CHAPTER-1

INTRODUCTION

1.1 Status of agricultural mechanization in India

Most of the developing countries of Asia have the problem of high population and low level of land productivity as compared to the developed nations. One of the main reasons for low productivity is insufficient power availability on the farms and low level of farm mechanization. This is especially true for India.

It is now realized the world over that in order to meet the food requirements of the growing population and rapid industrialization, modernization of agriculture is inescapable. It is said that on many farms, production suffers because of improper seedbed preparation and delayed sowing, harvesting and threshing. Mechanization enables the conservation of inputs through precision in metering ensuring better distribution, reducing quantity needed for better response and prevention of losses or wastage of inputs applied. Mechanization reduces unit cost of production through higher productivity and input conservation.

Agricultural implement and machinery program of the Government has been one of selective mechanization with a view to optimize the use of human, animal and other sources of power. In order to meet the requirements, steps were taken to increase availability of implements ,irrigation pumps ,tractors ,power tillers, combine harvesters and other power operated machines and also to increase the production and availability of improved animal drawn implements. Special emphasis was laid on the later as more than 70% of the farmers fall in small and marginal category. Liberal credit has helped in acquiring new machines. For example, Faridkot district in Punjab recorded 137 tractors per thousand hectares in 1986-87 where as many of the districts in the country may not have a single tractor even today. The availability of farm power through mechanical means was estimated as 2.71 hp per hectare in Punjab in 1986-87 where as many states may not have one tenth of it.

It is generally said that mechanization of small farms is difficult .But Japan having average land holding even smaller than ours, with proper mechanization has led agriculture to great heights. In order to minimize the drudgery of small fanners ,to increase efficiency and save fanner's time for taking up additional /supplementary generating activities , the use of modern time saving machines/implements of appropriate size needed to be suitably promoted.

1.2. Level of Mechanization in India

Industrialized countries of the west and in the Asian sub-continent have achieved almost 100 % mechanization in agriculture. Among the developing countries even in China, South Korea and Pakistan are much ahead of India. Facts recorded from FAO Year Book 1990, indicating the density of tractors and combine harvesters per thousand hectare may be seen. The world average is 19.15 tractors per thousand hectare and the tractor density in India is only 5.59 per thousand hectare which is far below the international average

.In India, the introduction of improved implements was initiated in 1880, with the advent of the Department of agriculture. With the organization and expansion of the departments in the year 1905, steps were taken to accelerate the pace of introduction of improved farm implements. A modest beginning of mechanization was made by utilizing World War II surplus machines by the Central tractor Organization in late 40's and early 50's

Manufactures of tractors and power tillers in India commenced in 60swhere as manufacture of engines and pumps started much earlier. Till mid 70s, part of demand of fann machines was met from indigenous sources. Though substantial units of agriculture machines have been introduced in the recent past, yet adoption had mostly been in the northern states and in the scattered pockets/areas where better irrigation facilities were available

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1.3. Research & Development System

The Indian Council of Agricultural Research (ICAR) is the main organization looking after all agricultural research, including agricultural implements and machinery. It coordinates a number of research projects with centers at different places in the country. Some of the State Governments have also facilitated in setting up of research organizations at state level. Each of the state has at least one agricultural university.

A research program usually concentrates on the development of equipment suitable to a given farming conditions. The objective is to improve upon the performance of indigenous implements or develop a new implement that can either enhance labour productivity or appropriately mechanize the operation where a labour or power shortage hinders completing the task in time.

Major tractor manufactures have set-up their own R&D facilities with well equipped laboratory with well equipped test track. Example: Escorts, Eicher, HMT, TAFE, PLT & Mahindra. However the small scale industries hardly have any facility for research and development. Most of the items being manufactured by them have been adopted from the designs available within and outside the country.

1.4. Future Prospects

Technology in the developed countries has undergone sea change in recent years. Products being manufactured in India require a similar approach to provide more reliable machines in terms of economy in operation, comfort, safety, easy maintenance and higher efficiency. Turbo charging and supercharging of the engines have become quite common now a days in the developed countries. Similarly, synchromesh transmission system on agricultural machines has become a common feature.

