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Design and Manufacturing of Twin Head Welding SPM

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ABSTRACT

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work-pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This work aims to design double end drive (DED) machine for automation of circular welding process in exhaust system. Exhaust system consist assembly of bend pipe, flexible bellow and straight pipe. These bend pipe and straight pipe are weld with flexible bellow in middle. It has two circular positions on both face of pipe. These two faces are located at two different locations in horizontal plane. To weld the pipe and bellow onto their respective position, we have to design a SPM which must carry an automate drive for uniform and precise circular welding. This work also illustrates role of automation, Automation is much helpful in cost saving and to increase the productivity of the system.
Keywords: automation, circular, exhaust, welding

1. INTRODUCTION

1.1 Welding

The art of joining metals is about 3000 years old. The origin of welding is probably to be traced to the shaping of metals. In industry every worker is working for changing the shape of metals by different methods and machines. "Welding is the process of joining together two pieces of metal so that bonding takes place at their original boundary surfaces". At the point when two sections to be consolidated are softened, warmth or weight or both are connected and with or without included metal for development of the metallic bond. With the regularly expanding interest for both high generation rates and high exactness, completely motorized or robotized welding forms have assumed a conspicuous position in the welding field.[1] The rate at which computerization is being brought into the welding procedure is astounding and it might be normal that before this current centuries over morerobotized machines than men in welding manufacture units will be found. Also, computers assume a basic job in running the mechanized welding forms and the directions are given by the computer will be taken from the projects, which thusly, require calculations of the welding factors as scientific conditions. To make successful utilization of the mechanized frameworks it is fundamental that a high level of certainty is accomplished in anticipating the weld parameters to achieve the coveted mechanical quality in welded joints. To create scientific models to precisely anticipate the weld solidarity to be bolstered to the mechanizedwelding frameworks has turned out to be more fundamental.[2]

In addition to melting the base metal, a filler material is typically added to the joint to forma pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material (parent metal). Pressure may also be used in conjunction with heat, or by itself, to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized.[3]

Although less common, there are also solid state welding processes such as friction welding in which the base metal does not melt. Some of the best known welding methods include :

- Oxy-fuel welding: also known as oxy-acetylene welding or oxy welding, uses fuel gases and oxygen to weld and cut metals.
- Shielded metal arc welding: also known as stick welding or electric welding, uses an arc of electric current between the material and an electrode stick, which is held in the hand in an electrode holder, to weld metals together.
- Gas tungsten welding: also known as TIG (Tungsten Inert Gas), uses a non-consumable tungsten electrode to produce the weld.
- Gas metal arc welding: commonly termed MIG (Metal Inert Gas), uses a wire feeding gun that feeds wire at an adjustable speed and flows an argon-based shielding gas or a mix of argon and carbon dioxide (CO_2) over the weld puddle to protect it from atmospheric contamination.
- Flux-cored arc welding: almost identical to MIG welding except it uses a special tubular wire filled

with flux; it can be used with or without shielding gas, depending on the filler.

- Submerged arc welding: uses an automatically fed consumable electrode and a blanket of granular fusible flux.
- Electro slag welding: a highly productive, single pass welding process for thicker materials between 1 inch (25 mm) and 12 inches (300 mm) in a vertical or closeto vertical position.
- Electric resistance welding: a welding process that produces coalescence of laying surfaces where heat to form the weld is generated by the electrical resistance of the material.

