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DESIGN AND DEVELOPMENT OF AUTOMATIC CRADLE

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Abstract:

In the present days we see both the husband and the wife are working .So it becomes quite difficult to take care of their infant. Many a times there are no grandparents in the house; the mother alone has to manage with the household activities. To improve the household management, the design and implementation of a new indigenous low cost baby cradle that swings automatically when they decide to switch on the power supply. It is found that when the baby is in cradle he feels comfortable and also sleeps well when he is there in cradle. The system consists of DC motor, slider crank mechanism for cradle movement. The speed of the cradle can be controlled as per the user's need.

Key Words: DC Motor, Slider Crank Mechanism.

1. INTRODUCTION:

This cradle system is a complete automatic device that converts the rotating motion of the motor to oscillating motion with a limited force as per users need. A cradle is a structurally simple unit consisting of three moving parts. In this three, therefore the two components are made up of mild steels and the rest one is made up of wood is named as wooden pulley. The cradle which we designed and fabricated is used for caring the infant babies while the parents put the baby in the cradle. In our project the DC motor which has the speed reduction function by its own setup is used to provide the oscillating motion for the cradle. The dc motor is rotate with the help of 12v battery .By using the low speed port. This project gives details about slider crank mechanism .By varying the pulley sizes we can integrates the oscillating degree. This mechanism is achieved by providing the power supply to the DC motor. Whenever the motor rotates the wooden pulley which is connected with motor shaft is getting rotates .At that time the basinet move forward and backward this motion is also known as oscillation motion. The oscillating is distance is measured by using the unit degree .The movement of the basinet is obtained with respect to the radial distance of the wooden pulley. The wooden pulley and basinet are getting contact with the help of the connecting rod and this link is made up of stainless steel .Thus the connecting rods are joined by using the nuts, bolts, washers. The basinet is made up of mild steel and those mild steels are joined by the welding process. They are made up of square rod at the size range of (1*1 inch) that links are joined with arc welding process. Therefore the main objective of this project is to move basinet forward and backward within the particular range from their ideal position. Therefore the bearings placed the major role by support for the smooth oscillation of the basinet .In this system therefore the bearings are joined by using the phenomenon of welding.

2. Problem Identification:

The ordinary cradles needs the human effort and particularly induce the mother's stresses in working times. The infants experience different force of oscillation, while the cradle operates manually. To overcome these problems we design the cradle with slider crank mechanism. By using the mechanism we can get the required oscillation motion on the cradle.

3. Description of Components:

DC Motor:

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors. Figure 1 shows the DC Motor 12 V, 17 W DC motor is used in the fabrication of the cradle.

Figure 1: DC Motor

Battery:

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with

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respect to available energy and local demand pattern. To be economically attractive the storage of solar electricity requires a battery with a particular combination of properties like Low cost, Long life, High reliability, High overall efficiency, Low discharge, Minimum maintenance. Battery specifications are Potential difference 12v, Rechargeable, Below15 amps.

Figure 2: Battery

Basinet:

Carriage is the portion of the cradle which swings when it is driven by the motor through links. This consists of a spring which gives comfort for baby when it moves. The carriage used in our project is 25× 12 × 14 (length × breadth ×height) inches in dimension. The Basinet is made up of mild steels and its dimensions are provided as per the requirement and therefore all the joints in the basinet are obtained due to the welding operation.

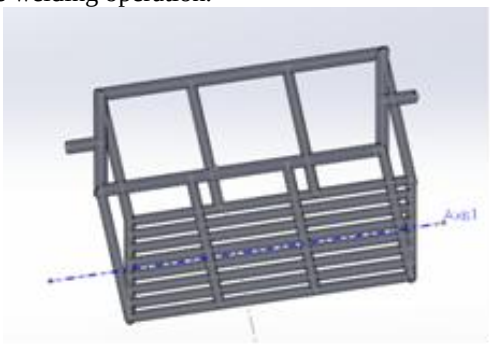

Figure 3: Basinet

Bolt:

