

DESIGN OF SPECIAL PURPOSE MACHINE FOR SICKLE TEETH REGENERATION

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Abstract : Today, in the world number of agriculture related machines and equipments are available with new technology. But many agricultural related work have been operated manually. From the time immemorial, sickles made by blacksmiths are being used widely for harvesting the crop. The sharpness of sickle tool reduces quickly and harvester has to sharpen it frequently ^[1]. The average time consumption with simple sickle tool was recorded as 25.6 hr/ha while in improved sickle tool it was 20.6 hr/ha ^[2]. The research related to the new design of special purpose machine to sharpen sickle tool as been made. Special purpose machines are always useful to perform the task quickly, automatically and accurately ^[3]. In this design special purpose machine is equipped with high speed steel disc, electrical motor, driver & driven pulleys, housing bearing and fixture.

IndexTerms–Sickle, Fixture, Special purpose machine.

I. INTRODUCTION

The movement of the sickle tool during reaping operation is a backward pull followed by its forward movement with the blade teeth facing the crop. This operation is being done in a typical standing but bending posture. Sometimes sickles have been used for digging a little in soil and reaping the root of crops. It is very hard and tidy process to perform the same task with blunt teeth.

Currently teeth generating process on sickle tools and on many other agriculture equipments have been done manually. These manually teeth generation processes are time consuming and need comparatively more effort and higher working skills. Design of the special purpose machine should be made such that different variety of sickles can accommodate and re-sharp. In sickle variation in concavity (C), length (L) and width (B) generally varies from 30-50 mm, 190-240 mm and 23-40 mm respectively.^[4]



Fig.1.1 Variations in Sickle

1. Proposed Design

Proposed design of the special purpose machine has been made by considering following major requirements:

1. Clamping and unclamping of the sickle should be easy.
2. Machine should be light in weight.
3. Automatic feed should be given to sickle while re-sharpening.

Proposed design includes 0.5 hp motor with 1500 r.p.m. From motor motion transmits through driving pulley to driven pulley and from driven pulley to shaft and finally to cutting disc. Fixture is provided to clamp and guide the sickle. Helical tension spring is used to maintain the continuous contact between sickle and cutting plate against cutting force. Cover guard is provided for extra safety and proper re-sharpening. Proposed design is shown in figure 1.1.1.

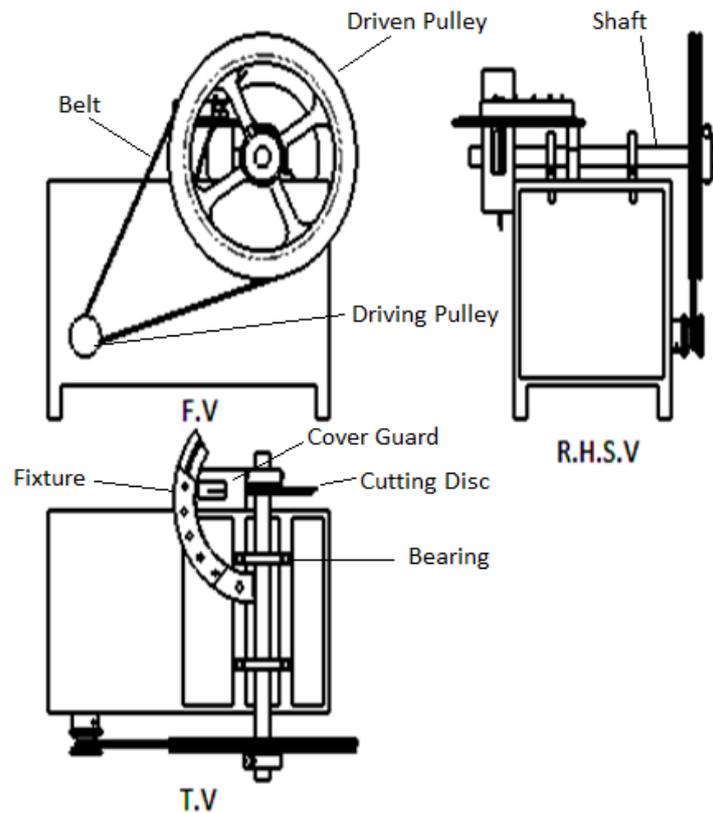


Fig.1.1.1 Proposed Design

2. Selection of Machine Elements

Diameter of the driving and driven pulley has been decided such that cutting disc rotates with 100 r.p.m. V-belt is selected to transmit the motion from driving pulley to driven pulley as centre to centre distance between both pulleys is very less i.e. 358.5 mm. Length of the belt can be obtained considering diameters of driving and driven pulleys. Shaft size has been calculated considering weight of driven pulley and cutting force due to re-sharpening of sickle.