Many different energy sources can be used for welding, including a gas flame (chemical), an electric arc (electrical), a laser, an electron beam, friction, and ultrasound. While often anindustrial process, welding may be performed in many different environments, including inopen air, under water, and in outer space. Welding is a hazardous undertaking and precautions are required to avoid burns, electric shock, vision damage, inhalation of poisonous gases and fumes, and exposure to intense ultraviolet radiation.[4]

Until the end of the 19th century, the only welding process was forge welding, which blacksmiths had used for millennia to join iron and steel by heating and hammering. welding and ox fuel were among the first processes to develop late in the century, and electric resistance welding followed soon after. Welding technology advancedquickly during the early 20th century as the world wars drove the demand for reliable and inexpensive joining methods.[5] Following the wars, several modern welding techniques were developed, including manual methods like SMAW, now one of the most popular welding methods, as well as semi-automatic and automatic processes such as GMAW, SAW, FCAWand ESW. Developments continued with the invention of laser beam welding, electron beam welding, magnetic pulse welding (MPW), and friction stir welding in the latter half of the century. Today, the science continues to advance. Robot welding is commonplace in industrial settings, and researchers continue to develop new welding methods and gain greater understanding of weld quality.[6]

In industry, there are different geometrical shapes to which an operator has to weld. Each and every shape carries its own operational constraints. Circular welding is one of the most critical welding process carried out manually, especially when accuracy and uniformity is of high concern. A manual mode of circular welding carries so many disadvantages like lower accuracy and precision, high wire, gas and electricity wastage and frequent micro cracks.[7] This gives rise to need of automation for circular welding. The bulkiness and complexity of circular welding due to the presence of different holding arrangements and fixtures makes it expensive and highly time-consuming process. On the other hand, due to the complexity of the process, availability of skilled worker is difficult. Moreover, due to monotonous and high concentration job schedule, worker fatigue becomes high and hence it pressures the tendency of worker to have high wages.[8]

To avoid these undesirable circumstances, the application demands import of automation for this circular welding process. Welding automation world-wide utilizes different pneumatic and hydro pneumatic instrumentation.[9] Advancement in pneumatic as well as in hydro pneumatic instrumentation has been a keen part of concern. It has become one of vital aspect in the field of research and development due to its effective output and range of accuracy. Newer and newer effective methods have been carried out to improve the automation and to make it inexpensive. This report illustrates role of automation. Based on our project, Automation is much helpful in cost saving and toincrease the productivity of the system.[10]

Basic requirement for any manufacturing company is to have effective work output. In the world with ever growing technologies, system becomes obsolete very early. Thus it is verynecessary to implement a proper work system to reduce production time and to avoid high cost of not automating. The automation of manufacturing facilities and manufacturing support system increases the shop efficiency. It reduces the scrap and rework, thereby reducing the material and manufacturing cost.[11]

There is always a need of firm and realistic pattern of work output, for which automation is much reliable. Automation can be defined as the technology involved in automated handlingbetween machines and continuous processing at the machines. Automation is not a new technology and has been utilized in the industry since quite some time. In current times, automation has widely exploited the advantages of the electronic and robot technology for achieving efficient and complete control over production.[12]

2. AUTOMATION IN WELDING

Automated welding can give substantial gains in efficiency and productivity - in the correct applications. Welding is ostensibly the most unpredictable assembling process and is much of the time the slightest comprehended. An amazing number of organizations burn through a huge number of dollars to robotize gathering while at the same time overlooking the welding procedure. Manual welding is as yet the best procedure for some gatherings. Be that as it may, numerous constructing agents are actualizing computerized welding frameworksto expand quality, efficiency, and productivity.[13]

Welding computerization can be separated into two fundamental classifications: self-loader and completely programmed. In self-loader welding, an administrator physically stacks theparts into the welding installation. A weld controller at that point keeps the welding procedure, the movement of the light, and stillness of the parts to preset parameters. After the weld is finished, the administrator expels the finished get together and the procedure starts once more.[14]

In completely programmed welding, a custom machine, or arrangement of machines, stacksthe work piece, lists the part or light into position, achieves the weld, screens the nature of the joint and empties the completed item. Extra part set up and last item quality checks may likewise be structured into the machine if fundamental. Contingent upon the activity, amachine administrator might be essential.[15]

