

DESIGN OF CIRCULAR WELDING POSITIONER

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ABSTRACT :

This paper deals with working and construction of the all the components of circular welding positioner Which is very important for mass production related to the circular welding. In today's world, complexity of welding job It is essential to develop the new techniques to reduce the burden on worker for good welding. These device rotate the job at the fixed rate to assist the welding process of circular component and ensure the good profile and homogeneous welding. It depends upon the skill of the worker to move the electrode along the welding line. Automated welding positioned totally satisfies for circular welding ,It provides the relative motion between torch and workpiece. The robot work under the surveillance of operator. It consist of worm and worm wheel, belts , pullys and motor etc.It has applications in bottle filling plant, cylinder welding,compressor etc.This design reduces the cycle time and increase the functionality of the labour , also allows the complex welding jobs completed in simple two position arm.In this paper includes manufacturing , testing ,cost along with time parameter which is required to manufacturing all the components of positioned. In this arc torch is fixed to the adjustable clamp , not held in hand.

KEY WORDS : Circular welding, Co2 welding, Welding positioner, Worm and worm wheel, Automation

1. Introduction

Welding is the process of joining the two materials. The materials that are welded are metals, non-metals. It is often used for joining the other metals such as thermoplastic.

In today's competitive world, It is essential for mass production to automate the process which are done by manually. In welding process , Electric arc welding and Co2 welding are done by manually.

In electric arc welding, after striking the arc the electrode is moved along the welding line and small gap is maintained between electrode & metal, similar process is done in Co2 welding. Quality of the welding in this processes is depend upon the skill of the operator. Thus well-skilled and experience operator is required.

Welding positioner is a special device which is used to obtained the better and economical results for welding process. It is advanced technology used to perform the welding, specially for circular welding. It provide the smooth, relative, progressive motion between torch and joints to be welded.

A set of uniformly placed good quality tack welds has to be made to bridge the gap and to provide some rigidity against the stresses developed during welding. A Welding-positioner assures enhanced quality and increased productivity. This is the most important gain, because of reduction of downtime, and also as the welding parameters can be selected to

provide the maximum weld deposition rate, compatible with acceptable (not excessive) heat input. Arc-on time is equally increased resulting in potential reduction of welding costs.

There are various type of positioners, some have fixed tables that are always vertical, which are called as headstock positioners. The type where the table tilt and rotate at various speeds in both directions are called as just welding positioners

It is mostly used for CO2 welding process. Which is suitable for lap joints, Taking into consideration tensile strength and fatigue strength under various welding conditions . It is useful for mass production system.

1.2 Diagram of welding positioner:



Fig: Circular wedding positioner

2.PROBLEM DEFINATION:

In conventional arc welding or Co2 welding, we are often used to weld the circular component such as pipe , cylinders etc. To weld such components , electrode is move along circular path along its circumference and partial arc length. It is difficult to move the electrode along such path and the process is also time consuming. To solve such problems welding positioner is used.

3.DESIGN FEATURE:

The principles of positioning are the same for all weldments, large or small. Base product is affixed to the welding positioned and allows movement into the proper weld position. Which occurs quality faster assembly. Fabricated sub assemblies added to the entire weldment can be moved to allow the excess of weld joints for easier access of welder

There are two types of design-

2.1Physical constraint :

It deals with the various physical constraints, arrangement of various components, selection of components, height of the machine from ground. It is deals with following facts-

1. Based on physical constraints-
on the basis of use in small scale or big scale industry , space is main factor. So system should be compact
2. Arrangement of various components-
Components are arrangement such that they are easy to replacable, easy for maintainance , good for appearance
3. Chances of failure-
Failure of component is main criteria for designing any component. Factor of safety kept so high that design should not fail. Proper maintainance is required
4. Servicing of component-
Components are easily available for servicing. Fail component should easily dismantaled
5. Height of the machine from ground-Height of machine is maintain such that cleaning of dust and durt is possible
6. Weight of machine-
Weight of machine is depend on material and size of component used in machine.

2.2Mechanical design:

In Mechanical design the components are categories in two parts.

1. Design parts
2. Parts to be purchased

For design parts detail design is done and dimensions thus obtained are compared to next higher dimension which are readily available in market. This simplifies the assembly as well as post production servicing work. The various tolerances on work pieces are specified in the manufacturing drawings. The process

charts are prepared and passed on to the manufacturing stage. The parts are to be purchased directly are specified and selected from standard catalogues and are specified so as to have case of procurement.