Fluid couplings or turbo clutches are being incorporated to cushion both engine and transmission against shock load, jerking, vibration and reducing clutch wear. Monitoring and control systems are needed on machines to assist the operator by way of automation in control and information's on wheel slip, area covered, maintenance requirement etc. These developments are required for tractors, power tillers, combine harvesters, engines and other similar machines.

Indian Farm Machinery Industry has not made significant achievements in exports expect a small quantity of tractors .Therefore tractor and farm machinery manufactures will have to strive for marketing in the world wide competition market to get reasonable market share in the exports.

CHAPTER-2

LITERATURE SURVEY

2.1. GENERAL

Soil tiller and weeder reduces human effort as compared to operation by bullocks. The bullock implements require the hand and body pressure to achieve depth and alignment of the implement in use, whereas in soil tillers and weeder, the implements are mostly self guided. This reduces human drudgery to a great extent. The comparative higher output of operation by the soil tiller and weeders as compared to bullocks reduces the operational time and achieves timeliness in operation. The maintenance of the soil tiller and weeder is easy. It is ideally suited for mechanizing small farm holdings which account for 80 % of the farm holdings of the country.

2.2. EARLIER RESEARCHERS

Md. Aqib Naque[2006]

Working of the project is based on engine and chain sprocket mechanism which moves the cutter or tiller. It is a great saver of time and expenses on field operations. Thus it will have very effective uses on the farm field either for tiling as well as for weeding. Development of high capacity energy efficient versatile machines and combination machinery for increased labor productivity, reduced unit cost of operation, improved timeliness of operation and suitable for custom hiring.

Kr. Mandal [2010]

Light weight power tillers have been introduced recently in the country. Most models of the light weight power tiller being manufactured in India have been provided with a front or rear mounted powered rotary unit for forward movement as well as for tillage operation. There is scope for these power tillers to be used as seedbed preparation and inter culture operation in wide spaced row crops like cotton and sugarcane. In order to assess the performance of lightweight power tiller, one such model was evaluated at Central Mechanical Engineering Research Institute, Durgapur under various soil conditions.

Barbee [2012]

The problem arises from the fact that available workers to work in farm lands is insufficient. And as a result most of the fields are left uncultivated. The middle class fanners cannot bear the high cost of power tillers available in the market. To design and fabricate a tiller based on diesel that is easy to operate and should come with an affordable price so that middle class fanners would not find any problem buying them.

Theoretical analysis indicates that the teeth number and sprocket pitch have the most influential effect on the vibration in the conveying direction; external impulsive loads are caused a significant increment of chain force, especially when loads caused by large materials; the initial pressure angle affects the roller chain stress conditions immensely.

Junzo huo[2012]

Mechanical models of a chain drive system are proposed and applied to the theoretical analysis of chain drive system of a certain type of heavy duty apron feeder in mobile crushing station, including a five-bar model discussing the speed fluctuation problems of the chain drive system, an elastic collision model probing the effects of impulsive loads and a model of meshing area revealing the stress of chain links. Theoretical analysis indicates that the teeth number and sprocket pitch have the most influential effect on the vibration in the conveying direction; external impulsive loads are caused a significant increment of chain force, especially when loads caused by large materials; the initial pressure angle affects the roller chain stress conditions immensely.

Then, multi-body dynamics models are established for the verification of theoretical results and dynamic simulation. Simulation results are in good agreement with the theoretical results and illustrate that impulsive loads affect chain tension significantly.

S.Anjum [2012]

This paper describes the design of a non-conventional chain drive mechanism for a m. Chain drives are regularly used when power or motion or both of them are to be transferred over a short distance. A lot of different systems were available in the markets that had certain standards. To drive small scale machines no standard chain was available. In this study paper a roller chain was designed because of its simplicity, strength, ability to work in harsh environment and low maintenance.

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Manda.R[2012]

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F.A.Adamu, B.G.jahun[2014]

In this paper the author describes about the performance factor of a power tiller machine. They also describe the demand for light weight power tiller and its availability. Other parameters such as fuel efficiency, field capacity are discussed. we have to take into consideration these factors while designing a multipurpose machine.

