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Fabrication And Analsys Of Metal Cutting Chop Saw

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Abstract— A chop saw is a power tool used to make accurate cuts in wood, plastic, and metals. It has a fixed blade, attached to a moving arm that spins over a small worktable. Chop saws are used to create a rough, initial abrasive cut in a desired material. In principle, a chop saw is an electrically powered motor which turns a high speed abrasive wheel. Wide variety of parts can be machined by using this chop saw. The chop saw can make an initial straight, abrasive cut in a material to either make the piece of better workable size or to create a rough outline of a desired shape. The chop saw is used in the initial stages of a project because of the draft quality present in it's work. Normally A straight cross cut is made with the chop saw table set at the 0° position. We are going to introduce two new systems in this Chop Saw housing. They are
Spring loaded pedal system
Coolant system
By providing spring loaded pedal system we can increase cutting force on work piece and it results in faster cutting, also can obtain additional support. Coolant system reduces the heat developed at work-tool interface, residual stresses on the work piece and also decreases wear in the abrasive wheel. By introducing these additional features the performance and reliability of the machine can be improved. And also we are going to analyze the cutting forces acting on the work and the tool.
Keywords— chop saw, coolant system, spring loaded pedal system.

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 a thin grinding. The 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.

Abrasive saws are lightweight and portable, and they can be brought to building sites. As a result, work that previously had to be performed in workshops can now be performed on-site, which made many construction jobs much easier. Abrasive saws can be used in many construction projects. Some can be used for dry cutting, wet cutting, bench grinding, or back stand grinding. The tool can also be used in the production of auto parts, ceramics and glass, plastics, electronics, and optical products. Before using an abrasive saw, there are many safety precautions that should be considered. The user should thoroughly inspect the saw before using it. He or she should also keep in mind that an abrasive saw should never be used in a wet or damp area, because of the risk of electrocution.

Fig: Metal cutting chop saw

cutting chop saw motor is identified as a critical component because the performance of cutting machine depends on motor present metal cutting machine has a motor with single speed so, present work aim design a machine with different speeds to cut different materials. As a general rule, conversion of electrical power into mechanical power takes place in the rotating part of an electrical motor. The motor contains stator and rotor. The stator is containing the yoke and slots section. The yoke is made with with iron. The purpose of yoke is to carry the flux inside the poles and and to protect motor mechanically. The slots are made with si-steel. The winding is placed in the slots ,the supply is given to the winding. The rotor is placed on the shaft. The rotor contains slots, the slots are made with si-steel. The winding is place on the slot, it is short circuited at ends, to produce circulating currents he slots are designed with sliding angle to reduce the noise in the motor. The belts or ropes are used to transmit power from one shaft to another by means of pulleys which rotate at the same speed or at different speeds. The amount of power They have already discussed that a V-belt is mostly used in factories and workshops where a great amount of power is to be transmitted from one pulley to another when the two pulleys are very near to each other. A Shaft is a Rotating machine element which is used to Transmit Power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torques (or twisting moment) setup within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various pulleys, gears etc, are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for transmission of torque and bending moment. The metal cutting chop saw is cutting different materials like metal rods ,wood, fiber sheets, bricks, cement sheets, MS sheets, hallow tubes, pipes and GI pipes by changing blade and varying motor speed. The rotor is placed on the shaft which contains slots. The slots are designed with the sliding angle to reduce the noise in the motor, and machine with different speeds to cut different materials. In present metal cutting machine one constant speed is used, for cutting the materials. By keeping it in view, the concept of multiple cutting machine is developed, in which variable speeds are applied. This range of speeds are obtained with the help of motor and pulley arrangement. The hard materials are also cut easily with the help of machine.

II. LITERATURE SURVEY

In ancient Egypt, saws made of copper are documented as early as the Early Dynastic Period, circa 3,100–2,686 BC. Examples of saws and models of saws have been found in many contexts throughout Egyptian history. Particularly useful are tomb wall illustrations of carpenters at work that show sizes and the use of different types. Egyptian saws were set with the teeth projecting only on one side, rather than in the modern fashion with the more advantageous alternating set.

