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DESIGN AND FABRICATION OF WEED REMOVING MACHINE

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ABSTRACT

In today's world every thing is getting modernized. Agriculture fields are slowly destroying and 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 the field work is done manually and so the farmers depend on the field workers for doing it. Because of the higher pay offered in other sectors like construction, workers prefer those jobs and so agricultural sector takes shortfall of manpower. This being the scenario, workers are not available for the works such as plucking out the unwanted grass and weeds growing in between the plants. It is very important to pluck out the grass and weeds in order to obtain fruitful results from the cultivation, as the grasses and weeds observe a part of nutrition given to the plants.Given the present situation, removing weeds becomes a costlier affair. In order to address this problem, this project proposes a simple, economical and efficient machine to remove the weed, which would be operated by a single person – savings of labour as well as time. The machine has been designed, fabricated and tested.

Keywords—weedremover,analysis,design,fabrication

1.INTRODUCTION

With agriculture facing a shortage of manpower, need for automating the various activities in the field arises or it is becoming the need of the day. With this in mind, a simple machine has been designed and fabricated for removal of weed and unwanted plants between the rows of paddy plants. As the machine is moving the weed remover removes the weeds present between the plants. This machine can be used effectively in the agricultural fields such as paddy field. To use this machine in agriculture field the seeds should be sowed at a distance equal to or more than the width of this machine.This machine is of simple design without using any motor or engine. Only a chain and sprocket arrangement is used. This machine eliminates the need for many workers and makes the work easier, economical and efficient.

2.LITERATURE SURVEY

Removing the weeds by using this method is difficult, time consuming and cost is also more. In this project we have designed and fabricated a weed removing machine of mechanism which is innovate and which is not available in the market.

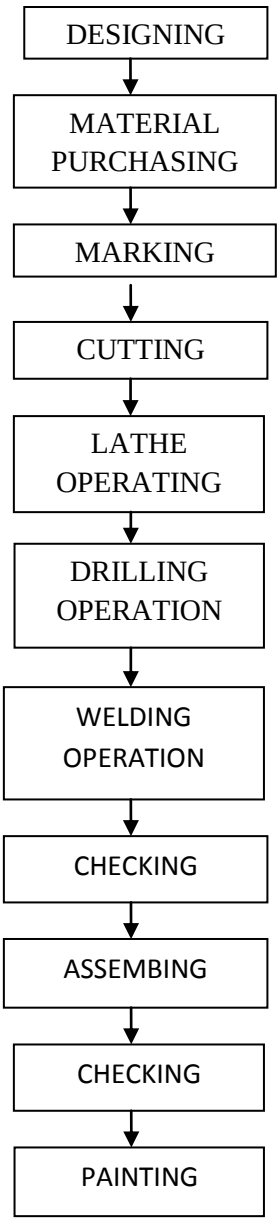
3. SPECIFICATION OF THE MACHINE

Height of the machine	: 1m
Width of the machine	: 0.55m
Breadth of the machine	:0.75m

Weight of the machine :50kg
Width of the weed removed
by the cutter (Cutter width) :0.4m

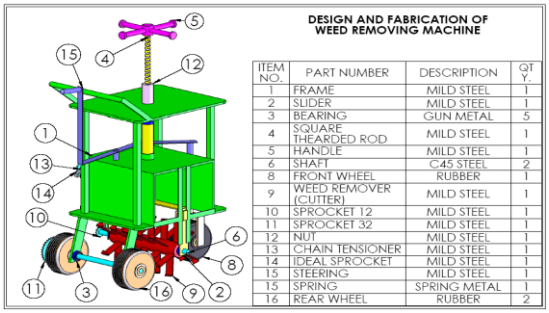
Average speed of weed remover :150rpm
Average travel speed of the machine :50rpm
For one revolution of the
handle, the depth of cut : 6mm