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P.sarec,O.sarec[2015]

The lowest values of soil penetration resistance below are discussed and measured in this paper. The resistance is measured with the help of chisel shaped shares. In the case of format kofferling cultivators vadastead top down 400 and format turbulent 450 showed good capacity In embedding plant residue. we have taken these results for our project.

CHAPTER-3

PROPOSED MODEL

3.1. Earlier model & Proposed model

The earlier tiller machine contains only rotor withb lades and cage wheel. We modified that by adding deflector in between them and the rotor is placed in back of the machine.

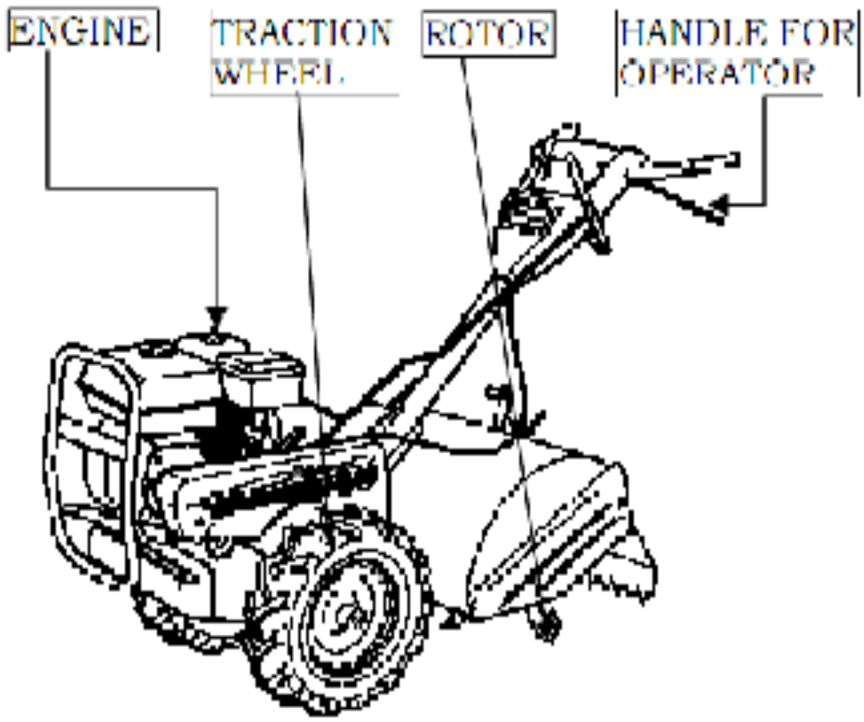

Fig-1 Power tilling machine

PROPOSED MODEL:

