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Design and Fabrication of Automatic Three Axis Welding Machine

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ABSTRACT: This concept of 3-axis automatic welding machine mainly used for the small scale industries and large scale industries where the automatic welding is needed. Industries are significant for production of useful goods and services at high cost also they signify the more production with low machine cost.

This machine can be used to weld the workpiece or job in the different sides the semi-automatic way. It is used in the small scale industries to operate automatically. It is also useful to weld the single workpiece in the different directions without changing the place of the workpiece.

In this three-axis automatic welding machine different automatic equipment are used to weld. This is very useful in the industries where the most preferred and good quality at weld is required.

The paper reviews a few welding machines and research in the same area which shows the need of the automatic double axis welding machine. This machine can weld workpiece in the different direction without changing its position.

KEYWORDS: Rack and pinion mechanism motor, welding machine, wires, metal frame, welding torch etc.

I. INTRODUCTION

This project is designed to weld the job or the workpiece in the different direction. It is used in many industries like small scale industry, large scale industry, automobile industry, building construction etc. This project will increase the weld quality and speed of the welding by which the production will increase. Also the cost of this project is quite less as compared to others. This project will be fabricated with the help of parts like metal frame, motors, rack and pinion mechanism wire welding machine etc.

This will lead to the welding in the semi-automatic way. The rack and pinion mechanism will help the motor to move from left to right in horizontal way. The shaft of the motor is connected with the pinion and pinion will move from left to right on the rack. When the motor gets rotated this machine weld in different height also. The rack and pinion mechanism converts rotary motion into linear motion. Also the assembly is fixed dimension so there is the limit of dimension to overcome this we can make this welding machine with the greater dimension to weld the large size of job or the workpiece.

The welding torch is connected to the backside of the motor by which when motor moves left to right then the torch also moves with it. This welding machine is used in optimized low cost. Also the quality of weld and the speed of weld will increase and the industries will move towards the more production.

As the industries signify for the production of useful goods and services at low production cost. Nowadays the industries are using manual welding and due to this the quality of weld and welding speed cannot be specified. The more investment and low production are the problems of some industries, to overcome this problem in the industries according to the welding machine. Also the industries do not have to pay for this machine except welding machine and bills to perform the simulation operation.

II. LITERATURE SURVEY

Namkug Ku, Ju-hwan Cha, Kyu-Yeul Lee, Jongwon Kim, Tae-wan Kim, Sol Ha, Donghun Lee

This paper describes the development of a self-driving mobile welding robot. The robot is used to weld U-shaped welding areas in enclosed double-hull structures. In order to place itself inside the double-hull structure, the robot is capable of passing through an access hole 600 mm wide and 800 mm high. This research addresses the mechanical and control systems of the robot. The mechanical system of the robot consists of an eight-axis mobile platform, and a six-axis welding unit. The control system consists of a main controller, a welding machine controller (arc sensor board), and seam tracking sensors, i.e., a touch sensor, a laser sensor, and an arc sensor. To reduce the number of cables that would be dragged by the welding robot, the main controller is designed as an embedded type that is mounted on the back of the mobile platform.

V. Hecht-Linowitzki, J. Klett, T. Hassel

In this paper the enormous growth of the offshore wind power industry has increased the demand for the development and qualification of special underwater welding consumables for water depth higher than 20 meters. In order to understand problems associated with underwater wet welding and recommend possible solutions to the problems, Werkstoffkunde applies an internal pressure chamber and a multi-axis welding machine for testing welding equipment. This welding compound offers excellent possibilities to investigate the welding equipment (power sources etc.) on one site and the welding process on the other. In recent studies the influences of different ingredients of the stick electrode coating have been investigated. Based on a typical rutile electrode composition the correlation of its amount into the covering and the welding properties in dependency of the water depth was investigated [5] [6]. Furthermore hydrophobizing measures to substitute the waterrepellent coatings of stick electrodes have been investigated.

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A new type of pipe-to-pipe intersecting line welding device uses a large and small cam structure and a circular arc-shaped sliding track of the welding gun frame, which ensures that the welding gun rotates with the workpiece to coordinate the lifting movement and the corresponding adjustment of the welding gun's position. Production practice shows that the movement's position is precise, there is no accumulation of transmission errors, and the welding gun's movement has high reproducibility and precision. It has a low-cost automated special welding equipment for pipe-to-pipe intersections.

III. HISTORY



Fig2.1. Welding operation using manual welding machine

This figure shows that the industries are using manual welding machines to weld workpieces or jobs and due to this the quality of weld and the speed of weld cannot be insured. Also there is a risk to form hazards to the workers.

These machines are having slow welding speeds and quality of weld is also less.

Also nowadays in the industries due to old welding techniques they have to move workpieces to weld in the different directions. In this paper all problems are discussed.