4. PROCESS CHART FOR FABRICATION



5. DESIGN AND ANALYSIS OF WEED REMOVING MACHINE

5.1 DESIGN OF WEED REMOVING MACHINE



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	FRAME	MILD STEEL	1
2	SLIDER	MILD STEEL	1
3	BEARING	GUN METAL	5
4	SQUARE THEARDED ROD	MILD STEEL	1
5	HANDLE	MILD STEEL	1
6	SHAFT	C45 STEEL	2
8	FRONT WHEEL	RUBBER	1
9	WEED REMOVER (CUTTER)	MILD STEEL	1
10	SPROCKET 12	MILD STEEL	1
11	SPROCKET 32	MILD STEEL	1
12	NUT	MILD STEEL	1
13	CHAIN TENSIONER	MILD STEEL	1
14	IDEAL SPROCKET	MILD STEEL	1
15	STEERING	MILD STEEL	1
15	SPRING	SPRING METAL	1
16	REAR WHEEL	RUBBER	2

Fig 1 design of weedremoving machine

5.2 ANALYSIS OF WEED REMOVING MACHINE

Fig 2 DEFORMATION

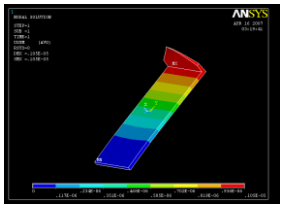


Fig 3 STRESS

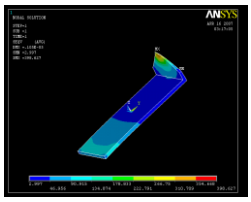


Fig 4DEFORM UNDEFORM

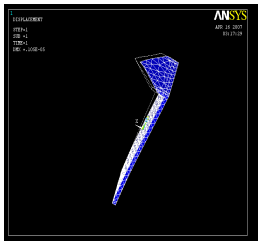
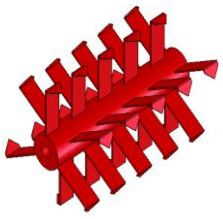


Fig 5 WEED REMOVER



S.NO	PARTS	OPERATION	MACHINE	TOOL
1.	Frame	Cutting, Drilling, Welding	Gas cutting equipment, Drilling & Welding machine	O2 + LPG Gas Twist drill, Electrode.
2.	Shaft	Machining, drilling, cutting	Lathe, Gas cutting	Single point cutting tool, Twist drill, Electrode.
3.	Weed Remover	Cutting, Welding	Gas cutting equipment, welding machine	O2 + LPG Gas, Electrode.
4.	Spindle	Square threading	Lathe	Threading tool
			Lathe	Threading tool

Analysis of the weed remover is done using Ansys software. 40N is load applied over the cutter in analyzing.

Why 40N was selected?

We wounded a rope between the anvil and the spring balance. Spring balance was kept stationary and the anvil was used for weeding operation. 4kg was the reading we got in the spring balance. 4kg = 40N. Thus 40N was used in the analysis.

TESTING

Fig5 Fig 6

BEFORE WEED REMOVING After WEED REMOVING AFT

Table 1 OPERATION PLANNING

TABLE2 COST INCURRED

COMPONENT NAME	PRICE IN Rs
Frame	1585
Slider	250
Bearing	300
Spindle	200
Handle	50
Shaft	300
Rear wheel	300
Front wheel	200
Welding work	750
Painting	350
Weed Remover (cutter)	800
Small Sprocket	35
Big Sprocket	65
Nut	110
Chain Tension	30
Ideal Sprocket	35
Steering	175

Spring	15
Lathe work	500
Transport	150
Total	**6200**

TABLE3 DESIGN CALCULATION

SPRING:

Material chosen is High carbon steel (HCS).

Let C= (D/d) = 3.5, and deflection y= 5mm.

Ks = ((4C – 1)/(4C-4))+ (.615/C)

= ((4(3.5) – 1)/(4(3.5)-4))+ (.615/(3.5))

= 1.5

The stress for HCS from PSG data book is

$\tau = 480\ N/mm^2$

Let the factor of safety is 2.

Therefore the design stress take is $\tau = 240\ N/mm^2$

Maximum load acted over the spring is P=200N.

We know $\tau = ((Ks*8*P*C)/(\pi*d^2))$

$240 = ((1.5*8*200*3.5)/(\pi*d^2))$

Thus d = 2.5mm.

Rod diameter of the spring,

d~ 3mm.