Fig-2 scale forming tiller machine

3.2. Components

1. Frame

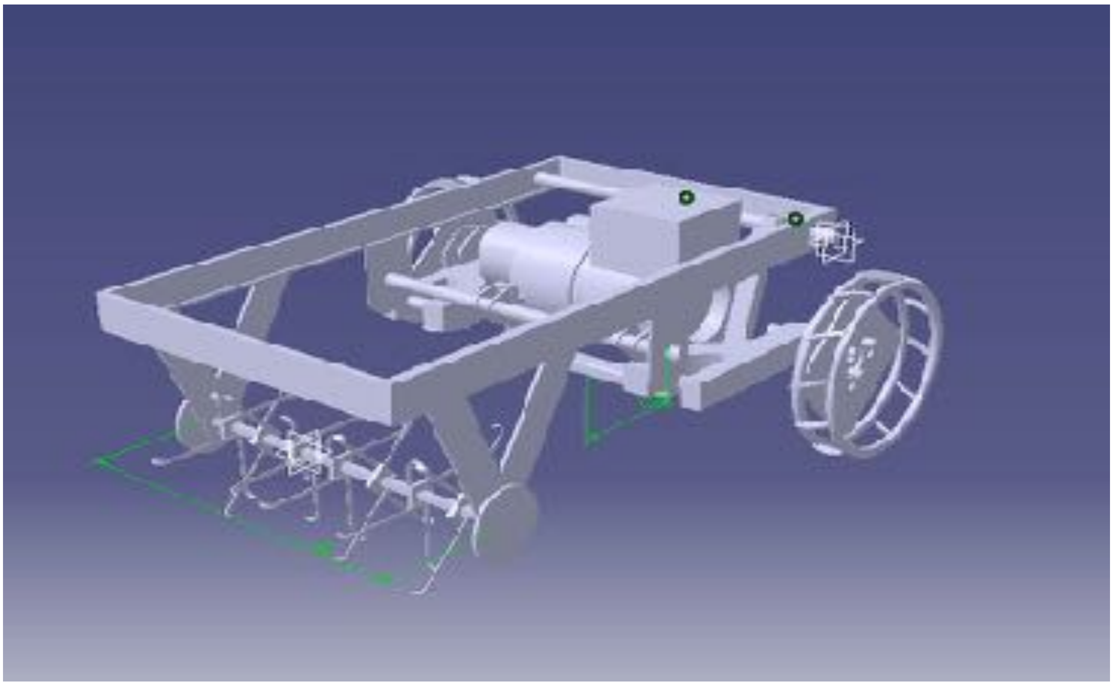

Fig-3 metal frame

2. Rotor with blades

Fig-4 rotor with blades

3. Cage wheel

Fig-4 cage wheel

Fig-5 cage wheel

4. Sprocket

Fig-6 sprocket

5. Chain drives

Fig-7 chain drive

6. Diesel engine

Fig-8 diesel engine

7. Bearings

Fig-9 Bearings

8. Deflector

Fig-10 deflectors

9. Ploughshare

Fig-11 ploughshare

CHAPTER-4

4. DETAILS OF COMPONENTS

4.1. Frame

The frame is the integral component of this machine where the other various components are attached to it.

4.1.1. Function of frame

- To support for other components of the machine.
- To withstand static and dynamic loads without under deflection or distortion.

4.1.2. Loads on Frame

- Weight of the vehicle and the engine load will causes vertical bending of side members.
- Load due to cage wheel impact with obstacles on land which causes that particular side of the wheel to remains obstructed while the other side will tends to move forward, distorting the frame to parallelogram shape.
- Engine torque and braking torque tending to bend the side members in the vertical plane.

4.2. Rotor with blades

It is present at the front end of the machine. It helps to plough the soil at constant speed. It gets rotational power from the engine through pulley and chain drive. Here blades are connected on shaft through bolts and nuts in order to replace when it was damaged.

4.2.1. Blade Materials

The chemical composition of the steels to be used for the manufacturing of blades shall be as follows.

a) Carbon steel:

Carbon	-	0.70 to 0.85 %
Silicon	-	0.10 to 0.40%

Manganese- 0.50 to 1.0 %

b) Silico-Manganese Steel:

Carbon - 0.50 to 0.60 %

Silicon - 1.50 to 2.00%

Manganese - 0.50 to 1.00%

Some of the typical steels that may be used are T70Mn65, T75, T80Mn65 and 55Si2Mn90.

4.2.2. Blade Hardness

The blades should be heat treated, quenched and tempered. The hardness in edge portion shall be 56 ± 3 HRC and shank portion shall be 37 to 45 HRC.

4.3. Cage wheel

It is present at the rear end of the machine. It is provided with lugs in horizontal direction along it's circumference in order to improve more stress on soil and makes the wheel to move forward without slip.

It gets power from engine through chain and pulley drive and rotates with constant speed but the speed of cage wheel is less than the speed of the rotor.

fig-12 Cage wheel

4.4. Sprockets

The sprocket is used to transmit power from one shaft to another by means of chains, chains . Since the velocity ratio is the inverse ratio of the diameters of driving and driven sprocket, therefore the sprocket diameters should be carefully selected in order to have a desired velocity ratio. The sprocket must be in perfect alignment in order to allow the chain to travel in a normal to the sprocket faces.

