DESIGN AND OPTIMIZATION OF ABRASIVE CUT-OFF MACHINE

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Abstract - The objective of this work is to optimize the Abrasive cut-off saw like full use of cutter, use of winding motor for long life, weight and load capacity. The key idea is to utilize the abrasive cutter and increase the capacity of motor, thereby avoiding sudden failure due to heavy load and increasing the life of the cutter.For remodelling we use Solidworks® software. For analysis of machine performance, we compare the results of original machine and ours. .

***Keywords:*OPTIMIZE, ABRASIVE, WINDING MOTOR, REMODELING, SOLIDWORKS, ANALYSIS**

I. INTRODUCTION

An abrasive saw, also known as a cut-off saw or metal chop saw, is a power tool which is typically used to cut hard materials, such as metals. The cutting action is performed by an abrasive disc, similar to the grinding wheel. Technically speaking this is not a saw, as it does not use regularly shaped edges (teeth) for cutting. The abrasive saw generally has a built-in vice or other clamping arrangement, and has the cutting wheel and motor mounted on a pivoting arm attached to a fixed base plate.They typically use composite friction disk blades to abrasively cut through the steel. The disks are consumable items as they wear throughout the cut.

The abrasive disks for these saws are typically 14 in (360 mm) in diameter and $^{7}/_{64}$ in (2.8 mm) thick. Larger saws use 410 mm (16 in) diameter blades. Disks are available for steel and stainless steel.

Since their introduction, portable metal cut-off saws have made many building site jobs easier. With these saws, lightweight steel fabrication previously performed in workshops using stationary power band saw or cold saw can be done on-site.

Abrasive saws have replaced more expensive and hazardous acetylene torches in many applications, such as cutting rebar. The abrasive cut-off saw is a cutting machine used for cutting hard materials. The cutting blade is made up of the abrasive materials will make the cutting blade to cut the work piece to a required manner. Though the development of technology the scientific inventions are making the world to move to next level. Even though, some of the applications are yet to develop still now and its one of the machine is the abrasive cut-off saw

In an abrasive cut-off the cutting tool is used one-fourth of the abrasive disc. The abrasive disc is used only certain limit because of the design of the cutting machine

The cutting action is performed by the cutting tool. The abrasive disc is made of Aluminium oxide, Silicon carbide and Zirconia. Usually the disk is used up to a certain level and the rest are scrapped. Here, the disc is utilized fully.

When, the heavy load is performed on the cutting blade the motor is affected and the motor cannot be reused. So, why armature motors are replaced by thewinding motors. Winding motors can be reused. When, the heavy load given by the cutting tool the motor will not get affected. Winding motors are stable to run when heavy load is given also.

WORKING

The motor is driven by the power supply. The driver pulley clamped with the motor delivers the power to the driven pulley.The power is transmitted by the V-belt drive. The driven pulley is half the diameter of driver pulley, therefore the speed is doubled for the cutting action. The feed is given manually and slowly for smooth cut-off. The return of the cutter is by weight of motor

II. MODELING AND ANALYSIS

Solidworks is a 3-D modelling tool. Unlike other 3-D modelling tools, Solidworks is not fully three dimensional. In Solidworks, one draws in a plane and then extrudes solids from the plane. Planes are used to obtain position in three dimensional space. It is possible to draw in three dimensional space using Solidworks, but is very difficult. The machine dimensions are taken from the original machine for reference and themodel is created using SOLIDWORKS® modelling software.

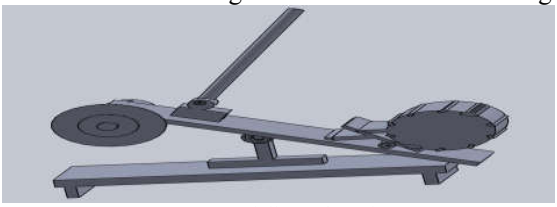

Fig 3.1 Modelling of machine

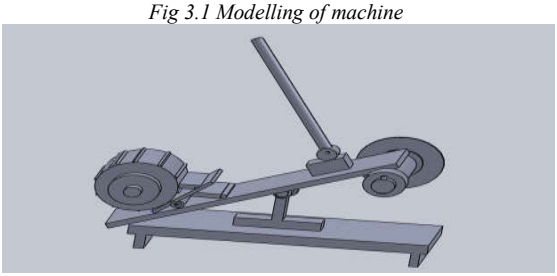

Fig 3.2 Remodelling

TABLE I

MACHINE SPECIFICATION

Belt	v-belt b-class 37"
Driver pulley	4"
Driven pulley	2”
Motor	1.5HP, 9kw, winding motor
Cutter	Abrasive, 3mm thick, dia14"
Machine base	24" x 10.5"
fulcrum height	4"
Rotary shaft	4.5",
Bearing	Taper bearing
Vice	Mechanical vice

A. Practical Analysis

The model is arranged, and setup for analysis. The tool which is scraped by the market machine is clamped at our innovation. The machine is run and feed is given with innovated model, and motor capacity, feed rate, cutter least diameter are analysed.

IV. CAMPARISION

Market abrasive saw	Remodelled abrasive saw
Armature motor is used which cannot tolerate high loads. It cannot be reused once damaged.	Winding motor is used which is capable of withstanding high loads. It can be rewinded and reused to some extent.
Driving of cutter is direct. Control of speed is almost not possible.	Driving of cutter is by belt and pulley drive. The speed is controlled by tension of belt.
The return of the cutter is by spring action. Spring should be maintained.	The return of the cutter is by the gravity. The weight of the winding motor helps in return.
The abrasive disc is utilized upto level and the rest is scraped.	The abrasive disc is utilized fully upto its minimum diameter. The scrap of the machine will be the non-abrasive part of disc.
The feed height is limited to a level. The feed can be given upto the height of spring.	The feed height is comparatively higher by saving the space of spring.
High expense on abrasive disc and motor.	Cost on abrasive disc and motor is saved.

V. RESULTS

The performance results of both the machines are compared with the utilization of abrasive disc. The load capacity is also compared between both the machines. The results are found to be favour of new generation model. The remodel is found to be efficient on almost all the hard materials with constant feed rate. The machine is safer to work with, and easy to handle.

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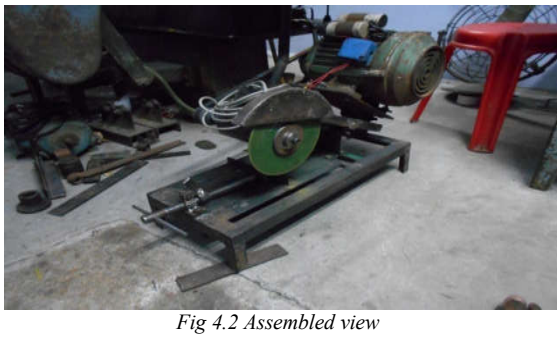

Fig 4.2 Assembled view

Fig 4.3Assembled and Finished view

A. Comparison of Results

TABLE II

Original disc diameter	Least diameter by original machine	Least diameter by optimized machine
14”	8”	4”

CAMPARISION TABLE

Features	Original machine	Optimized machine
Speed	Dangerously 10000 rpm	Safely 3000 rpm
No of output (Ex. MS 2cm thickness rod) machined per plate	60 nos	90 nos
Motor life	Upto 0.5 kw	Upto 0.9 kw

V. CONCLUSION

The comparison of the models reveals the result that remodel of abrasive saw have many different advantages like long life motor, high load capacity, total utilization of abrasive disc, easy return by gravity. The machine is rough modelled, calculated, fair modelled, fabricated, assembled and analysed. The results proves the model optimize the possible points which can be modified.

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