Design and manufacturing of welding positioner for gas metal arc welding(GMAW)

By- arvind addepalli, tejas kulkarni, kunal joshi, sanket thorat, naresh jadhav

Abstract— this project aims at designing and manufacturing a welding positioner which helps mass production industries related with circular welding. As it depends upon the skill of worker to move electrode along the welding line .this equipment can rotate the job at a fixed rate to assist the welding process for circular components and ensure good profile and homogenous welding. This equipment will be used for welding a cylindrical tank which will be used as a housing for transformers.

Index Terms— circular welding,welding positioner,motor, gearbox , cylindrical tank , tilting arrangement , degrees of freedom , general specifications.

1 INTRODUCTION

Normally, gas metal arc welding (**GMAW**) is done manually. Moving the electrode or wire along the welding line is a work that involves high degree of skill and especially for circular components it becomes much more difficult.
When manual welding process is required to be done on circular jobs, the operator has to handle the job, welding torch and the filler metal. In such cases it becomes difficult to meet the rate of production and also adds to the fatigue of the operator.
Also manual welding has higher rejection rates and also the weld formed is not uniform.

2 NEED OF IDEA

- In the present age of mass production it is often required to automate the manufacturing processes that were done manually, the process of joining in many applications is welding.
- normally, gas metal arc welding (gmaw) is done manually
- Moving the electrode or wire along the welding line is a work that involves high degree of skill and especially for circular components it becomes much more difficult
- When manual welding process is required to be done on circular jobs, the operator has to handle the job, welding torch and the filler metal. In such cases it becomes difficult to meet the rate of production and also adds to the fatigue of the operator.
- Also manual welding has higher rejection rates and also the weld formed is not uniform.

.

3 PROBLEM DEFINITION

Till this date , the above component is welded manually , due to manual welding , following problems were observed by the manufacturer

- Reduced rate of production- presently **6 tanks per shift (8 hrs.)**
- The welds produced sometimes is not uniform
- Increased operator fatigue due to the size of the tank

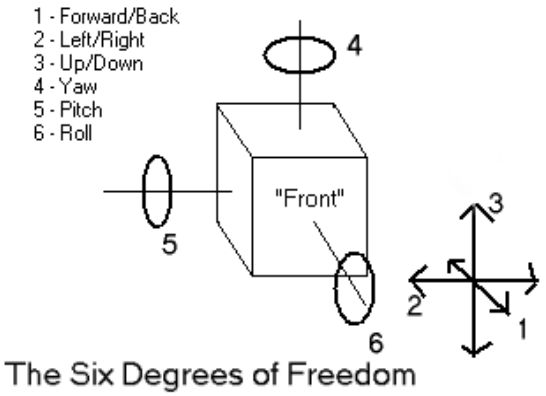
4 OUR SOLUTION TO THE PROBLEM

To address these problems, and to increase the rate of production, we are designing a positioner that would rotate the work piece and will weld the work piece accurately and with uniform rate of weld.

5 PRINCIPLE

- A job in space has six degrees of freedom, it usually refers to motion of rigid body in three dimensional space, namely the ability to move. In order to weld the work piece, we require the yaw and roll, while others are restricted.
- The work piece rotates or the yaw degree is achieved by rotating the table which will hold the work piece
- The roll degree will be achieved with the help of a tilting mechanism , by using a gearbox and sector arrangement

- The welding torch will be held by a holding attachment , which will be placed at a suitable distance from the rotating element



(1)

6 DETAILS OF EQUIPMENT-

The positioner consists of following main components

- Motor- it will function as a prime mover ,the motor is a variable frequency drive (vfd) type for adjusting speed as per rate of weld
- Transmission gearbox – to achieve required speed reduction as per rate of welding
- Table – to mount the work piece
- Torch attachment - to hold the torch
- Tilting gearbox - to tilt the table for elliptical and horizontal positioning of the work piece
- Supporting structure – to hold all the components,
- Motor speed control unit - for variation in motor speed