Fig-13 sprockets

4.5. Engine

As per standards the torque required for the output shaft was taken as 4.7 Nm at a speed of about 3000 rpm. We studied the details of the engines available. We selected the engine that could provide a torque of around 5 Nm. The selected engine has a rated power of 2.6 KW @ 5000 rpm. We found that as the speed of the engine was increased above 2500 rpm large amount of emissions was obtained Hence we decided to restrict the speed of the engine to be less than 2000 rpm and set the maximum acceleration as 2000 rpm. This was achieved by controlling the fuel to be supplied by acceleration.

We know that as the speed of the engine is decreased the brake power output also decreases. We assume brake power output is proportional to the speed of the engine. Since we have set the maximum engine speed as 2000 rpm, the brake power output will be 2000*2.6/5000 = 1.04 KW. But in actual practice the decrease in power will be a parabolic variation. In order to take account of this factor we assume a service factor 1.2. Hence the output power of the engine will be 1.04*1.2=1.25 KW. Thus we have selected a four stroke single cylinder engine as the power source.

4.5.1 4-stroke compression ignition engine

The diesel engine is an internal combustion engine.The ignition of the fuel that has been injected into the combustion chamber is caused by the high temperature which the air is greatly compressed Diesel engines work by compressing only the air.This increases the air temperature inside the cylinder to such a high degree that it ignites atomised diesel fuel that is injected into the combustion chamber.This contrasts with spark-ignition engines such as a petrol engine which use a spark plug to ignite an air-fuel mixture. In diesel engines, glow plugs may be used to aid starting in cold weather, or when the engine uses a lower compression-ratio, or both.

The original diesel engine operates on the "constant pressure" cycle of gradual combustion and produces no audible knock.The diesel engine has the highest thermal efficiency (engine efficiency) of any practical internal or external combustion engine due to its very high expansion ratio and inherent lean burn which enables heat dissipation by the excess air.

A small efficiency loss is also avoided compared to two-stroke non-direct-injection gasoline engines since unburned fuel is not present at valve overlap and therefore no fuel goes directly from the intake/injection to the exhaust. Low-speed diesel engines (as used in ships and other applications where overall engine weight is relatively unimportant) can have a thermal efficiency that exceeds 50%.

4.5.1.1. suction stroke

In the suction stroke or intake stroke of diesel engine the piston start moves from top dead centre of the cylinder to bottom dead centre of the cylinder The inlet valve opens. At this time air at atmospheric pressure is drawn inside the cylinder through the inlet valve.

The inlet valve remains open until the piston reaches the lower end of cylinder. After it inlet valve close and seal the upper end of the cylinder.

4.5.1.2 Compression stroke

During compression stroke the piston moves from the bottom dead centre to the top dead centreBoth valves are closed and the cylinder is sealed at that time. The piston moves upward. This movement of piston compresses the air into a small space between the top of the piston and cylinder head.The air is compressed into 1/22 or less of its original volume. Due to this compression a high pressure and temperature generate inside the cylinder.

Both the inlet and exhaust valves do not open during any part of this stroke. At the end of compression stroke the piston is at top end of the cylinder.

4.5.1.3 Power stroke

At the end of the compression stroke when the piston is at top end of the cylinder, diesel is injected into the cylinder by the injector.The heat of compressed air ignites the diesel fuel and generates high pressure which pushes down the piston.

The connection rod carries this force to the crankshaft which turns to move the vehicle. At the end of power stroke the piston reach the bottom end of cylinder

4.5.1.3 Exhaust stroke

When the piston reaches the bottom dead center of cylinder after the power stroke, the exhaust valve opens. At this time the burn gases inside the cylinder so the cylinder pressure is slightly higher than atmospheric pressure.

This pressure difference allows burn gases to escape through the exhaust port and the piston move through the top dead center of the cylinder.

At the end of exhaust all burn gases escape and exhaust valve closed. Now again inlet valve open and this process running until your vehicle starts.

4.6. Chain drives

The chain are used to transmit power from one shaft to another by means of sprocket which rotates at the same speed or different speeds.

The amount of power transmitted depends on the following factors:

1. The velocity of the chain.
2. The tension under which the chain is placed on the sprocket.
3. The arc of contact between the chains is used.