Few out of every odd welding task is a decent contender for computerized welding. Applications will profit most from mechanization if the quality or capacity of the weld is basic if dull welds must be made on indistinguishable parts or if the parts have amassed noteworthy incentive before welding. Brilliant contender for computerization incorporate batteries, capacitor jars, solenoids, sensors, transducers, metal howls, hand-off fenced in areas, light components, fuel channels, canteen carafes, restorative parts, atomic gadgets, pipe fittings, transformer centers, valve components and airbag segments. Organizations that gather constrained amounts of items requiring precise or basic welds may profit by a self- loader frame work, yet would presumably not require completely computerized frameworks.[16]

2.1 Benefits of Automated welding

Automated welding systems offer four main advantages: improved weld quality, increased output, decreased scrap and decreased variable labor costs. Weld quality consists of two factors: weld integrity and repeatability. Automated welding systems ensure weld integrity through electronic weld process controllers. Combining mechanized torch and part motionswith electronic recall of welding parameters results in a higher quality weld than can be accomplished manually. This offers instantaneous quality control. Furthermore, because a weld is made only once, defects are readily visible and detectable. Humans tend to "smooth over" a mistake with the torch, hiding lack of penetration or a possibly flawed weld. In somecases, leak testing and vision systems can be integrated into fully automated systems to provide additional quality control.[1]

Repeatability is a function of the quality of the weld process controller and of the engineering of the machine motions. Mechanized welding provides repeatable input parameters for more repeatable output. Assuming the controller is functioning properly, the question becomes: Can the mechanisms of the machine position the parts or the torch withinthe specified tolerances for welding? The answer to this question will attest to the quality ofsystem purchased.[2]

Semiautomatic and fully automatic systems increase output by eliminating the human factorfrom the welding process. Production weld speeds are set at a percentage of maximum by the machine, not by an operator. With minimal setup time and higher weld speeds, a mechanized welding system can easily outpace a skilled manual welder.[3]

Automating the torch or part motions, and part placement, reduces the possibility of human error. A weld takes place only when all requirements are satisfied. With manual welding, reject welds often increase when welders become fatigued. Depending on the value of the parts when they arrive at the welding station, the cost savings in scrap alone may justify the purchase of an automated welding system. Automation should also be considered when assemblers need to minimize the risk of shipping a bad part to a customer. Reliance on human welders can dramatically increase a manufacturer’s labor costs. When planning for labor costs, manufacturers must consider the time that welders spend producing assemblies.[4]

Typically, a semiautomatic system has at least twice the output of a skilled welder. A fully automatic system can be built with twin welding positioners on an automated shuttle. Sucha system can load and unload parts at one station while welding occurs at the other. In this way, a fully automatic system can run at four arial the pace of semiautomatic system, or eight Arial the pace of a skilled welder. Lost opportunity costs are also significant. If a skilled welder fails to report to work, the company’s variable costs skyrocket. Eight hours of production time is lost. Availability of skilled labor for manual welding may also pose a challenge. Conversely, general machine operators are more readily available and more affordable than skilled labor.[5]

2.2 Deciding for Automate

With quality and productivity as buzzwords, and customers demanding superior products, implementing an automated welding system may determine whether a company remains competitive. To avoid pitfalls along the way, assemblers need to establish a strategy and follow it closely.

First, assemblers should determine the exact objectives of the project. What specifically needs to be improved, accelerated or changed through automated welding? The following questions can help assemblers sort this out as:

- Does the function of the part depend on a high-quality weld? What are the ramifications if the end customer receives or uses a defective part?
- What level of automated welding system will the production system justify?
- What metals are involved? Do they lend themselves to automation?
- How is the joining process currently being done? What is unsatisfactory about it?
- What budget is available for the welding portion of the project?

3. DOUBLE END DRIVE WELDING MACHINE

Double End Drive Welding machine is extraordinarily structured for this segment to deliver large-scale manufacturing. And is shown in figure below.