7 GENERAL SPECIFICATIONS

Capacity	70 KG
Eccentricity	50 MM
Centered of gravity	30 mm
Rotational speed range	05-6 RPM
Table size	d 675
T- slots on table	4 @ 90˚ spacing
Motor drive capacity	0.18KW/1440RPM
Table tilt angle	0˚ TO 90 ˚

8 DESIGN OF ELEMENTS

I. DETERMINATION OF CONSTRAINTS-

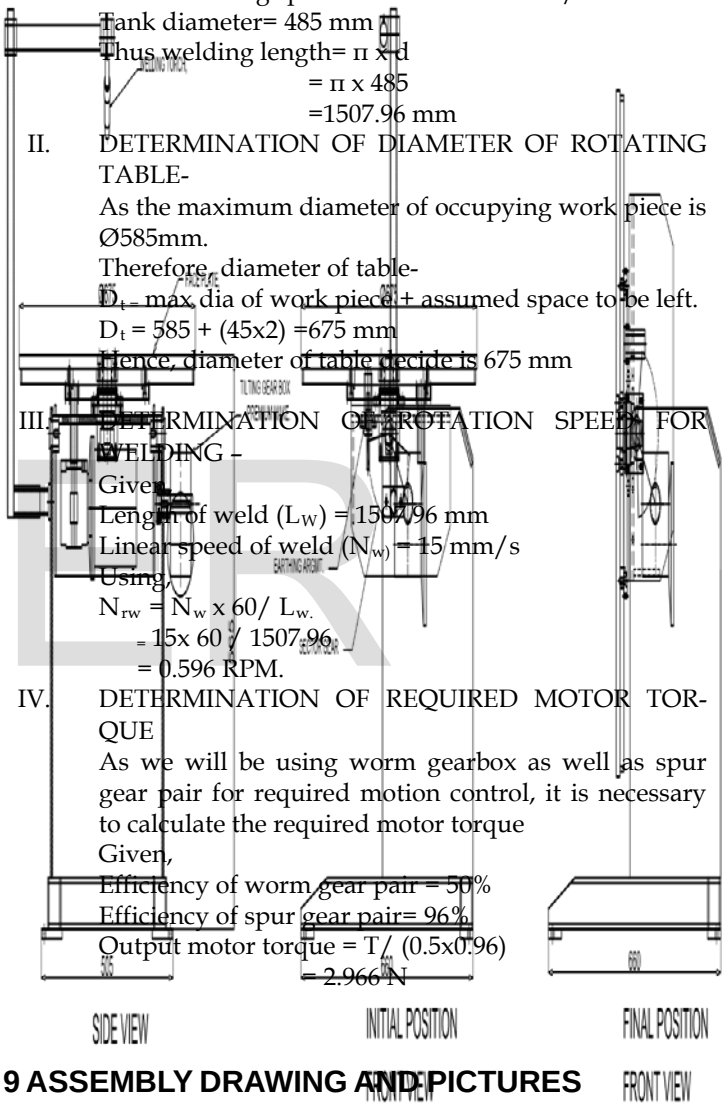
Linear welding speed of GMAW =15 mm/s
Tank diameter= 485 mm
Thus welding length= π x d
= π x 485
=1507.96 mm

II. DETERMINATION OF DIAMETER OF ROTATING TABLE-
As the maximum diameter of occupying work piece is Ø585mm.
Therefore, diameter of table-
D_t = max dia of work piece + assumed space to be left.
D_t = 585 + (45x2) =675 mm
Hence, diameter of table decide is 675 mm

III. DETERMINATION OF ROTATION SPEED FOR WELDING –
Given,
Length of weld (L_W) = 1507.96 mm
Linear speed of weld (N_w) = 15 mm/s
Using,
$N_{rw} = N_w \times 60 / L_w$.
= 15x 60 / 1507.96
= 0.596 RPM.