4. It may be noted that the shaft should be properly in line to ensure tension across the chain section.
5. The sprockets should not be too close together, in order that the arc of contact on the smaller sprocket may be as large as possible.
6. A long chain tends to swing from side to side, causing the chain to run out of the pulleys, which in turn develops crooked spots in the chain.
7. The tight side of the chain should be at the bottom, so that whatever slag is present on the loose side will increase the arc of contact at the pulleys.
8. In order to obtain good results with flat chains, the maximum distance between the shafts should not exceed 10 meters and the minimum should not be less than 3.5 times the diameter of the larger pulley.

4.6.1. Advantages of chain drive

1. As no slip takes place during chain drive, hence perfect velocity ratio is obtained.
2. Since the chains are made of metal, therefore they occupy less space in width than a belt or rope drives.
3. It may be used for both long as well as short distances.
4. It gives a high transmission efficient.
5. It gives less load on the shafts.
6. It has the ability to transmit motion to several shafts by one chain only.
7. It transmits more power than belts.
8. It permits high speed ratio of 8 to 10 in one step.
9. It can be operated under adverse temperature and atmospheric conditions.

4.6.2. Disadvantages of chain drive

1. The production cost of chains is relatively high.
2. The chain drive needs accurate mounting and careful maintenance, particularly lubrication and slack adjustment.
3. The chain drive has velocity fluctuations especially when unduly stretched.

4.7. Bearing

A bearing is a machine part whose function is to support a moving element and to guide or confine its motion, while preventing the motion in the direction of applied load. They take up the radial and axial loads imposed on the shaft or axle.

4.7.1. Classification

Bearing can be classified in the following many ways:

1) Depending up on the direction of load to be supported:

   a) Radial bearing

b) Thrust bearing.

2) Depending up on the nature of contact between the working surfaces:

a) Sliding contact bearing

b) Rolling contact bearing.

3) Depending up on the type of loading:

a) Bearing with steady load

b)Bearing with variable or fluctuating load.

4.7.2. Selection of bearing type

The performance of each bearing must be compared in relation to load capacity, friction, space requirements, accuracy, noise etc

Table-1 Bearing selection

S L NO	**CHARACTERISTICS**	**SLIDING**	**ROLLING**
1	LOAD: one way Both way Unbalance shock starting	GOOD GOOD GOOD FAIR POOR	EXCELLENT EXCELLENT EXCELLENT EXCELLENT EXCELLENT
2	SPEED	Usual value is up to 75 m/s	Usual value is up to 50 m/s
3	STARTING FRICTION	POOR	GOOD
4	TYPE OF FAILURE	Often permits limited emergency operation after failure	Limited operation may contine after fatigue failure
5	DAMPING OF VIBRATIONS	GOOD	POOR

6	NOISE	Quiet	May be noisy depending up on the quality of bearing and resonance of mounting
7	TYPE OF LUBRICANT	Oil orother fluids,grease, dry lubricants ,air or gas	Oil or grease
8	QUANTITY OF LUBRICANT	Large ,except in low speed boundary lubrication types	Very small except where large amount of heat must be removed

CHAPTER-5

DESIGN OF COMPONENTS

5.1 Chain drive

N_1	speed of engine shaft in rpm
N2	speed of intermediate shaft in rpm
D	diameter of driver sprocket in mm
d	diameter of driven sprocket in mm
α	lap angle in rad
A	area of the chain in mm^2
m	mass of the chain in kg/m
v	speed of the chain in m/s

