

Automatic Multi Purpose Welding Device

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ABSTRACT

To build a multi - axis welding robot with grinding operation that can be controlled using a remote controller at 20m range. Here we are fabricating a prototype for a welding robot which can even weld in narrow space. This prototype can be further continued as a real application model in future ,in this prototype the welding operation is controlled by pneumatic cylinders.

INTRODUCTION

Multi-axis welding machine with grinding operation mechanism is a prototype to achieve welding by using pneumatic power and mechanical arrangement. The pneumatic system is used because it is low cost and compared to the hydraulic system it is safer and more efficient. This welding machine also reduces the human error and less hazardous occurs compared to normal welding process. The total movement of the machine can be controlled by using the RFI remote for the forward and backward movement and the other welding probe controls are controlled by the pneumatic switches. The intention of using this procedure are the followings

- To reduce human error and human involvement
- To increase productivity
- To maintain the quality of the welding
- To increase the safety of the welding
- To weld at narrow spaces Also, for the smoothening the surface of joining metals using grinding operation before or after the welding operation The dimensions of the multi axis welding machine are 100x40x120.

GENERAL:

Multi axis welding machine with grinding operation robot, this machine does work for human can't do easily. Here the welding point is fixed in the end of a hydraulic cylinders which moves in multiple axis and weld even in complex ways and shapes. Welding is a fabrication process where by two or more parts are fused together by means of heat, pressure or both and when it is cooled the joint is formed by the welding process. The earliest example of welding from BRONZE AGE where small gold circular boxes were made by pressure welding lap joints together. It is estimated these boxes were made over 2000 years ago. During the iron Age (1200-600BC) 2 The Egyptians and eastern Mediterranean area learnt the art of welding. Welding is usually used on metals and thermoplastics but can also be used on wood. The complete welded joints may be referred to as a weld man.

CLASSIFICATION OF WELDING:

There are different types of welding used for different purpose each type will have a different application, in our project we use arc welding, the different types of welding are;

- Gas welding 3
- Solid state welding
- Arc welding
- Newer welding
- Resistance welding

TYPES OF ARC WELDING:

- Carbon arc
- Metal arc
- Plasma arc
- Gas metal arc
- Gas tungsten arc In our project we specifically use carbon arc welding, since it is affordable cost for equipment and doesn't need much due to lack of gas, it is easily portable, versatile and works on metal that's even dirty.

CYLINDRICAL GRINDING:

The cylindrical grinder is a type grinding machine used to shape the outside of an object. The cylindrical grinder can work on a variety of shapes; however, the object must have a central axis of rotation. This includes but is not limited to such shapes as a cylinder, an ellipse, a cam, or a crank shaft. Cylindrical grinding is defined as having four essential actions:

- The work (object) must be constantly rotating
- The grinding wheel must be constantly rotating
- The grinding wheel is fed towards and away from the work
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PROBLEM IDENTIFICATION

- The infrastructures and economics in the low scale industry in bare minimum for the welding.
- The uniformity and quality of the weld will be low when normal process is used.
- When normal welding process is used there is a high chance of hazardous
- for the workers.
- The separate cost for normal grinding and welding process is high.
- There is a difficulty to weld at narrow spaces (pipe lines)
- The labour cost is high and can't be productive for long duration at normal
- welding process

LITERATURE REVIEW

Initially we went through the International Research Journal of Engineering and Technology (IRJET), we looked for more similar projects like Automatic double axis welding machine, Three axis pneumatic cylinders, Three axis pneumatic Automatic welding machine etc. We went through these projects and we identified the problems like the initial cost is high, the quality of the

weld is poor, the place to be weld and the welded place should be smooth as welding causes uneven surface, the movement of the machine is manual. We approached to Mr Muthu Kumar, who fabricated Pneumatic Four axis material handling robot, and we discussed about the various difficulties he faced While fabricating his project.