A.DESIGN OF PARTS

1.Motor Selection -

Thus selecting a motor of the following specifications

1. Single phase AC motor
 2. Commutator motor
 3. TEFC construction
 4. Power = 1/15 HP = 60 watt
 5. Speed= 0-6000 rpm (variable)
- Motor torque calculated $T=0.095 \text{ Nm}$

B. Design Of Worm Shaft

Material selection: -Designation: EN 24

ASME CODE FOR DESIGN OF SHAFT: $\tau_{per} = 0.18 \times 800 = 144 \text{ N/mm}^2$

$\tau_{per} = 0.30 \times 680 = 204 \text{ N/mm}^2$

Considering minimum value of the above values, $\tau_{per} = 144 \text{ N/mm}^2$

Shaft is provided with key way, this will reduce its strength. Hence reducing above value of allowable stress by 25%.

$\tau_{per} = 108 \text{ N/mm}^2$

This is the allowable value of shear stress that can be induced in the shaft material for safe operation. To calculate worm shaft torque:

Power = Motor is 60 watt power

run at 6000 rpm, connected to worm shaft by belt pulley arrangement with reduction ratio 1:5. Hence input to worm gear box = 1200 rpm $T=0.48 \text{ Nm}$

C. Design Of Worm Wheel Shaft

Material Selection: - Designation: EN 24

Asme code for design of shaft: $\tau_{per} = 0.18 \times 800 = 144 \text{ N/mm}^2$

$\tau_{per} = 0.30 \times 680 = 204 \text{ N/mm}^2$

Considering minimum value of the above values, $\tau_{per} = 144 \text{ N/mm}^2$

Shaft is provided with key way, this will reduce its strength.

Hence reducing above value of allowable stress by 25%. $\tau_{per} = 108 \text{ N/mm}^2$

This is the allowable value of shear stress that can be induced in the shaft material for safe operation.

D. Design Of Key -

Selecting parallel key from standard data book for given application. Material of key is 55C8

Shaft diameter	Above – 12 Upto - 17
Key cross-section	Width(b) – 5 Height(h) - 5

Dimensions (b×h×l):-5×5×24

E. Design Of Worm And Worm Wheel -

The pair of worm and worm wheel used in the machine is designated as 1/80/10/1.5

The worm is made of case hardened steel EN24 whereas the worm wheel is made of Phosphor bronze. As the drive is capable of transmitting 0.1796 kW and we intend to transmit 0.06 kW therefore the drive is safe.

F. Design Of Open Belt Drive -

Motor pulley diameter = 20 mm

Reduction ratio = 5

Input shaft pulley diameter = 100 mm

Coefficient of friction = 0.2

Maximum allowable tension in belt = 200 N Center distance = 120 mm

Arc of contact for smaller pulley (α) = 141°

Ratio of belt tension = 4.2

Width at the base is given by (b2) = 3.1mm

Area of cross section of belt (A) = 18.2

Mass of belt per meter length = 0.23 kg/m Velocity =

4.19 m/sec Centrifugal tension (Tc) = 4.034 N

Tension at tight side (T1) = 200 - 4.034 = 195.966N

Tension on slack side (T2) = 49N

4. PROCEDURE :

Procedure of complex of alignment & positioning of Various component is necessary. It requires study of all the research and manufacturing processes. It includes –

- Material selection
- Analysis of selected material
- Make a design
- Test it on its prototype
- Calculate the centre of gravity
- Design of gear box for various components

PART LIST		
Part No.	Part Name	Material
1	Worm	C.I.
2	Worm Wheel	C.I.
3	Table	Structural grade steel
4	Pulley	M.S.
5	Frame	M.S.
6	Table Shaft	High grade alloy steel

5. OBJECTIVES :

Main objective of this invention is to give the better supporting structure with greater capabilities Handled the bulky assemblies which are handled by manual systems

- Occupies small space
- Both rugged and durable
- Efficiently and effectively fulfill its intended purpose. Capable of handling small as well as large sized work pieces

- Retain framework in various positions into which it is swung.
- Facilities assembly of components in correct position

6. ADVANTAGES:-

- Reduces welder fatigue
- Increases welder safety
- Improves weld quality.
- Increases productivity over manually positioning the parts.
- Assists welders in maneuvering and welding large weldments and parts
- Ensures smooth welding table rotation.
- Faster welding speeds especially for obtaining X-ray quality welds.

7. CONCLUSION :

Welding positioned totally satisfies the requirements of the job. It considerably reduces the operators fatigue and time required for the process. Precise and the noiseless operation is generated, It handles the bulky assembly efficiently. Less skilled worker is required. Compact assembly in its self and the controls are fitted on front side at ergonomic position.

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