T_c centrifugal tension in N

T maximum tension in N

T_1 tension on tight side in N

T_2 tension on slack side in N

Velocity ratio for the drives

$N_1/N_2=D/d$

$1200/N_2=145/36$

$N_2=298rpm$

For open chain drive,

$\text{Sin}\ \alpha = (R-r)/x$

$\alpha = 10.5^0 \Rightarrow 0.18\text{Radian}$

Angle of lap on smaller sprocket,

$\theta = 180^0-2\alpha$

$=159^0 \Rightarrow 2.77\text{Radian}$

Area of Chain, $A=105\ mm^2$

Mass of chain, m=0.106 Kg/m

Angular velocity of shaft,

$\omega = 2\pi N_1/60$

$\omega = (2\pi*1200)/60$

$=125.66\ \text{Rad/sec}$

Speed of Chain,

$S = (\pi*36*1200)/60$

$=2.26m/s$

Centrifugal Tension,

Tension in Chain,

$T=2.5*105$

$=262.5N$

Tension on tight side,

$T_1=T-T_c$

$T_1=261.96N$ $2\beta=35^0$; $\beta=17.5^0$

$\ln (T_1/T_2)=\mu\ \theta\ \text{cosec}\beta$

$T_2=0.25*2.77*\text{cosec}\ 17.5^0$

$T_2=96.4N$

Power transmitted,

$P= (T_1-T_2)*v$

$P= (261.96-96.4)*2.26$

$P=374.16\ W$

Length of chain,

$L=\pi(R+r)+(2x)+((R-r)^2/x)$

$L=\pi(72.5+18)+(2*300)+((72.5-18)^2/300$

$L=895mm$

5.2. shaft

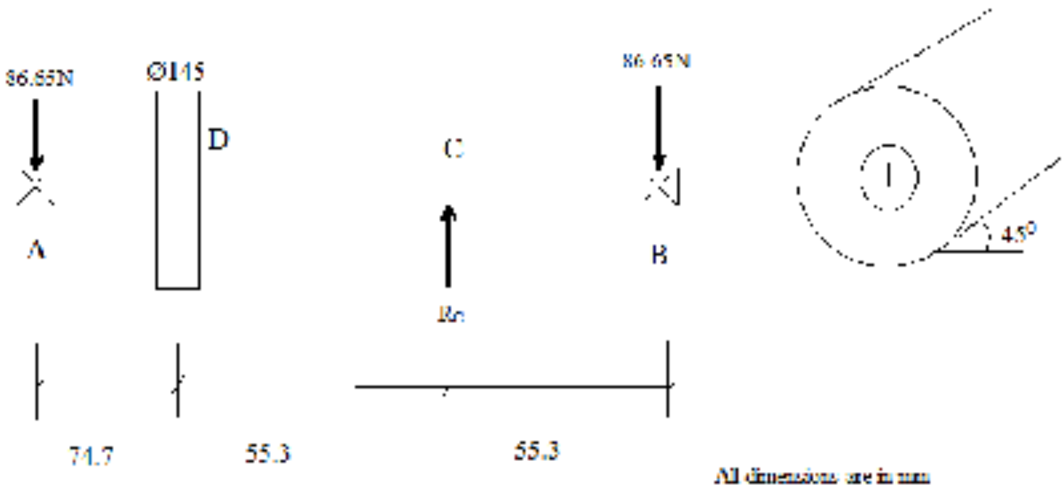

Figure-3 Line diagram of shaft

Force created by chains,

$W=(T_1+T_2)$

$=261.96+96.4$

$=358.36N$

$W_H=W \cos 45^0$

$=253.4N$

$W_V=W \sin 45^0$

$=179.2N$

Moment about C,

$M_V=(86.65*130)-(179.2*55.3)+(86.65*55.3$

$M_V=4487.485N\text{-}mm$

$M_H=10,243.219N\text{-}mm$

Torque transmitted by shaft,

$T = (P*60)/(2\pi N_1)$

$T=2.97N\text{-}m$

$T=2970N\text{-}mm$

Design of shaft based on Equivalent Twisting Moment,

$T_e = _v)^2 + (1.2T)^2)$

$=15.78$ KN-mm

$T_e = (\pi/16)*f_s*d^3$

$15.78 = 1.36*d^3$

$d^3 = 11512.56$

$d = 22.58$mm

Design based on Equivalent Bending Moment,

$(\pi/32)*\sigma_b*d^3 = (M/2)+(T_e/2)$

$d^3=132498.29$

$d=21.76$m

Hence shaft diameter is selected based on Equivalent Twisting Moment,

$\therefore d=22.58$m

CHAPTER-6

WORKING

In land scale forming machine, both the rotor and the cage wheel gets power from the diesel engine. Rotor is located at the back end of the machine where the cage wheel is located at the rear end of the machine. In between them a soil ploughshare (soil deflector) is present.