According to Chinese legend, the saw was invented by Lu Ban. In Greek mythology, as recounted by Ovid, talos, the nephew of Daedalus, invented the saw. In archaeological reality, saws date back to prehistory and most probably evolved from Neolithic stone or bone tools. He identities of the axe, adz, chisel, and saw were clearly established more than 4,000 years ago.

A. Mechanically Powered Saws

1) Circular-Blade Saws:

a) Circular Saw: a saw with a circular blade which spins. Circular saws can be large for use in a mill or hand held up to 24" blades and different designs cut almost any kind of material including wood, stone, brick, plastic, etc.

b) Table Saw: a saw with a circular blade rising through a slot in a table. If it has a direct-drive blade small enough to set on a workbench, it is called a "workbench saw." If set on steel legs, it is called a "contractor's saw." A heavier, more precise and powerful version, driven by several belts, with an enclosed base stand, is called a "cabinet saw." A newer version, combining the lighter-weight mechanism of a contractor's saw with the enclosed base stand of a cabinet saw, is called a "hybrid saw."

c) Radial Arm Saw: a versatile machine, mainly for cross-cutting. The blade is pulled on a guide arm through a piece of wood that is held stationary on the saw's table.

d) Rotary Saw Or "Spiral-Cut Saw" Or "RotoZip": for making accurate cuts, without using a pilot hole, in wallboard, plywood, and other thin materials.

e) Electric Miter Saw Or "Chop Saw," Or "Cut-Off Saw" Or "Power Miter Box": for making accurate cross cuts and miter cuts. The basic version has a circular blade fixed at a 90° angle to the vertical. A "compound miter saw" has a blade that can be adjusted to other angles. A "sliding compound miter saw" has a blade that can be pulled through the work, in an action similar to that of a radial-arm saw, which provides more capacity for cutting wider work pieces.

f) Concrete Saw: (usually powered by an internal combustion engine and fitted with a Diamond Blade) for cutting concrete or asphalt pavement.

g) Abrasive Saw: a circular or reciprocating saw with an abrasive disc rather than a toothed blade, for cutting very hard materials such as metal.

h) Pendulum Saw Or "Swing Saw": a saw hung on a swinging arm, for the rough cross cutting of wood in a saw mill and for cutting ice out of a frozen river.

In the present cutting machine we would implemented two systems these are namely

Spring loaded pedal system

Coolant system

(i) Spring Loaded Pedal System: Here the pedal system was operated by with the help of leg force. By using the spring loaded pedal system we can increases the cutting force (or) the cutting pressure. Due to this we can reduce the cutting time .By considering the above conditions we can easily decreases the total machining cost of machine

(ii) Coolants In Metal Cutting: The traditional cutting fluids pose serious health and environment hazards. People exposed to cutting fluids may have skin contact with these fluids, inhale mists or vapour, or even swallow mists particles of these fluids. Due to their toxicity, they may cause health problems like dermatitis, problems in the respiratory and digestive systems and even cancer. Improper disposal of these cutting fluids may even cause serious environmental problems such as water pollution and soil contamination. Strict regulations and their enforcement against using cutting fluids has therefore, been tightened. Thus, the waste disposal and post handling of the cutting fluids and other related costs have increased substantially with tougher environmental laws. Companies and organizations are being forced to implement strategies to reduce the usage of cutting fluids in their machining operation (Klocke and Eisenliatter, 1997). Therefore, it is in need to look for new coolant application techniques. Application of mist coolant and chilled air for effective cooling without polluting the environment is becoming more and more popular. Besides pollution control, the industries also reasonably insist economic viability through technological benefits in terms of product quality, tool life and saving power consumption by using of mist coolant and chilled air-cooling.

By comparing the present fabricated cutting chop saw with normal chop saw they can improve the cutting performance and motor life for different materials at the same time minimizing the time and cost.

III. FABRICATION

Components:

- Table
- Motor
- Pulleys
- Belt drive
- Shaft
- Bearings
- Cutting saws
- Coolant system
- Spring
- 10.rope
- Reference scale

Different types of table materials: Many different types of metal materials are available for preparing the metal sheets namely

aluminum, steels etc. Among mild steel sheets are rarely used metal material.