D= (C*d) = 3.5*3

= 10.5mm

Mean diameter of the spring, **D ~ 10mm**

We know deflection, y= ((8*P*C^3*n)/ (G*d))

5 = ((8*200*3.5^3*n)/ ((.8^5)*d))

Thus, n=18.5

Number of turns, **n ~ 20**

SHAFT:

Material chosen for the shaft is mild steel (C45)

Shear stress for this material, $f_s = 360N/mm^2$

taken from the PSG data book.

Let d and l be the diameter and length of the shaft respectively.

We know, Torque, Mt = $((\pi/16)*(f_s*d^3))$

$= ((\pi/16)*(360*d^3))$ --- a

The length of the shaft required is 500mm.

Since the angle of twist will be very small,

let the angle of twist be θ = 0.2.

We know, θ = ((Mt * l)/ (G*J)) ----b

Where, J = $((\pi*d^4)/32)$ ------c

Substituting a and c in b we get,

θ = ((2*360*500)/ (.8*(10^5)*d))

Mean diameter obtained is, **d= 22mm.**

We know,

$d=d_o-(P/2)$ where d_o is the outer diameter

$22=d_o-(6/2)$

There fore the outer diameter obtained is **d_o=25mm.**

SQUARE THREAD ROD:

For the one revolution of the handle,

the up and down motion required is 6mm.

There fore the let the pitch value be **p= 6mm.**

Maximum load that can be applied over it is W=100N,

Let the helix angle be α = 5°

For square thread, coefficient of friction,

μ = tan φ = 0.08.

There fore φ = 5°

We know Torque T= P*(d/2)

Where, P= load in N,

d= mean diameter of the square thread rod.

Let the torque be 200Nmm.

There fore, T= P*(d/2)

= W*(tan (α+ φ))*(d/2)

200= 100*(tan (5°+ 5°))*(d/2)

SPROCKET AND CHAIN:

For 1 rotation of the wheel the weed remover

should rotate 3 times that is the requirement.

There fore the speed ratio required is **i =3.**

So, we choose Big sprocket of diameter **d_1=150mm**.

Small sprocket of diameter **d_2=50mm.**

Thus satisfying the condition, $(d_1/ d_2) = i$.

0.2= ((2*360*500)/ (.8*(10^5)*d)) d = 22.5 Diameter of the shaft is **d ~ 25mm**	

6.ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Mechanism is a simple one.
- Motor or Engine is not required.
- One Labour is enough for operation.
- Working is very easy compared to primitive work method.
- Initial and maintenance cost are less.
- Time consumption is less for weeding.

DISADVANTAGES

- Rotation of weed cutter is slower, so weed removal rate is less.
- More skilled Labour is need

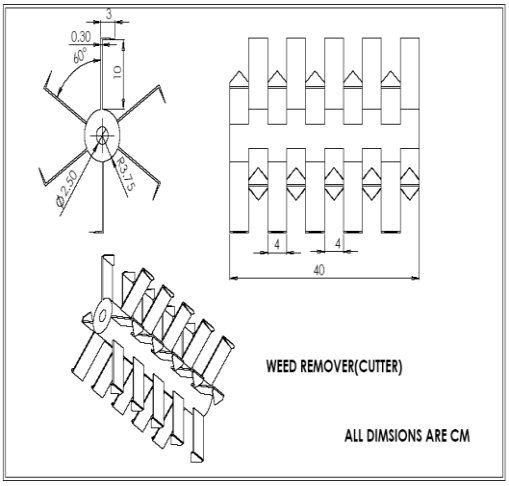


Fig 7 Dimensions of weed remover (cutter)

7.CONCLUSION AND FUTURE WORKS

This machine adds to the modernization of the agriculture. A machine like this will make the farmer to be independent and not rely on the labourers for removing weed. Since the break even can be achieved in the first year itself, the savings would be enormous in the consecutive years. This machine would be further tested in the fields and based on the feed back from the farmers, the design would be optimized and improvements made. Although the machine cost seems to be high, once mass produced, the cost can be drastically reduced.

FUTURE WORKS

- Engine is to be set for effective weeding operation.
- Profile of the weed remover blades should be optimized.wheel with buttons should be used for easy movement of the machine over the mud.

REFERENCE

- PSG design data book.
- "Machine Design" book by R.S.Kurmi and J.K.Gupta.
- The Elements Of Mechanical Design By James G Skakoon.