Table 2.1 Machine Element Specifications

Sr. No.	Element	Specification	Material
1.	Driving Pulley	OD: 50mm, ID: 25mm	Cast Iron
2.	Driven Pulley	OD: 300mm, ID: 25mm	Cast Iron
3.	V-Belt	Length: 1290 mm	Steel wires surrounded by rubber compound
4.	Shaft	Diameter: 25mm, Length: 400mm	Carbon Steel: 40C8
5.	Radial ball bearing	SE 507-606 ID: 25 mm (SKF)	Chrome Nickel Steel
6.	Cover Guard	Width: 800mm, Thickness: 3mm, Length: 350mm	Mild Steel
7.	Fixture	Thickness: 5mm	Mild Steel
8.	Tension Helical Spring	Century Stock Number: 80110 O.D: 3.05 mm Rate: 0.66 N/mm	Tempered Carbon Steel Wire

3. Design of Fixture

The Fixture is used to hold sickle and it can help producing radial auto movement of sickle in predetermined path. The top plate of the fixture can slide on bottom plate and it can be fixed as per the dimension of the sickle. One end of fixture is tilted with main machine structure, so it can revolve with respect to this fix point and can adjust according to the variation in sickle concavity.

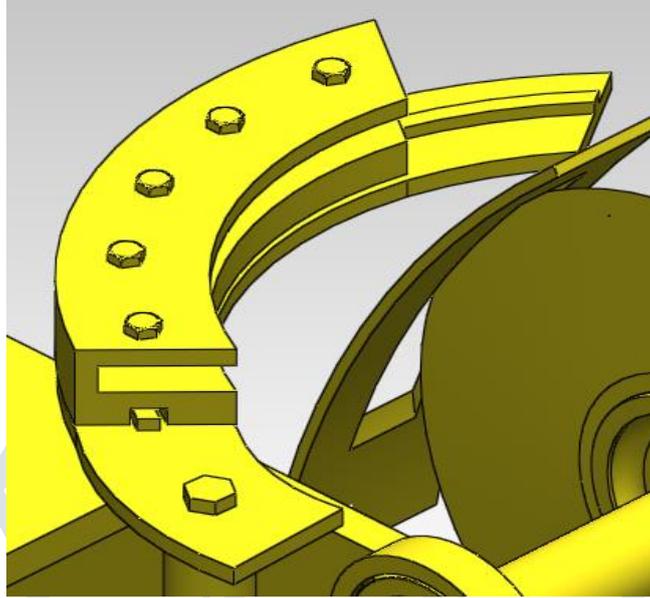


Fig.3.1 Fixture

3.1 Characteristics of Fixture

The main characteristics of the fixture are described bellow

1. It can hold various sickles.
2. Sickle can slide within fixture easily with respect to rotation of cutting disc.
3. Clamping and unclamping of sickle should be easy.
4. It can withstand cutting force while re-sharpening.

4. Design of Cutting Disc

Cutting disc has been designed considering that it can feed the sickle while re-sharpening it. To fulfill such requirements offset as shown in figure 4.1. Offset distance can be decided considering the pitch of the sickle teeth. It can also be made adjustable for setting different offset. High speed steel with 180 mm diameter has been selected as a cutting plate. High speed steel is used as cutting disc material as it can cut the teeth effectively and has excellent wear resistance capacity. Usually pitch of the sickle varies from 0.8 mm to 1.5 mm. By using adjustable cutting disc, one can re-generate teeth of the sickle.

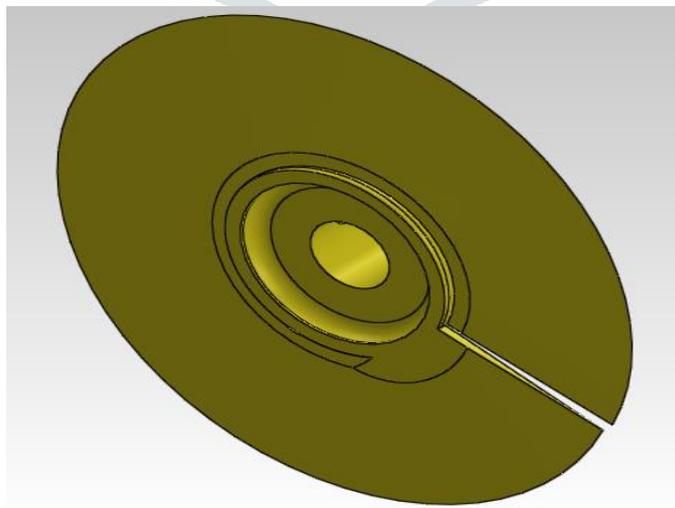


Fig.4.1 High Speed Steel Cutting Disc

5. Assembly of Special Purpose Machine

Final assembly of the special purpose machine for re-generating sickle teeth has been done as shown in Figure 5.1.