We also interacted with many labours and we came to know the difficulties that they are facing while welding like Skin inflammation, several eye problems etc. We also went through the many sample projects which are similar to our project. The sample projects are

FABRICATION OF THREE AXIS PNEUMATIC ADVANCE TRAILER

The Fabrication work or the infrastructural work demands efficient and userfriendly machinery which will lead to more and more use of modern three axis pneumatic trailer. Trailer has lots of applications in today's world. In industrial and domestic considerations, trailer can haul a variety of products including gravel, potatoes, grain, sand, compost, heavy rocks, etc. In this paper the fabrication of three axis pneumatic advance trailer and used 3-way trailer mechanisms, which will help the trailer to unload in 3 directions. The trailer will unload the material in only one single direction. These are rectified to unload the trailer in all three sides very easily. Now the mainly concentrated on this difficulty, and hence a suitable arrangement has been designed.

DESIGN AND FABRICATION OF PNEUMATIC THREE AXIS DUMPING TROLLEY55

The modern dumping mechanism trailer/dumper has been fabricated by detecting the difficulty in unloading the material. In today's world there is a variety of products like industrial waste, agricultural products, stones composts, rocks, gravel etc. Conventional trailers can unload in one direction only. In case of limited space availability, they fail to operate. The trailer has mainly concentrated on this difficulty, and hence a suitable arrangement has been designed. In this project we are fabricating the prototype of the dumping mechanism which can operate or unload the goods in three directions smoothly without any application of impact forces. In this we will use pneumatically operated system using direction control valves. It will be convenient to the driver to unload the trailer and to overcome the space requirement from control panel. This mechanism prevents blocking of the road, increases the productivity of the trailer and shortens the time of unloading with small increment in cost

DESIGN AND FABRICATION OF PNEUMATIC BEARING PULLER PROJECT

A bearing is a part of a machine such as an engine that compels relative motion. This helps to reduce friction between the moving parts. A bearing puller is a tool used to remove bearing sets from a rotating machine shaft or from a blind bearing hole. The most common application is removing a caged set of ball or tapered bearings from a rotating shaft. Traditional method of bearing removal is hammering which causes several problems. In the machine the press fit operations are very complicated to align the assembly, this type of operations requires heavy force for disassembling the bearing from the machines. The Pneumatic bearing puller performs pulling operation safely and without harming bearing surfaces. This pneumatic bearing puller system can be widely and effectively used for removing the bearing. Nowadays pneumatic system plays an important role in almost all applications. This bearing puller consists of pneumatic cylinder, actuator, puller and vice. Pneumatic cylinder uses air pressure to unmount the bearings.

COMPONENTS

- Pneumatic cylinder - 2Nos
- Wiper motor.
- Welding machine.
- Hand Lever Valve.
- Wheel.
- Grinding wheel.
- Rack and pinion.
- RFI remote.
- Bearings.
- Pneumatic Fittings.
- Battery
- Compressor.
- Electrode

NEUMATIC CYLINDER

In Multi axis Welding machine and grinding operation, two pneumatic pencil cylinders are used for various purpose, Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like hydraulic cylinders, something forces a piston to move in the desired direction.

The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage. Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement. For example, in the mechanical puppets of the Disney Tiki Room, pneumatics are used to prevent fluid from dripping onto people below the puppets.

WIPER MOTOR

A 24-volt Dc motor is used for the movement of the machine. The rpm of the Dc motor is 100 rpm. Windshield wipers are powered by a small electric motor, usually mounted on the firewall or under the cowl (the area under the windshield's base). The motor activates linkage that moves the wiper arms back and forth. On vehicles with a rear window wiper, a separate motor powers the one in the rear. Signs that a wiper motor is about to fail include slow or intermittent operation, wipers that will operate at only one speed, or arms that stop in the middle of the windshield when turned off. If your wipers don't work, the fault could also lie with other parts of the wiper system. In the winter, for example, trying to use the wipers when the blades are stuck to the windshield because of ice or snow can blow the fuse for the motor or trip a circuit breaker. Other possible causes are the interior switch that controls the wipers failing, wires in the system being damaged, or the linkage that pushes and pulls the wiper arms breaking. Moving parts in the linkage may also be stuck from corrosion and/or gunk and need lubrication. The wiper motor is a crucial part. During bad weather, it moves the wipers to clean the windshield. The motor is usually built to last a lifetime and rarely goes bad. When it does, your car becomes unsafe to drive. It's important to replace a worn or blown wiper motor, but how do you tell type that your car needs or one that suits your preferences? That's what this article will talk about and make buying a car wiper motor easy. Let's start by understanding the motor and its purpose.