IV. PROJECT OBJECTIVES

- To fulfill the need of automated welding machine in small scale and large scale industries.
- To reduce the timing of process.
- To reduce human efforts introducing automation.
- To reduce maintenance cost.
- To increase work efficiency.
- To increase the quality of weld.
- Easy to move through wheels

V. PROBLE STATEMENT

- In existing industries the manual welding are used.
- In many industries chances of hazards occurs due to manual techniques.
- The risk of any sudden process increase.
- Does not give better output.
- The cost of available machines are more.

VI. RESEARCH METHODOLOGY

A. COMPONENT

- I. Metal frame
- II. Welding machine
- III. AC motor
- IV. Motor controller
- V. Rack and pinion

I. METAL FRAME

The metal frame is made of mild steel .It is suitable for slightly stressed component. It is available in round square etc. Shape.It is suitable for machining allowance.it also closes dimentional tolerance.



Fig 4.1. Metal Frame

II. WELDING MACHINE

The welding machine help to creat a higher voltage to weld the material.It takes current from a high voltage power.also welding machine convert high voltage into usable arc of energy.It is also connect earthing and electrode holder.



Fig 4.2. Welding Machine

III. AC MOTOR

Ac Motor is an electric motor driven by alternating current(AC).The rotor magnetic field may be produce by permanent magnet.motor enclosure also protect from moisture and containment.



Fig 4.3.Ac Motor

IV. MOTOR CONTROLLER

AC motor use alternating current to generate a huge range of mechanical output power.AC motor controller solve the problem of regulating speed.Their adjustable output allows the motor speed to be precisely controller.



Fig.4.4.Motor Controller



V.RACK AND PINION

Rack and pinion is a type of gear converts rotational motion into linear motion.It may have straight teeth or helical teeth .Helical teeth are mostly preferred due to higher load bearing capacity.



Fig 6. Rack And Pinion

6.2 MATERIAL USED FOR MACHINE

Sr.No	Components
1	Rack And Pinion
2	Ac Motor
3	Motor Controller
4	Metsal Frame
5	Welding Machine

VII. WORKING PRICIPLE

This Automated Welding Machine works on the rack and pinion mechanism, this mechanism is used in this machine to give the motion to the welding torch which will help to weld the job or the workpiece. The metal frame is used to make the assembly of the project and rack and pinion are set on the horizontal way to move from left to right. The rack and pinion mechanism converts rotary motion into the linear movement. The Ac motor is used to get the motion to the pinion to move from left to right, the motor shaft is connected with the pinion and when the motor get rotate the pinion gets the motion and it will move from left to right.

The motor controller is used to control the speed of the motor in the needy way according to the requirements of the welding. This all automatic devices will work in the semi-automatic way to get the good quality of weld and for the good efficiency.

Also the up down i.e. the vertical movement we got by the rack and pinion mechanism by which the movements of the assembly will be occurred. By this motor the rack will move from up and down to weld the workpiece on any limited



height. The whole assembly works on semi-automatic way when we will give command to the devices they will work and will get the good quality of weld and efficiency will be increase.

VIII. DESIGN AND CALCULATION OF PROJECT

A. DESIGN AND DRAWING

This drawing will explain about the design and sketching tht had been chosen to be the final idea to be produce or fabricate. All the design in this project is going to be explain in details.

B. PROPOSED SKETCH

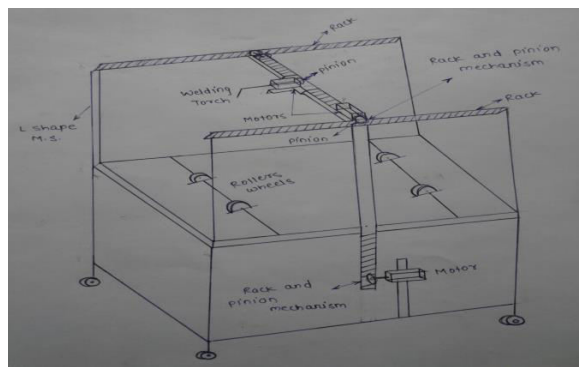


Fig 6.1 Proposed sketch

C. CALCULATION

The mild steel bar length 25x25x3 Angle Weight calculation of mild steel angle

Weight = volume + density,

We need to calculate volume ,

$$\text{Volume} = A + B (0.025 \times 0.003 \times 1) + (0.022 \times 0.003 \times 1) = 0.000066225 \text{ m}^3$$

$$\text{Density of MS} = 7850 \text{ kg/m}^3 \quad 0.0000150 \times 7850 = 0.1177 \text{ kg}$$

Its value for 1-meter mild steel rod

Now we need to calculate weight calculation 2.Frame Design: Frame design for safety FOR 25x25x3

L angle mild steel channel B= 25 mm, D= 25 mm, t= 3 mm.