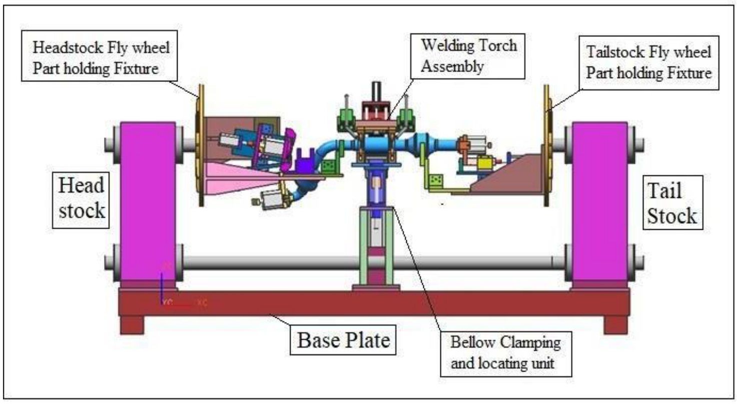

Fig.1. Double End Drive (DED) Machine

Double end drive (DED) welding machine. Welding Machine consists of various manufactured and standard parts. Their construction and working, with its function, are as follows.

- Base Plate
- Head Stock
- Tail Stock
- Headstock Fly Wheel Part holding Fixture
- Tailstock Fly Wheel Part holding Fixture
- Bellow Clamping and locating unit
- Welding Torch Assembly

4. MACHINE MAINTENANCE AND SAFETY PRECAUTIONS

4.1 Maintenance

Hardly any maintenance is required for the control panel. However, dusting of control panel is required at regular intervals. Tighten all contacts in the control panel so that there are no Loose connections in the panel. Check the earthing terminal & ensure –ve contact on the DED all the time. All the power cables in the +ve circuit should be tight & isolated from the negative circuit at all times.

4.2 Daily Check

- Make sure that the Air Pressure for the DED is correct. (i.e. 5 bar indicated on FRLUNIT)
- Make sure that the Gas Pressure for the Co2 Welding M/c. is Correct (i.e. 3 bar indicatedon the regulator)

4.3 Periodical Inspection (After Every 3 Months)

- Check that the connecting pipes are not loose.
- Check input/output cables for the systems & welding power Supply for poor contact due to loose fit or corrosion. Also check That the insulation is normal & up to the specified limit.
- Check each pressure gauge to make sure that its 0-point is correct.

- Earth Cable: Ensure that the earth cable of the equipment's & Welding power supply is
- firmly connected to its respective points.
- Cleaning: The systems should be cleaned with dry air.

4.4 Safety Precautions.

- Please observe general safety of working environment.
- Use safety equipment's. Always wear eye protection. Dust mask, Non – Skid safetyshoes, helmet, or hearing protection must be used for conditions.
- Check at regular intervals that all safety equipment's are effective.
- Report any unsafe working condition to safety officer.
- Damage & defective parts must be repair or replace before using.
- Avoid accidental starting. Be sure switch is "OFF" before plugging in.
- Remove adjusting keys or wrenches before turning the tool "ON". A wrench or a key that is left attached to a rotating part of the tool may result in personal injury.
- Do not overreach keep proper footing & balance at all time.
- Proper footing & balance enables better control of the tool in unexpected situations.
- Read operating instruction manual carefully.

5. CONCLUSION

Automation of circular welding which is successfully achieved in the form of 'Double End Drive [DED] welding Machine' with all desirable features a Double End Drive Welding carries.

- Designs and dimensions obtained in the design cycle came to their supposed results, which leads to error-free welding cycle without susceptible failures.
- As there is no scope for non-uniformity due to automation, the weld thickness is neverincreases hence saves energy which frequently takes place in manual welding due to human errors.
- Automation allows us to clamp and unclamp the work-piece in shorter time period which saves time. Quality improvement and a decrease in time consumption followedthe objectives.
- The manual welding process has many limitations like less productivity, in consistencequality of welding and dimensional inaccuracy. As all processes of the welding are automated with proper drives.

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