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DESIGN AND FABRICATION OF AGRICULTURAL CULTIVATOR MACHINE

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Abstract - *The main objective of our project is to design and development of ploughing machine to use it for cultivation of soil. Our aim is to reduce the man power required for the operation of the plough. The only way is to automate it but we cannot fully automate it due to few constraints such as it will require electricity which will not be mostly available in villages, we will be requiring Microprocessor and sensors which will again increase the cost and might require skill to use it. We thought of solution being that instead of automating it fully we planned to semi automate it using engine, motors and power transmission equipment. This might help us reaching our goal by reducing the man power as well as cost. In this work we are planning to design & fabrication of ploughing machine to use of agricultural operations.*

Key Words: Cultivation of soil, Ploughing machine, Power transmission equipment.

1. INTRODUCTION

A developing country like India is expected to continue to rely more on hand tools for the foreseeable future for cultivation. The use of hand tools for land cultivation remains predominant in India because draft animals and tractors require resources that a lot of Indian farmers don't have quick access to. The need for agricultural mechanization in India must therefore be assessed with a deeper understanding of the tiny holder farmer's activities and what values farm power generated for them. As our population continues to increase, it is necessary that we must produce more food, but this can only be achieved through some level of mechanization. As introducing advanced technology for ploughing & weed removal, a ploughing machine is done with using bike engine which gives more mileage & meanwhile it produced in lower price, this equipment is useful to farmers for ploughing, weed removal & so on, the tool holder which is provided at rear end is flexible to adopt different types of agriculture tools for various agriculture operations, this machine is extremely cheap in cost & can serve a needful to the farmers. In today's world everything is getting modernized. Agriculture fields are slowly destroying & these lands are used for some other purpose this is because the income from agriculture is less, although the work involved is high. Most of field field work is done manually & so the farmers depend on fields workers for doing it. It is vital to pluck out the grass and weeds so as to get fruitful results from the cultivation, because the grasses and weeds observe a neighborhood of nutrition given to the plants. Given this situation, removing weeds becomes a costlier affair. In order to address this problem a simple, economical & efficient machine remove weed, ploughing & other operations, which would be operated by a single person which saves the person savings & labour time. The machine has been designed, fabricated & tested.

2. LITERATURE REVIEW

In this review we gone through various aspects of machines set up in various parts of world for the purpose of Ploughing. In order to carry out this work we have undergone extensive research of topic and contribution of by various authors is as follows, D.A. Mada, Sunday Mahai, [2013] [1] concluded that the importance of mechanization in agricultural. Fuel efficiency and field capacity of such parameters are also discussed. We take those points in consideration while designing a sustainable agricultural vehicle. Md. Aqib Naque, Akhtar Ali Rizvi [2013] [2] This machine is developed to reduce the time and effort required for production up to the great extent. Also, this machine manufacturing cost is less as compared to other, by selecting above topic we are understand, familiar and know the details of agricultural technology, with the help of this machine we are trying to reduce labour cost, time of a middle class and small sector farmers. Biswas H S, [1990] [3] Indian Institute of Technology, Kharagpur, India. 283p. In this research paper, we got the method for selection of tool depends on moisture contents in soil.

3. WORKING PRINCIPLE

This is equipment used for ploughing the land by using the bike engine that is 2stroke ic engine and as well as it can remove the weeds which grow in different crops so that the machine can be used for multipurpose and reliable this device has a bike engine which will work on petrol and serve the farmers in better way

As the engine operates it drives the wheel by using sprocket & chain mechanism, as this device moves in forward direction the wheels rotates and move in forward direction the engine is mounted on the frame and back side of the equipment is flexible to adopt different tools for various agriculture operations. The block diagram which is shown in Fig:1 represents the cycle of operation where the power from engine is transmitted from GV shaft to sprocket which is fixed to the shaft with the help of bushes, then the Chain sprocket mechanism is going to actuate and power is transmitted to the shaft. Shaft rotates which in turn drives the two wheels mounted on the bearings and wheel hubs. The vehicle then moves in forward direction and the blades attached at rear end enter into the soil between rows of crops and thus weed removal takes place. Due to this, a huge

amount of labour effort can be reduced and within less time more weeds can be removed with less cost and easy operation. Depending on the requirement of the farmer, tools can be designed & fabricated & can be mounted on the tool holder.

