MULTIPURPOSE WELDING ROTATOR

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Abstract - ***This paper describe multipurpose rotating machine mainly for welding of circular job of large diameter (upto 60-80cm diameter) for mass production industries & also use for other application like spray painting for circular application with required angle ,bottle filing plant, wire wounding . In this device we use Worm & worm wheel, Cummutator motar,Belt drive,Proximity sensor, Ball bearing ,Electronic relay,inching switch , Circular wooden plate with sheet metal cover & at center of plate use metal strip for earthing purpose .***

Key Words: Circular welding plate with required angle,Spray painting,manual welding,wooden plate.

1. INTRODUCTION

In now days of mass production it is often required data to automate the manufacturing processes that were conventionally done manually.In presence various welding technique is used for the welding processes such as CO_2 welding or Electric arc welding,TIG (tungsten inert gas welding), in that various fixture is use for various welding, but in many application we use some technique which is not work efficiently & accurately .Moving the electrode along the welding line is a skill full work and especially for circular component become much more difficult.[1]

To avoid such a problem we implement welding rotator .The need of a special device which can rotate the job at an fixed rate to assist the welding process for circular component and ensure good profile and homogeneous welding.[2] Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding can be done in many different environments, including open air, under water and in outer space. Regardless of location, welding remains dangerous, and precautions are taken to avoid burns, electric shock, eye damage, poisonous fumes, and overexposure to ultraviolet light.

2. PROBLEM DEFINITION

In CO_2 welding or sometimes electric arc welding the need often arises for welding of circular shape components , where the welding is carried out on the entire periphery or an partial arc length of the job. The electrode is thus moved along this circular path in the conventional method. But movement of the electrode is much more difficult and it is much more easy to index the job.

3. DESIGN CALCULATION:

3.1 MATERIAL SELECTION

Designation	Ultimate tensile Strength	Yeild strength
EN24	800	680

3.2 ASME Code For Design of Shaft

Since the loads on most shafts in connected machinery are not constant, it is necessary to make proper allowance for the harmful effects of load fluctuations

According to ASME code permissible values of shear stress may be calculated form various relations.

$= 0.18 \times 800$
$= 144\ N/mm^2$

OR

$fs_{max} = 0.3\ fyt$
$= 0.3 \times 680$
$= 204\ N/mm$

considering minimum of the above values;

$fs_{max} = 144\ N/mm^2$

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

fs_{max} = 108 N/mm^2

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

3.3 To Calculate Worm Wheel Shaft Torque

$$P = \frac{2\Pi NT}{60}$$

Motor is 50 watt power, run at 6000 rpm, connected to worm shaft by belt pulley arrangement with reduction ratio 1:4.Hence input to worm gear box = 1500 rpm.The worm gear box is the reduction gear box with 1:80 ratio.Hence input speed at the input shaft = 1500/80 =18.75 =20 rpm (approx)

$$T = \frac{60 \times P}{2 \times \pi \times N}$$

$$= \frac{60x120}{2\Pi x20}$$

T = 57.29 N-m

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3.4 Check For Tensional Shear Failure of Shaft

Design of Worm Shaft (Material Selection)

Designation	Ultimate Tensile Strength N/mm^2	Yeild Strength N/mm^2
20Mn Cr5	800	680

ASME Code For Design of Shaft

Since the loads on most shafts in connected machinery are not constant, it is necessary to make proper allowance for the harmful effects of load fluctuations

According to ASME code Assuming minimum section diameter on input shaft = 16 mm

d = 16 mm

Td = Π/16 x fs_{act} x d^3

$$fs_{act} = \frac{16 \times Td}{\pi \times d^3}$$

$$= \frac{16 \times 57.29 \times 10^3}{\pi \times (16)^3}$$

fs_{act} = 71.23 N/mm^2

As $fs_{act} < fs_{all}$

$\Rightarrow$ I/P shaft is safe under torsional load

permissible values of shear stress may be calculated form various relation.