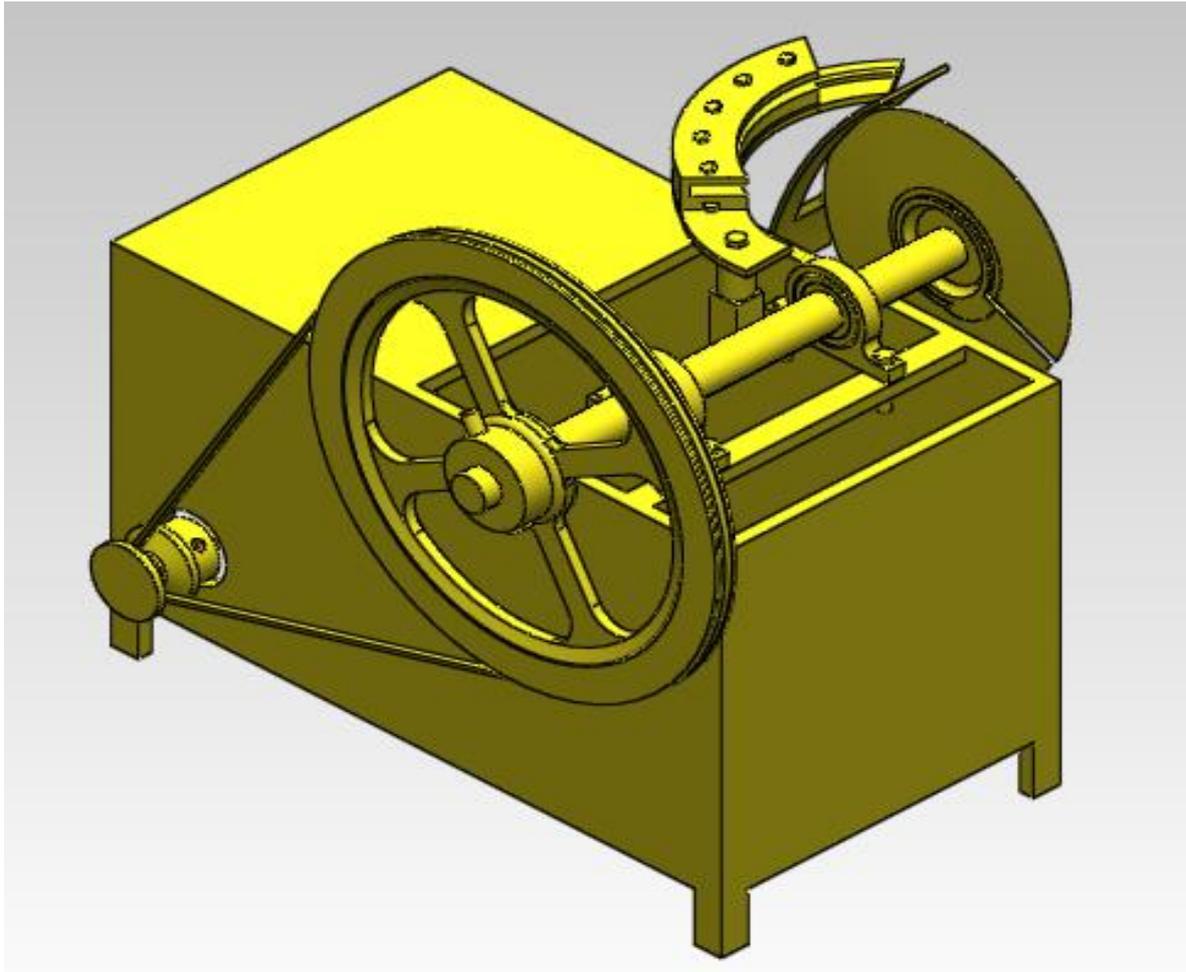


Fig.5.1 Special Purpose Machine for Sickle Teeth Regeneration

5.1 Advantages of Using Special Purpose Machine

1. Quick and accurate re-sharpening of sickle teeth.
2. Low operating cost.
3. Feed motion of the sickle is automatic.
4. Less skill operator can perform the task.

II. CONCLUSIONS:

It was concluded that use of special purpose machine help harvesters to re-sharpen the sickles quickly. From the experiment it was found that to re-sharpen one sickle by conventional process, it takes 230 seconds while by using special purpose machine it can be done in only 60 seconds for re-sharpening hundred teeth. Hence, the time require for teeth generation is lesser as compare to the conventional process and also it requires lesser skill of the operator. Such improved technologies need to be demonstrated on a large scale among the rural farm. Quick sharpening of the sickles also helps to harvest more crops in lesser time.

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