WHEEL

The outer diameter of the wheel is 340 mm and the inner diameter is 250 mm. A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the key components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labour in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel, and flywheel. Common examples are found in transport applications. A wheel reduces friction by facilitating motion by rolling together with the use of axles. In order for wheels to rotate, a moment needs to be applied to the wheel about its axis, either by way of gravity or by the application of another external force or torque. Using the wheel, Sumerians invented a device that spins clay as a potter shapes it into the desired object.

RACK AND PINION

A rack and pinion are a type of linear actuator that comprises a circular gear (the pinion) engaging a linear gear (the rack). Together, they convert rotational motion into linear motion. Rotating the pinion causes the rack to be driven in a line. Conversely, moving the rack linearly will cause the pinion to rotate. A rack and pinion drive can use both straight and helical gears. Though some suggest helical gears are quieter in operation, no hard evidence supports this theory. Helical racks, while being more affordable, have proven to increase side torque on the datums, increasing operating temperature leading to premature wear. Straight racks require a lower driving force and offer increased torque and speed per percentage of gear ratio which allows lower operating temperature and lessens viscous friction and energy use. The maximum force that can be transmitted in a rack and pinion mechanism is determined by the tooth pitch and the size of the pinion as well as the gear ratio.

RFI REMOTE

In electronics, a remote control (also known as a remote or clicker [1]) is an electronic device used to operate another device from a distance, usually wirelessly. In consumer electronics, a remote control can be used to operate devices such as a television set, DVD player or other home appliance. A remote control can allow operation of devices that are out of convenient reach for direct operation of controls. They function best when used from a short distance. This is primarily a convenience feature for the user. In some cases, remote controls allow a person to operate a device that they otherwise would not be able to reach, as when a garage door opener is triggered from outside. Early television remote controls (1956–1977) used ultrasonic tones. Present-day remote controls are commonly consumer infrared devices which send digitally-coded pulses of infrared radiation. They control functions such as power, volume, channels, playback,

track change, heat, fan speed, and various other features. Remote controls for these devices are usually small wireless handheld objects with an array of buttons. They are used to adjust various settings such as television channel, track number, and volume. The remote-control code, and thus the required remote-control device, is usually specific to a product line. However, there are universal remotes, which emulate the remote control made for most major brand devices. Remote controls in the 2000s include Bluetooth or Wi-Fi connectivity, motion sensor-enabled capabilities and voice control. Remote controls for 2010s onward Smart 31 TVs may feature a standalone keyboard on the rear side to facilitate typing, and be usable as a pointing device.

BEARING

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is used to reduce friction. In the ball bearing and roller bearing, to reduce sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance. The term "bearing" is derived from the verb "to bear";[1] a bearing being a machine element that allows one part to bear (i.e., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness, and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise components; their manufacture requires some of the highest standards of current technology.

BATTERY

A battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When

a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the freeenergy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells; however, the usage has evolved to include devices composed of a single cell. Primary (single-use or "disposable") batteries are used once and discarded, as the electrode materials are irreversibly changed during discharge; a common example is the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and mobile phones. Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to, at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone exchanges and computer data centers. Batteries have much lower specific energy (energy per unit mass) than common fuels such as gasoline. In automobiles, this is somewhat offset by the higher efficiency of electric motors in converting electrical energy to mechanical work, compared to combustion engines. The 12 Volt Direct Current (DC) Battery is used. It gives the power to the wiper motor.

