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Fabrication Of Four Way Machining By using Scotch Yoke Mechanism

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Abstract - - *The main view of our project is to made four operations on a single frame by using a single phase electric motor to reduce the work space and the labour. The objective of our project is about using scotch yoke mechanism and the motion of the mechanism is used to make two operations namely shaping and hacksaw cutting. Bevel gear is used to make remaining two operations namely drilling and grinding.*

***Key Words*: Scotch yoke mechanism, bevel gear, shaping, hacksaw, milling and drilling**

1. INTRODUCTION

Industries are basically meant for lower inventory cost and higher productivity and low inventory cost. In industries each machining operation requires separate machinery. In this project we have introduced four operations by using mechanisms like scotch yoke and bevel gear mechanism to make operations like shaper, hacksaw cutting, drilling and grinding in a single frame and by using single power source of single phase 1hp motor.

1.1 Literature Review

The vast review of literature will help to understand the concepts, theorems and different factors affecting the performance of machine [1].

The use of hydraulic system started in ancient days itself. The Minoan culture flourished during the Bronze Age they used hydraulic system for the sources of water for urban centres during early civilizations [Bronze Age (4000–1100 BC)] included canals connected to rivers, rainwater harvesting systems, wells, aqueducts. The commercially available pumps are single acting pumps or double acting pumps which has less efficiency and frictional loss and the also cannot pump the water if there is a foreign body entering the cylinder and this damages the piston and create large stress over piston rods. The main aim of our project is to afford it for all types usages like high pressure pumping be neither high delivery head nor the high suction head. R. Praveen Kumar, G. Navaneetha Krishnan, V. Venkadesh and N.Premkumar[2].

The objective of this work is to automate the conventional power hacksaw machine in order to achieve high productivity of work-pieces than the power hacksaw machine using Microcontroller. The operator need not measure the length of the work-piece that is to be cut and to load and unload the workpiece from the chuck each time after a piece has been cut. . A pneumatic cylinder is used for holding the work-piece when cutting operation is done. An AC motor is used to bring about the reciprocating motion required for cutting the work-pieces. There is a self-weight attached with the reciprocating mechanism to provide the necessary downward force required for penetration of hacksaw blade into the work-piece.[4]

Before starting our work we have undergone through many research papers which indicates that for production based industries machine installation tricky task as many factors being associated with it such as power consumption electricity bill per machine, maintenance cost, number of units produced per machine i.e., capacity of machine, time consumption and many more... some research papers which have led us to approach the idea of a machine which may give solution [5].

1.2 Components Used

1. 1” inch G.I pipe (frame)
2. Electric motor-1hp (convertible)
3. V-belt
4. Flywheel-11"
5. En8 grade shaft
6. Plummer blocks (p 206)
7. Bevel gear – 30 degrees
8. Scotch yoke mechanism
9. HSS single point cutting tool
10. Hacksaw cutter(high carbon blade)
11. Open end clamp
12. Drill chuck
13. Abrasive grinding wheel 10⌀x6x16

2. Components in Detail

2.1 Electric Motor

It is a 1hp convertible motor where motor power consumption can be altered. It consists of two capacitors one for starter and another for running.

Static friction > sliding friction > rolling friction

Starting capacitor handles static friction whereas running capacitor overcomes sliding and rolling friction.

2.2 Fly wheel

It transmits power from motor to mechanism where it is made up of cast iron. It is of size 11". Where it converts high rpm, low torque from the motor to low rpm and high torque to the mechanism.

Flywheel is quite popular in load bearing situations (in wet grinders, speed multiplication pulleys etc.)

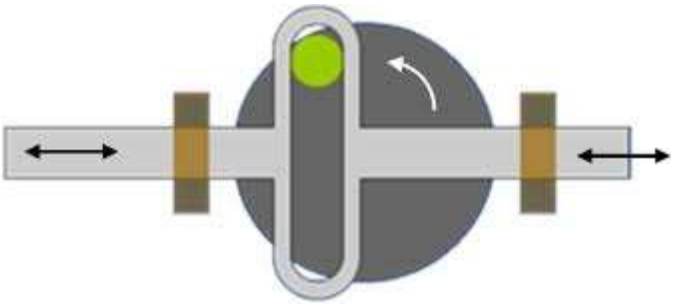
2.3 En8 Grade Shaft

EN8 carbon steel is a common medium tensile steel, with improved strength over mild steel. It is also called as readily machinable type steel in any condition. It belongs to the standard of BS 970-1955.