IV. ANALYSIS

In analysis of metal cutting chop saw, analysis of cutting time for different number of pieces is being made and machining cost is calculated and compared for metal cutting chop saw with and without pedal system and power hacksaw.

A. Power Consumption

The power consumption of the machine is based on the cutting time. Cutting time is calculated for different number of pieces by using stop watch.

P=VIT
Where,
P=Power consumption (KwH)
V=Voltage
T= cutting time/piece

Specifications Of Motor
Capacity : 1Hp,3Phase
Speed : 1440rpm
Current : 3.8 amp

1) To Cut The MS Sheet Of 5mm Thickness In Power Hack Saw: Cutting Time = 30s
Voltage = 440
Current I=4.7amp
$P=0.01723\times10^{-3}$KwH
Cutting Cost = power consumption ×cost/unit
Cost/unit=8.3/-
Cutting Cost=$8.3\times0.01723\times10^{-3}$
=0.143/-

2) To Cut The MS Sheet Of 5mm Thickness In Chop Saw With Out Pedal System: Cutting Time=17s
Voltage =440
Current I=4.3amp
$P=8.934\times10^{-3}$KwH
Cutting Cost = power consumption ×cost/unit
Cost/unit=8.3/-
Cutting Cost=$8.3\times8.934\times10^{-3}$
=0.075/-

3) To Cut The MS Sheet Of 5mm Thickness In Chop Saw With Pedal System:
Cutting Time=13s
Voltage =440
Current I=4.3amp
$P=6.832\times10^{-3}$KwH
Cutting Cost = power consumption ×cost/unit
Cost/unit=8.3/-
Cutting Cost=$8.3\times6.832\times10^{-3}$
=0.0567/-

B. According To Our Engineering Work Shop Records 6000 Pieces Are Been Cut Per Year

Total cost=cutting cost+ tool cost+ Labor cost

Tool cost= Number of cutting saws required per year
Cost of hack saw blade=500/-
Cost of abrasive wheel=150/-
Labor cost=50/- per hour

1) To Cut The MS Sheet Of 5mm Thickness In Power Hack Saw: Cutting Time=50Hrs
Voltage =440
Current I=4.7amp
P=103.41KwH
Cutting Cost = power consumption ×cost/unit
Cost/unit=8.3/-
Cutting Cost=858.2/-
Number of tools required=2
Tool cost=2×500 =1000/-
Total machining cost=858.2+2500+1000 =4358.2/-

2) To Cut The MS Sheet Of 5mm Thickness In Chop Saw Without Pedal System: Cutting Time=28Hrs
Voltage =440
Current I=4.3amp
P=52.97KwH
Cutting Cost = power consumption ×cost/unit
Cost/unit=8.3/-
Cutting Cost=439.65/-
Number of tools required=3
Tool cost=3×150 =450/-
Total machining cost=439.65+1400+450 =2289.65/-

3) To Cut The MS Sheet Of 5mm Thickness In Chop Saw With Pedal System: Cutting Time=22Hrs
Voltage =440
Current I=4.3amp
P=40.6KwH
Cutting Cost = power consumption ×cost/unit
Cost/unit=8.3/-
Cutting Cost=336.98/-
Number of tools required=3
Tool cost=3×150 =450/-
Total machining cost=336.98+1100+450 =1886.98/-

Table1: The cutting time, power consumption and cutting cost for one piece

TYPE OF MACHINE	Cutting Time/piece(sec)	Power consumption/piece(units)	Cutting cost/piece
Power hack saw	30	.01723	0.143/-
Chop aw with out spring system	17	8.934×10^-3	0.0775/-
Chop saw with spring system	13	6.832×10^-3	0.0567/-

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Table2: Total annual machining cost, power consumption and cutting time

TYPE OF MACHINE	Cutting Time/year(hrs)	Power consumption/year(units)	Cutting cost/year	Labor cost/year	Tool cost/year	Total cost/year
Power hack saw	50	103.4	858.2/-	2500/-	1000/-	4358.2/-
Chop aw with out spring system	28	52.97	439.65/-	1400/-	450/-	2289.65/-
Chop saw with spring system	22	40.6	336.97/-	1100/-	450/-	1886.98/-