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= 144 N/mm^2

OR

fs_{max} = 0.3 fyt

=0.3 x 680 =204 N/mm^2

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To Calculate Worm Wheel Shaft Torque:

$$POWER = \frac{2\pi NT}{60}$$

Motor is 50 watt power, run at 6000 rpm, connected to worm shaft by belt pulley arrangement with reduction ratio 1:4

Hence input to worm gear box = 1500 rpm

The worm gear box is the reduction gear box with 1:80 ratio

Hence input speed at the input shaft = 1500/80 =18.75 =20 rpm (approx)

$$T = \frac{60 \times P}{2 \times \pi \times N}$$

T = 57.29 N-m

T design = 57.29N-m

CHECK FOR TORSIONAL SHEAR FAILURE OF SHAFT.

DESIGN OF WORM SHAFT

3.5 Material Selection:

Designation	Ultimate Tensile Strength N/Mm^2	Yeild Strength N/Mm^2
20Mn Cr5	800	680

d = 16 mm

$Td = \Pi/16 \times fs_{act} \times d^3$

fs_{act} =

$$= \frac{16 \times 0.76 \times 10^3}{\pi \times (16)^3}$$

$fs_{act} = 0.94\ N/mm^2$

ASME CODE FOR DESIGN OF SHAFT.

Since the loads on most shafts in connected machinery are not constant , it is necessary to make proper allowance for the harmful effects of load fluctuations

According to ASME code Assuming minimum section diameter on input shaft = 16 mm

d = 16 mm

$Td = \Pi/16 \times fs_{act} \times d^3$

$$fs_{act} = \frac{16 \times Td}{\pi \times d^3}$$

$$= \frac{16 \times 57.29 \times 10^3}{\pi \times (16)^3}$$

$fs_{act} = 71.23\ N/mm^2$

As $fs_{act} < fs_{all}$

I/P shaft is safe under torsional load permissible values of shear stress may be calculated form various relation.

$fs_{max} = 144\ N/mm^2 = 0.18 \times 800$

$= 144\ N/mm^2$

OR

$fs_{max} = 0.3\ fyt$

$= 0.3 \times 680 = 204\ N/mm^2$

considering minimum of the above

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

$fs_{max} = 108\ N/mm^2$

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

TO CALCULATE TABLE SHAFT TORQUE

$$POWER = \frac{2\pi NT}{60}$$

Motor is120 watt power, run at 6000 rpm, connected to worm shaft by belt pulley arrangement with reduction ratio 1:4

Hence input to worm gear box = 1500 rpm

$$= \frac{2\pi NT}{60}$$

$$T = \frac{60 \times 120}{2 \times \pi \times 1500}$$

T = 0.76 N-m

T design = 0.76N-m

As $fs_{act} < fs_{all}$ CHECK FOR TORSIONAL SHEAR FAILURE OF SHAFT.

Assuming minimum section diameter on input shaft = 16 mm

I/P shaft is safe under torsional load

Fig:1 Welding rotator

Fig:2 Circular Wooden Plate with sheet metal cover

4.6 Performance Analysis Complete Circular Welding

The job to be welded is placed on the indexer table and considering the welding process and electrode size the speed regulator is adjusted to give desired table speed. The table carries indexer buttons as per no of welds and position of the same. Table is indexed to the first stop position. Now inching switch is operated simultaneously as the welding process is started, the job rotates as welding operation is done, after the second indexer button comes in front of the proximity switch it stops the welding process and the table movement. Inching switch is operated which starts the next position welding and the process is repeated till the last stop i.e., the first stop comes in front of the proximity switch. The job welded is unloaded and new work-piece is loaded for the next operation.

4. CONCLUSION

1- Heavy load capacity of table is 80 kg safe load.
2- Adjustable table speed (0 to 75 rpm)
3- Auto stop feature , to start and end process operation at precise positions.
4- Multiple indexer positions (6) , enables to make staggered welded joints.
5- Easy operation, as table automatically stops as per indexer button position and next operation is started by merely pressing the inching switch.
6- Compact, the entire drive assembly fitted below the table itself, and the controls are placed on the front at ergonomic positions.
7- Low power consumption (50 watt)

From above report it is conclude that for the complete circular welding as well as the spray painting in required angle with perfectly and efficiently in mass production .

Future scope

It will play vital role in mass production system and in following process like painting, air washing, wire winding, circle marking, any geometrical shape welding, act as indexer, CO_2 welding of circular or staggered welded joints, electric arc welding of circular or staggered welded joints, plastic moulding for multiple position dies, bottle filing plants. Etc.

5.REFERENCES

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