2.4 Scotch Yoke Mechanism

It is used to convert the rotary motion into reciprocating motion. Where the reciprocatory motion is utilised for shaper and hacksaw cutting.

This mechanism is used because the forward stroke of the motion is used for shaper operation and the backward or ideal stroke is used for hacksaw cutting operation.



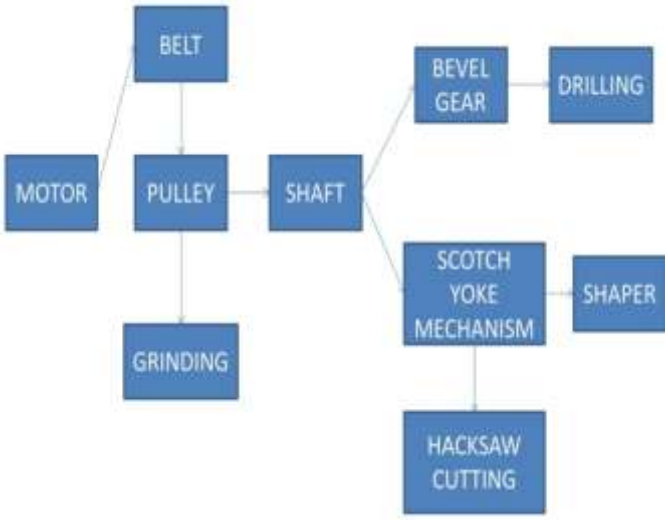
2.5 Bevel Gear Mechanism

In this project we had used 30 degree bevel gear which is used to transmit power to the drilling operation.

2.6 Drilling

In this we had used horizontal drilling for making slots for tool handles such as chisel handles, file handle etc.,

3. METHODOLOGY



Motor receives electric power and it converts into mechanical power and transfers to flywheel(pulley) through v-belt. It transfers the power to the grinding wheel and as well as to the shaft. It transfers power to the bevel gear mechanism which in turn rotates the drill bit. Either end of the shaft from the pulley power transmits slotted crank mechanism which results rotary to reciprocating mechanism. From which is used to done shaper and hacksaw cutting operations.

4. Over View Of The Project

5. Calculations

5.1 Specifications of the Project

Motor speed = 1440 rpm; single phase;1hp.

GI pipe = 30"x30".

Driver pulley = 1 inch.

Driven pulley =11 inch.

Belt = A68.

Shaft = 32 ".

Plummer block=3 * p 206.

Grinding wheel = 2 inch radius.

5.1 Calculation of Scotch Yoke Mechanism

Length of stroke = 62.5 mm

Radius of crank = 62.5mm

Motor rpm =1440 rpm

Pulley rpm=130 rpm

No of strokes/sec=130rpm/60=2.16 strokes/sec

Slotter length = 130 mm

Reciprocating mass ,m= 0.9 kg

Force of slotter,F =m*a

Acceleration of slotter a = velocity/ time

Due to frictional force 2.16 is taken as 2

Resisting force = μ*N= 0.5*120 rpm= 60 N { μ =0.5-0.7}

(Where μ =coefficient of friction, N=no of revolutions per crank)

Cutting force F =m*a= 0.9*0.125 = 0.112 KN= 112N

Calculations of motor and pulley system:

Motor rpm= 1440 rpm

Motor pulley dia = 1 inch

Driven pulley dia = 11 inch

Gear ratio = 11:1

Driven pulley = 130 rpm

P = (2*(22/7)*N*T min)/60

T min = (60*750)/(2*(22/7)*1440) = 4.97 N-m (motor)

T max = (4.97*1440)/130 = 55.05 /N-m (flywheel or pulley)

RESULT

Shaper: HSS tool Wood–MRR = 3mm Aluminium–MRR = 1mm Mild steel – MRR = 1mm.

Hacksaw cutting: high carbon steel blade Wood – depth of cut =5mm Aluminium – depth of cut = 2mm Mild steel – depth of cut = 1-2mm.

Drilling - HSS tool Hole size = 3/8"" Wood – depth of cut = 3-4mm Aluminium – depth of cut = 1-2mm Mild steel – depth of cut =1mm **.**

Grinding - High course grinding wheel Surface finish Wood- smooth finish up to 2mm Aluminium – rough finish up to 1mm Mild steel – rough finish upto 1mm.

These values are obtained from real life test conditions of the project.

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