4. COMPONENTS

4.1 Engine

Engine is used to provide torque and power to the ploughing machine and tools attached to it. The engine is a 2 stroke engine. It is mounted on the chassis. It provides power to the machine as well as it helps as load required to create enough downward force to tools to dig in earth.

4.2 Chassis frame

Chassis is constructed from angles made up of mild steel which are cut as required length and are then welded together with the help of welding torch (Arc welding). Chassis act as a load carrying part and mounting for all the parts of machine including engine, wheels, transmission system, tools, etc. It keeps all the part assembled together.

4.3 Transmission system

Sprocket: Sprockets are attached one to the engine shaft and another to shaft carrying the wheels. This arrangement helps to hold the chain and ensure proper transmission of power and motion to the wheels. Sprockets are attached of varying sizes so that desired velocity can be attained.

4.4 Chain

Chain is used to provide transmission of power as well as motion from engine shaft to the shaft carrying wheels. Chain is mounted on sprockets attached and properly aligned. Chain ensure smooth transmission without much loss. Chain used is of single strand type.

4.5 Pedestal Bearing and ball bearing

Pedestal bearing is used to support or attach shaft on the frame. It gives support to the shaft as well as allow to freely rotate. Pedestal bearing keeps shaft attached to the shaft and keep it align at fixed points. Ball bearing attached to the hub of wheels. Ball bearing reduces the friction and allows smooth rotation of shaft at hub. It helps to transmit motion to the wheels without much loss.

4.6 Tool

Tool is provided at the base of the back of the frame. Tool has sharper edges. Tool ensures proper loosening of soil. This is done to realize a desired granular soil structure for a seedbed and to permit rapid infiltration and good retention of moisture, to supply adequate air exchange capacity within the soil and to attenuate resistance to root penetration and shoot growth. Local plough and blade harrow are traditional implements used for loosening of soil. These are simplest tools designed to interrupt the topsoil and multi-passes are administered to organize seedbed. Ploughs are wont to break soil and invert furrow slice to regulate weeds, etc. Three standard ploughing tools are attached to the machine.

4.7 Fuel tank

Fuel tank stores and supplies fuel for the engine for running. Petrol is used as fuel for engine as engine used is petrol engine. Fuel tank maintains proper supply of fuel to the engine and ensure smooth running of engine as long as fuel is present in the fuel tank.

4.8 Shaft

Shaft is made up of cast steel. It is used to support wheels and provide motion to them with the help of proper transmission system. One sprocket is attached to the shaft which receives motion from engine with the help of chain

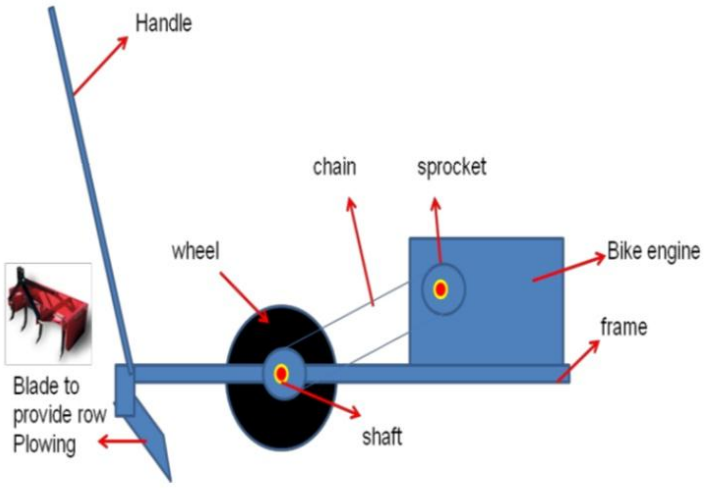
4.9 Handle

Handle is used to guide the vehicle in desired direction. Also it is used to vary the speed of machine as desired as accelerator is provided on handle. Handle is designed according to human comfort in height and handling of machine.

