Review Paper on Selection of Mechanism for TIG Welding Machine

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Abstract—*Because of growing demands in hardware products, automation is necessary in hardware product industries. Welding is very popular and important process of hardware manufacturing industries. Design of automatic welding machine is done for orbital welding to get accurate and precision of welded part and also for increasing the productivity. Applying given constraints like movement of welding torch, work envelope, fixture for holding objects. Various kinematic mechanisms like four bar mechanism etc. are studied to obtain design for holding welding torch and its circular movement. And also various mechanisms are studied to develop holding device for holding the object.*

Keywords: - Mechanism, Orbitalwelding, Productivity, Automation

I. INTRODUCTION

Tig welding is a most convenient process for joining similar or dissimilar metals. Specially for stainless steel workpiece. The TIG process has the advantages of -

- Narrow concentrated arc
- Able to weld ferrous and non-ferrous metals
- Does not use flux or leave a slag
- Uses a shielding gas to protect the weldpool and tungsten
- A TIG weld should have no spatter
- TIG produces no fumes but can produce ozone

The TIG process is a highly controllable process that leaves a clean weld which usually needs little or no finishing. TIG welding can be used for both manual and automatic operations.

In this machine we have to move welding torch 360° clockwise and anti-clockwise and welding path of this machine is circular. The objective part should remain steady and welding should be done smoothly. And also welding quality should be good.

This special purpose machine will be used to weld stainless steel cylindrical pipes which will be used as handles of doors and windows. The diameter of the cylindrical pipes are 20-50 mm. and length of the pipes would be 15-20 cm. thickness of the pipes are 3mm to 4mm. The kinematic mechanism model is an important part of the representation of e.g. machine tools, robots and fixtures.

To develop this type of special purpose machine we need to select mechanisms for holding workpieces, for holding welding torch and to rotate welding torch. A basic problem in the study of mechanisms is determining the mobility [6] (or the number of degrees of freedom) of the given system. For an open chain this is a rather trivial task, but if the mechanism contains closed loops the situation can be very complicated. Main purpose to develop this type of welding machine is to increase productivity, quality of welded parts. So by automation of TIG welding machine we can achieved desired results what we want.

II. FOUR BAR MECHANISM

A four bar mechanism consists of four rigid link which are linked in the form of quadrilateral by four pin joints.[7] A link that makes complete revolution is called crank, the link opposite to the fixed link is the coupler and forth link is a lever or rocker if oscillates or another crank if rotates. Here r1, r2, r3 and r4 are the links of the mechanisms.

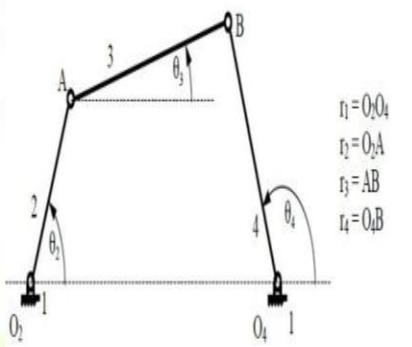

Fig. 1: Fourbar mechanism

III. INVERSIONS

A mechanism has been defined above as a kinematic chain in which one of the links is fixed. From the four bar mechanism, different versions of each of them can be obtained by fixing any one of the links p, q l or s. Such different versions, which can be obtained by fixing any of the different links, are called its “Inversions”. Many a time, a particular inversion of a mechanism may give rise to different mechanisms of practical utility, when the proportions of the link lengths are changed.

By this principle of inversion of a fourbar chain, several useful mechanisms can be obtained.

There are three inversions of four bar mechanisms, which are obtained by fixing different links of the kinematic chain. They are:

- Double Crank Mechanism
- Crank Rocker Mechanism
- Double Rocker Mechanism

A. Double Crank Mechanism

A double crank converts rotary motion from a crank to a second crank or link in a different plane or axis. It is also known as crank-crank, drag-crank or rotary-rotary converter. The links p, q and l shown above rotate through one complete revolution. This is one of the first inversions of four-bar mechanisms. In this, let’s call the link‘s’ the frame as the fixed link. We will call the link ‘q’ the crank, ‘p’ the coupler and ‘l’ the lever for now. Crank is not defined as the link, which is attached to the driver shaft; rather it’s the link, which does a complete revolution. And in this configuration, as there are two links, both q and l, which revolves completely about the hinged point on the frame, both of them, is cranks. The term is commonly used in automotive technology for the link in a four bar steering linkage that converts rotation of a steering arm to a center link and eventually to tie-rod links which pivot the wheels to be steered. A double crank is used when the steering arm operates in a plane above the other links. The double crank converts the sweeping arc of the steering arm to linear motion in the plane of the other steering links.