Cage wheel is driven by engine with the help of larger sprocket through chain. Due to it's larger sprocket size, cage wheel's speed will be reduced and rotates at constant speed. It pushes the entire machine in forward direction without slip on soil.

Rotor shaft is also driven by engine with the help of smaller sprocket through chain. Due to it's smaller sprocket size, rotor shaft's speed will be increased and it is enough to plough the soil.

The intermediate deflector will present at backside of an ploughshare and which form a scale by deflecting the ploughed soil on either side while the cage wheel pushes the ploughshare

CHAPTER-7

MODEL SPECIFICATION

7.1. Specification of Components

The land scale forming machine is powered from 2.6kw engine. The specifications are given below

Table-2 model specifications

SL.NO	SPECIFICATION	RATING
1.	Engine power	2.6kw,5000 RPM
2.	Engine torque	5 N-m/3750 RPM
3.	Displacement	120cc
4.	Overall dimension	565 × 230 (L×W)
5.	Overall diameter of rotary unit	60mm
6.	Tilling width	180mm
7.	Depth of cut	37mm
8.	Total weight	48kg
9.	Cage wheel diameter	230mm
10.	Number of lugs	10
11.	Number of blades	5
12.	Angle between adjacent lugs	25 degree
13.	Larger pulley	Ø145(2 no)
14.	Smaller pulley	Ø36(2 no)
15.	V-Chain	steel chain(2 no)

CHAPTER-8

COST ESTIMATION

Table-3 Cost estimation table

SL.NO	COMPONENTS	QUANTITY	COST(RS)
1	Engine	1	16000
2	Fuel tank	1	200
3	Iron components	15(kg)	20000
4	Solid shaft	2	2000
5	Bearing	4	1000
6	Larger sprocket	2	500
7	Smaller sprocket	2	500
8	Fabrication cost		9000
8	**Total**	-	**49200**

CHAPTER-9

9. ADVANTAGE

The advantages of our new scale forming machine is as follows

1. It is a great saver of time.
2. Because of smaller size, two wheels and limited constructional arrangements, the land scale forming machine becomes one of the lightest yet most effective farm power sources.
3. Its operations are controlled by an operator through its extended handles by walking behind it.
4. One of the special features of a scale forming machine is that it's both the wheels can do two jobs at the same time.
5. Cage wheel makes the scale forming machine to move forward through traction of its wheel with the ground and at the same time change the direction as operator desires.
6. Co-farmers required for cultivational purposes will be eliminated.
7. Working cost will be reduced.

CHAPTER-10

CONCLUSION

The model of the land scale forming machine was constructed successfully and was found to work as per the requirements. The machine that we developed can be used for many activities including the cultivation of tapioca, pulses, ginger, turmeric etc. This can be achieved by using special attachments.

The cost of the scale forming tiller machine that we developed is around Rs.50000, whereas the cost of exist power tiller is in terms of lakhs. Thus the equipment that we developed will be accessible to middle class farmers who are in deep crisis due to the unavailability of sufficient labor for working in farmland. The big scale farmers could only bear the costly equipments used in farmlands that have very specialized purpose. Thus this multipurpose equipment would be a boon to the small scale farmers.

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Future Prospects

Technology in the developed countries has undergone sea change in recent years. Products being manufactured in India require a similar approach to provide more reliable machines in terms of economy in operation, comfort, safety, easy maintenance and higher efficiency. Turbo charging and supercharging of the engines have become quite common now a days in the developed countries. Similarly, synchromesh transmission system on agricultural machines has become a common feature.

Fluid couplings or turbo clutches are being incorporated to cushion both engine and transmission against shock load, jerking, vibration and reducing clutch wear. Monitoring and control systems are needed on machines to assist the operator by way of automation in control and information's on wheel slip, area covered, maintenance requirement etc. These developments are required for tractors, power tillers, combine harvesters, engines and other similar machines.

Indian Farm Machinery Industry has not made significant achievements in exports expect a small quantity of tractors .Therefore tractor and farm machinery manufactures will have to strive for marketing in the world wide competition market to get reasonable market share in the exports.