4.10 Wheels

There are three wheels attached to the machine. Two rear wheels are attached to back and one small supporting front wheel is attached at front part of machine. Wheels are made by bending of mild steel straps in required circumference round then it is attached with the hub in the center with the help of spokes cut out of round M.S. bars.

5. MACHINE DESIGN



(**Fig:1** Block diagram representation of the equipment)

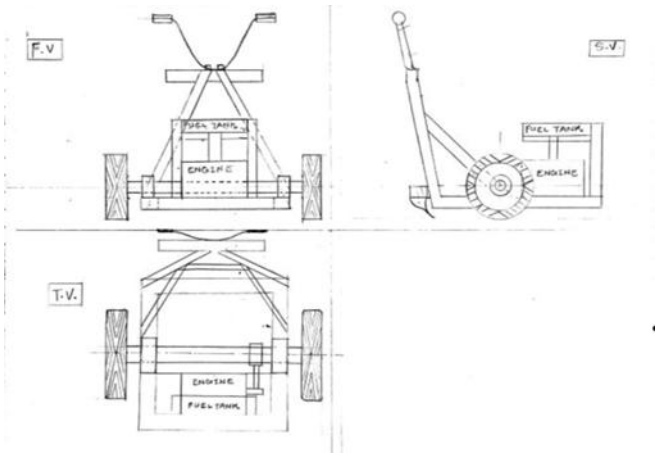


Fig:2 Different views of the equipment

6. DESIGN CALCULATION

6.1 Design of Speed Ratio

Take,
N1 = speed of larger sprocket
N2 = speed of smaller sprocket
T = torque applied
P = N = power applied
D1 = diameter of larger sprocket
D2 = diameter of smaller sprocket

Calculation:

Torque applied =Force * length
=100 * 0.18
=18 N
Power =(2*π*N1*T)/60
= (2*π*60*18)/60
= 0.13 kW

Now N1/N2 = D2/D1
Where D1 = 180 mm = 0.18 m
D2 = 78 mm = 0.078 m
N1 = 60 rpm
Therefore
60/N2 = 0.078/0.18
N2 = 138 rpm

6.2 Sprocket and Chain

As per the design requirements the minimum number of teeth's on the sprocket can be found out by using bore dia.

Z min = 4 ds / p + 5 for p < 25mm
Pitch p= 8mm
Ds= 15mm
Z min = (4 x 15) / 8 +15
= 12.5

The minimum numbers of teeth's to be taken are 12.5, but chosen are

On bevel gear shaft = φ80mm and 24 teeth's
On rear wheel shaft = φ60mm and 18 teeth's.

The chosen above the minimum requirements hence the design is on safer side.

N2 /N1 = T1 /T2
N2 /N1 =24/18
=1.333

Velocity ratio = 1.33
Number of chain links can be found out by.

K = (T1 + T2) / 2 + (2 x / p) + [(T1 - T2) / 2 π]2 p / x
Where x = center distance
= 400mm
K = (24 + 18) / 2 + (2 x 400)/8 + [(24 - 18) / 2 π]2
8 / 40
= 121.0182

Therefore, length of chain = L = K.P

L =121.0182 x8 =968.145mm

CONCLUSION

It is observed that the depth of tool totally depends on the molecular structure, condition of soil as well as moisture content into the soil. This work is about integrating of mechanical system to the agriculture fields for the agriculture operations. Many operations including ploughing, weed removal, ground softening etc can be performed. Different agriculture tools are often adopted by applying different mechanisms to the machine. Hence it's a multi operational device that can be effectively used in fields.

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FUTURE IMPLEMENTATIONS

1) By increasing the equipment strength and quality to its peaks.
2) We can attach different tools making it an multipurpose equipment.
3) Highly efficient engine could be attached to get best output.

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