IV. DETERMINATION OF REQUIRED MOTOR TORQUE
As we will be using worm gearbox as well as spur gear pair for required motion control, it is necessary to calculate the required motor torque
Given,
Efficiency of worm gear pair = 50%
Efficiency of spur gear pair= 96%
Output motor torque = T/ (0.5x0.96)
= 2.966 N

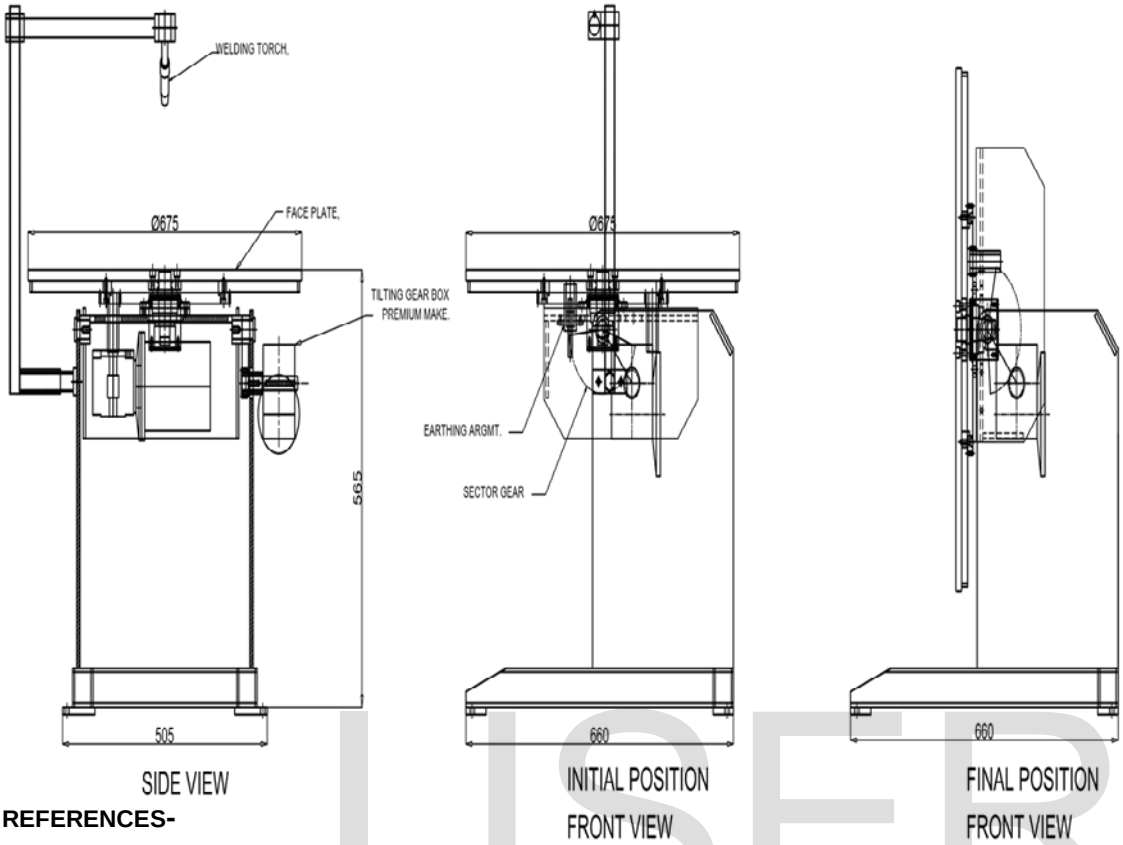
9 ASSEMBLY DRAWING AND PICTURES



tilt view of positioner

component to be welded

flat view with drive unit



REFERENCES-

Design of machine elements by – R S khurmi, JK gupta.
Design data book- psg publications, Coimbatore.