B. Crank Rocker Mechanism

In a four bar linkage, if the shorter side link revolves and the other rocks (i.e., oscillates), it is called a crank-rocker mechanism. In this case, there is only a slight change, leave the smallest side and connect any of its adjacent side as the frame. Then the smallest side will have full 360 degree revolution while the other link adjacent to the frame has only oscillating motion . This kind of mechanism is hence called a crank-lever mechanism or a crank-rocker mechanism or a rotary-oscillating converter.

Double Rocker Mechanism

A linkage in which no link undergoes entire 360-degree revolution but only oscillations is known as a double-lever mechanism. This linkage results when the shortest side in the mechanism is made the coupler. The other two links only get to oscillate in their place. A linkage in which the sum of the longest and shortest is less than the sum of the other two sides, is known as a Class I mechanism, otherwise it's Class II. This mechanism is achieved when it is Class II. It's also called rocker-rocker mechanism, double-rocker mechanism or oscillating oscillating-converter.

C. Parallel crank mechanism

If in a 4 bar linkage, two opposite links are parallel and equal in length, then any of the links can be made fixed, regardless, the two adjacent links will always act as a pair of cranks, i.e. , both will have complete revolution about their joints on the frame. The use of such mechanism is made in coupled wheels of locomotives in which the rotary motion of one wheel is transmitted to the other wheel.

IV. RESEARCH METHODOLOGY

A. Checking the available mechanism

As per our project work in market there are various mechanisms are available and welding machines. Mechanisms are limited to assemblies of such pairs. Consequently, a mechanism's kinematic function is specified by a fixed set of equations that can be solved with an efficient numerical algorithm. The most common categories are linkages, cams, and gear mechanisms. Linkages consist of lower pairs. Cam mechanisms consist of cams in permanent contact with followers. Gear mechanisms consist of meshed gears. These categories exclude many important mechanisms. Pairs with multiple contacts are more versatile than fixed-contact pairs because they can perform multiple functions through changes in their contacts. Higher-pair mechanisms are typically cheaper, lighter, and more compact than lower-pair mechanisms. Examples include sewing machines copiers, cameras, and compact disc players

B. Try most convenient and preferable mechanism

In market there are mostly the fixture is moving and the welding torch is steady for pipe welding machines ,but small pipes having small diameter 20-50 mm and thickness 3mm-4mm and material stainless steel so in that project work we are trying to move welding torch 360° clockwise and anticlockwise. Fixture for holding workpiece should be steady and welding torch will be moving but small pipes having small diameter 20-50 mm and thickness 3mm-4mm and material stainless steel so in that project work we are trying to move welding torch 360° clockwise and anticlockwise. Fixture for holding workpiece should be steady and welding torch will be moving.

V. LITERATURE REVIEW

Fu-shen REN, Xiao-ze CHENG, Su-li CHEN [4] had developed A new type of special welding robot, which mixed design method of series and parallel and realized the integrated design of organization for robot anchor and what would be the design for motion mechanism and welding torch adjusting mechanism and wire feeder, realized Independent control for position and orientation of welding torch . The robot kinematics model is built, and realized the real-time control of welding torch position, orientation and welding speed during the welding process. Conclude that mechanism for wire feeding and welding torch adjusting are similar to project work .

A M vaidya and P. M. Padole had [3] calculated the flexibility of links and joints stiffness. A mechanical system is made-up of several components, which can be divided into two major groups namely links and joints. For four bar mechanism the coupler point location and output angle is greatly affected by joint clearances and flexibility in linkages. The error in the output angle and coupler position is minimum for optimal transmission angles. In four bar mechanism joints can be exactly modeled with the help of clearance link assigned with proper axial, longitudinal and torsional stiffness. Joint stiffness does affects the model analysis of the four bar mechanism especially at higher order frequencies

owen butler and William[1] powers had done research on servo driven mechanism by this paper we can learn about the servo motor driven mechanism, which would be helpful in selection of mechanism.it is similar to project work which we are expecting for mechanism. And also there is a lots of calculations should be done for modifying the available mechanism L. joskowicz and E. sacks had developed computational kinematics which woul be helpful for designing or modifying the mechanism, by this paper able to do mechanisms analysis, feasibility.

Shanon and carl [5]had researched on the considerations in designing of mechanisms, This paper has introduced a parallel kinematic machine based on two parallel kinematic mechanisms. The PKM's were designed with control issues as driving factors. Consideration of load balance between actuation connectors drove the actuation PKM design. Error propagation from connector space to moving platform space was considered in the design of the metrology PKM. These considerations are incorporated into the control methodology. The load cells utilized in implementing the force measurement for the moving platform have a bandwidth of approximately 30 Hz. The sensitivity is such that the manual application of force should be detectable, but the resolution of the magnitude of the applied force may not be sufficient to allow the calculation of the force's direction with a useable precision. Replacement of this component with a more sensitive measurement scheme will alleviate this concern.

VI. CONCLUSION

By reviewing discreet mechanism, four bar mechanism should be appropriate for desired welding machine . It is simple and easy to design or modify, also for maintaining welding quality and increase the productivity.

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