Assume the maximum load on the frame to be 50 kg. Max. Bending moment = force x perpendicular distance = $50 \times 9.81 \times 450 \text{ M} = 220725 \text{ Nmm}$

We know, $M / I = \sigma_b / y$ M = Bending moment

I = Moment of Inertia about axis of bending that is; $I_{xx} \ y =$ Distance of the layer at which the bending stress is consider (We take always the maximum value of y, that is, distance of extreme fiber from N.A.) E = Modulus of elasticity of beam material.

$$I = BD^3 / 12 = 25 \times 25^3 / 12$$

$$I = 32552.08 \text{ mm}^4 \quad \sigma_b = My / I = 220725 \times 12.5 / 32552.08$$

$$\sigma_b = 84.750 \text{ N/mm}^2$$

The permissible shear stress for material is $\sigma_{per} = \text{Syt} / \text{fos}$ Where Syt = yield stress = 210 MPa

And fos is factor of safety = 2 So $\sigma_{per} = 210 / 2 = 105 \text{ MPa} = 105 \text{ N/mm}^2$ Comparing above we get, $\sigma_b < \sigma_{per}$.e $84.750 < 105 \text{ N/mm}^2$

So design is safe.

D.PINION SPECIFICATION

Teeth=20

diameter=50mm

AC motor of 60 Hz

No load rpm=

$$\text{Freq} \times 60 \times 2 / \text{no. Of poles}$$

$$= 60 \times 60 \times 2 / 4$$

$$= 1800 \text{ rpm}$$

This produce the torque to get an AC motor running.



Torque speed

1) For horizontal

Torque speed=

Weight x diameter of pinion

Dia. Of pinion=50mm=0.05m

Weight of torch=72gm=0.072kg

Weight of motor=150gm=0.15kg

Overall weight=0.072+0.15

=0.222kg

Torque speed

=0.222 x 0.05

=0.0111Nm

2)For vertical

Torque speed=

Weight x diameter of pinion

Dia. Of pinion=50mm=0.05m

Weight of torch=72gm=0.072kg

Weight of motor=150gm=0.15kg

Weight of assembly=5kg

Overall weight =0.05+0.15+5

=5.2 kg

Torque speed

= 5.2 x 0.05

= 0.26 Nm

Rack and pinion mechanism:

Module= diameter/no. Of teeth

Module=50/20

Module(m)=2.5

The rack is having 5 teeth per cm

Then,

Pinion will move

=20/5

=4cm=40mm

If the motor is set at 10 rpm

Then,

Pinion will move,

= Speed of motor x distance

= 10 x 40

= 400mm per min

Let's calculate what will be the speed of moving of torch i.e the linear movement of motor per second

1 min=60 sec

So,

The speed of pinion is 400 mm per minute

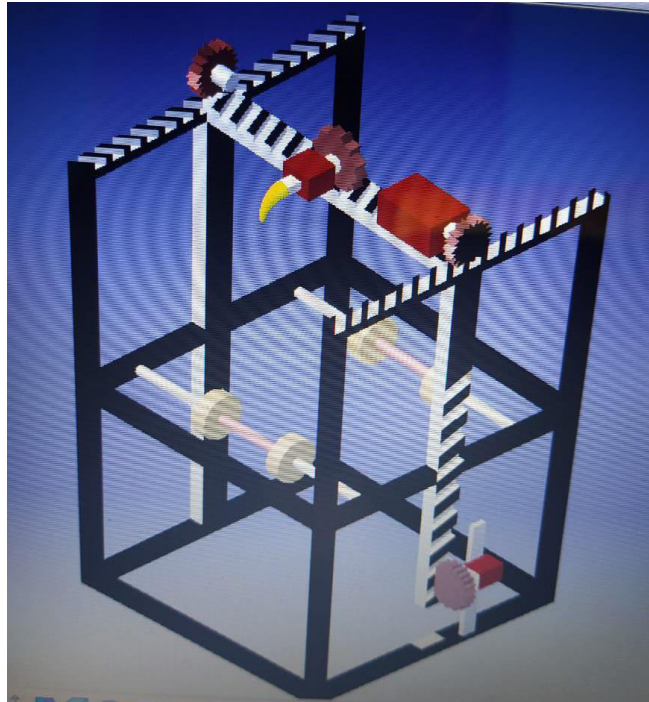
The movements of pinion per sec

=400/60

=6.666 mm per sec

So the speed of pinion will be 400 mm per sec

IX. CAD MODEL



X.COCLUSION

This project is made with pre planning, that it provides flexibility in operation. This innovation has made the more desirable and Economical. This project “Design And Fabrication of Automatic Triple Axis Welding machine” is designed with the hope that it is very much economical and help. This project helped us to know the periodic steps in completing a project work. Thus we have completed the project successfully

XI. FUTURE SCOPE

- In future it can be used in the small scale industries and also in large scale industries where the automatic welding will be required
- Also if any industry having less man power can use this automatic welding machine
- If any industry want less man power and equal production can use this welding machine

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