PNEUMATICS

The word 'pneuma' comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to mean the application of air as a working medium in industry especially the driving and controlling of machines and equipment. Pneumatics has for some considerable time been used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it will indeed be necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature. The compressibility of the air was first investigated by Robert Boyle in 1662 and that found that the product of pressure and volume of a particular quantity of gas

COMPONENTS:

- i. Pneumatic cylinder
- ii. Solenoid valve
- iii. Flow control valve
- iv. Regulator or pressure control valve
- v. Pressure gauge

vi. Connectors and vii. Hoses

1. CYLINDER: The cylinder is a double acting cylinder one, which means that the air pressure operates alternatively (forward and backward). The air from the compressor is passed through the regulator which controls the pressure to required amount by adjusting its knob. A pressure gauge is attached to the regulator for showing the line pressure. Then the compressed air is passed through the directional control valve for supplying the air alternatively to either side of the cylinder. Two hoses take the output of the directional control valve and they are attached to two ends of the cylinder by means of connectors. One of the outputs from the directional control valve is taken to the flow control valve from taken to the cylinder

4.20 Pneumatic cylinder An air cylinder is an operative device in which the state input energy of compressed air i.e. pneumatic power is converted in to mechanical output power, by reducing the pressure of the air to that of the atmosphere.

45 a) Single acting cylinder Single acting cylinder is only capable of performing an operating medium in only one direction. Single acting cylinders equipped with one inlet for the operating air pressure, can be production in several fundamentally different designs. Single cylinders develop power in one direction only. Therefore, no heavy control equipment should be attached to them, which requires to be moved on the piston return stroke single action cylinder requires only about half the air volume consumed by a double acting for one operating cycle.

B) Double acting cylinders: A double acting cylinder is employed in control systems with the full pneumatic cushioning and it is essential when the cylinder itself is required to retard heavy masses. This can only be done at the end positions of the piston stroke. In all intermediate position a separate externally mounted cushioning derives must be provided with the damping feature. The normal escape of air is out off by a cushioning piston before the end of the stroke is required. As a result, the air in the cushioning chamber is again compressed since it cannot escape but slowly according to the setting made on reverses. The air freely enters the cylinder and the piston strokes in the other direction at full force and velocity.



EXPERIMENTAL PROCEDURE

The base frame of 100x40x15 cm is made with iron rod which is the core structure for the machine.

- The shaft which contains the wheel set up that allows the machine to move front and back that are placed 12.5 cm from front and back respectively.
- The welding machine is placed in the lower base of the frame which is supported with the help of front wheel shaft.
- In the upper base of the frame the pneumatic switch and a base for the welding probe structure.
- In the base frame the wiper motor that is connected to the shaft of the back wheel.
- The chain sprocket mechanism for the movement of the machine.
- The base frame also contains the rack and pinion mechanism that allows the rotation of the welding arm up to 180 degrees.
- A cylindrical structure is vertically mounted on the bottom frame's centre rod.
- The rod attached to the cylinder in the centre is connected to the arm that contains the welding probe and the grinding machine.
- The arm is controlled by a pneumatic cylinder of diameter of 20mm and stroke length of 200mm.
- The rack and pinion are controlled by another pneumatic cylinder of diameter 20mm and stroke length of 100mm.
- The grinding operation is also controlled by a compressed air system.
- The bearing is used in the for the each and every rotation of the total mechanism

WORKING PRINCIPLE

The multi axis welding machine is done for the purpose of welding without human interaction in the welding process. • The total mechanism of welding probe and rack and pinion is controlled by pneumatic cylinders. • There is grinding mechanism used so that the weld metal can be given correct surface finish before or after the welding. • A compressed air system is used so that the pneumatic systems can be used efficiently. • There are wheels attached to the total mechanism for the forward and backward movement using a 24V DC motor using a 12V battery. • When the power is supplied to the compressor the air is compressed and supplied to the pneumatic systems. • The pneumatic switch that is placed in the right end controls the upward and downward movement of the welding and grinding arm • The pneumatic switch that is placed in the left end controls the rack and pinion mechanism which helps in the rotation of the arm. • Simultaneously the welding machine also gets the power supply which helps in the main welding part. • The right amount of power supply will enable the welding machine to give the required current supply that could make the weld rod to melt and weld at the required spot. • The grinding machine which is placed in the right side of the arm will work when the air is passed through it. • The speed of the grinding wheel is proportional to the compressed air supplied through the knob of the grinding machine. • The forward and backward movement of the 3axis welding machine is totally controlled by a RFI remote controller which have a range of 15m radius. • The speed of the machine for the forward and backward movement is constant, the supply for that is given by the 12V battery. • The weld rate of the machine is almost equal to the weld rate of the normal welding process. • The maximum speed of the forward and backward movement of the 3-axis

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