplanter. The continuous working time was recorded 17 minutes in 4 row transplanter, 28 minutes in 3 row and 32 minutes in 2 row transplanter. The cost of operation per hectare was calculated to be maximum Rs.2550 in manual transplanter and Rs. 2237 in 4 row transplanter. Keeping all the physiological and economical parameters into consideration the 3 row paddy transplanter was found to be the best among all transplanting methods.

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[6]International Journal of Novel Research in Engineering, Science & Technology Volume-1, Issue-1, March, 2016Prof. Abhijit G. Naik[1], Prof. Amay Deorao Meshram[2], Prof. Siraj Y. sayyad[3]
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DESIGN, MODELING AND PERFORMANCE ANALYSIS OF MANUALLY OPERATED SEED SOWING MACHINE”

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