V. CONCLUSION

In metal cutting chop saw different materials like wood, fiber sheets, metal sheets, hallow tubes, pipes & GI pipes by changing blade & varying motor speeds the hard materials also cut easily with the help of machine. In metal cutting chop saw by including pedal system we can reduce the cutting time and machining cost. Continuously works for a day without heating up of motor

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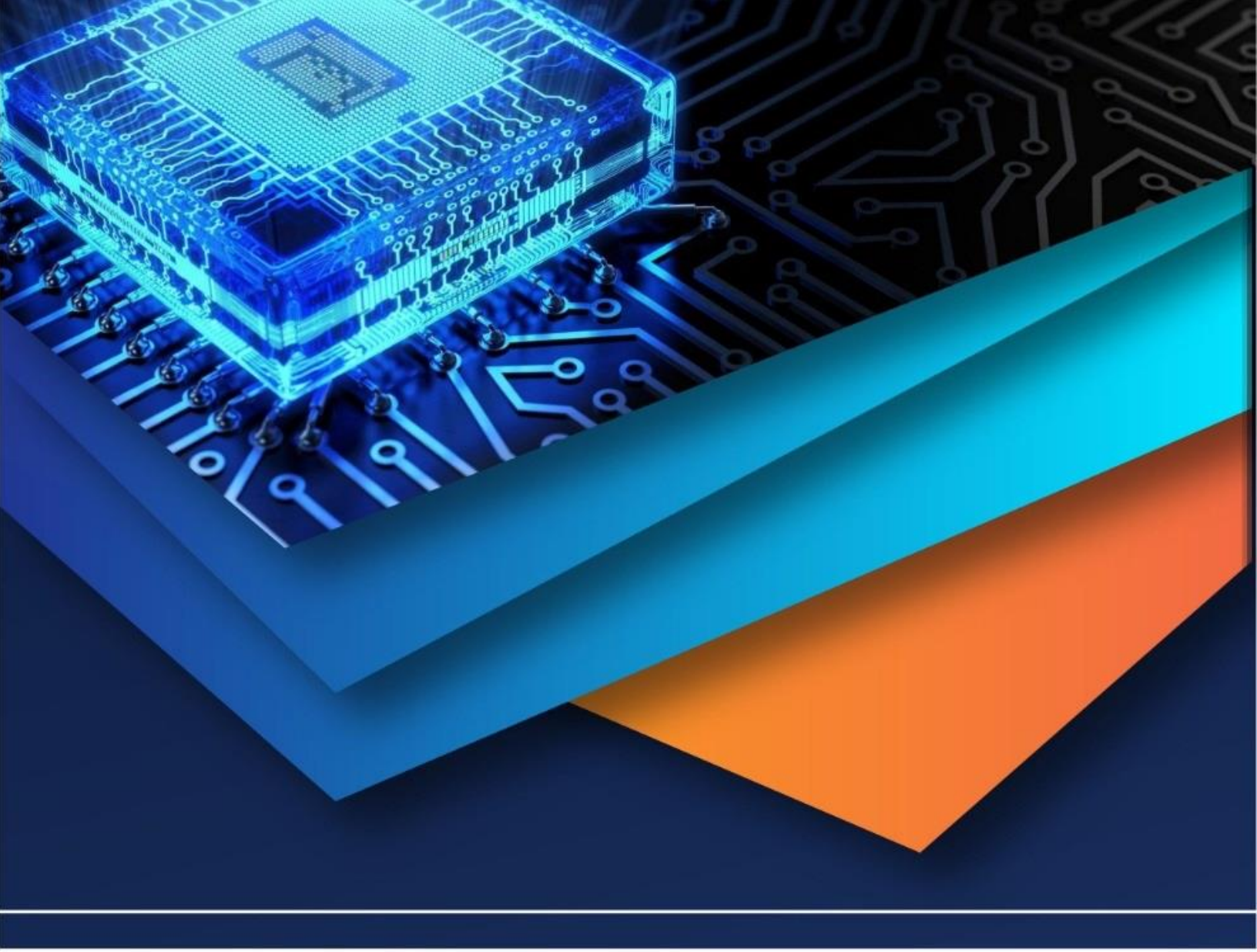

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