A bolt is a form of threaded fastener with an external male thread. Bolts are thus closely related to, and often confused with, screws. The first bolts had square heads, formed by forging. These are still found, although much more common today is the hexagonal head. These are held and turned by a spanner or wrench, of which there are many forms. Most are held from the side, some from in-line with the bolt. Other bolts have T-heads and slotted heads. Many screws use a screwdriver head fitting, rather than an external wrench. Screwdrivers are applied in-line with the fastener, rather than from the side. These are smaller than most wrench heads and cannot usually apply the same amount of torque. It is sometimes assumed that screwdriver heads imply a screw and wrenches imply a bolt, although this is incorrect. Coach screws are large square headed screws with a tapered wood screw thread, used for attaching ironwork to timber. Head designs that overlap both are the Allen and Torx heads; hexagonal or splined sockets. These modern designs span a large range of sizes and can carry a considerable torque.

Figure 4: Bolt

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Nut:

A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten multiple parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together. In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: lock washers, jam nuts, specialist adhesive Thread-locking fluid such as Loctite, safety pins (split pins) or lock wire in conjunction with castellated nuts, nylon inserts (nylon nut), or slightly oval shaped threads. Square nuts, as well as bolt heads, were the first shape made and used to be the most common largely because they were much easier to manufacture, especially by hand. While rare today due to the reasons stated below for the preference of hexagonal nuts, they are occasionally used in some situations when a maximum amount of torque and grip is needed for a given size: the greater length of each side allows a spanner to be applied with a larger surface area and more leverage at the nut. The most common shape today is hexagonal, for similar reasons as the bolt head: six sides give a good granularity of angles for a tool to approach from (good in tight spots), but more (and smaller) corners would be vulnerable to being rounded off. It takes only one sixth of a rotation to obtain the next side of the hexagon and grip is optimal. However, polygons with more than six sides do not give the requisite grip and polygons with fewer than six sides take more time to be given a complete rotation. Other specialized shapes exist for certain needs, such as wing nuts for finger adjustment and captive nuts (e.g. cage nuts) for inaccessible areas.

Figure 5: NUT

A wide variety of nuts exists, from household hardware versions to specialized Industry-specific designs that are engineered to meet various technical standards. Fasteners used in automotive, engineering, and industrial applications usually need to be tightened to a specific torque setting, using a torque wrench. Nuts are graded with strength ratings compatible with their respective bolts; for example, an ISO property class 10 nut will be able to support the bolt proof strength load of an ISO property class 10.9 bolt without stripping. Likewise, an SAE class 5 nut can support the proof load of an SAE class 5 bolt, and so on.

Bearing:

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In cradle, one race is stationary frame and the other is attached to the rotating shaft to which carriage is attached. As one of the bearing races rotates, it causes the balls to rotate as well because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other. Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.

Figure 6: Bearing

Silicon Washers:

A washer is a thin plate (typically disk-shaped) with a hole (typically in the middle) that is normally used to distribute the load of a threaded fastener, such as a bolt or nut. Other uses are as a spacer, spring (Belleville washer, wave washer), wear pad, preload indicating device, locking device, and to reduce vibration (rubber washer). Washers often have an outer diameter (OD) about twice their inner diameter (ID), but this can vary quite widely. Washers are usually metal or plastic. High-quality bolted joints require hardened steel washers to prevent the loss of pre-load due to Brinelling after the torque is applied. Rubber or fiber gaskets used in taps (or faucets, or valves) to stop the flow of water are sometimes referred to colloquially as washers; but, while they may look similar, washers and gaskets are usually designed for different functions and made differently. Washers are also important for preventing galvanic corrosion, particularly by insulating steel screws from aluminum

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surfaces. The origin of the word is unknown; the first recorded use of the word was in 1346, however, the first time its definition was recorded was in 1611. Washers may also be used in rotating applications, as a bearing. A thrust washer is used when a rolling element bearing is not needed either from a cost-performance perspective or due to space restraints. Coatings can be used in attempt to reduce wear and friction either by hardening their surface, or providing a solid lubricant

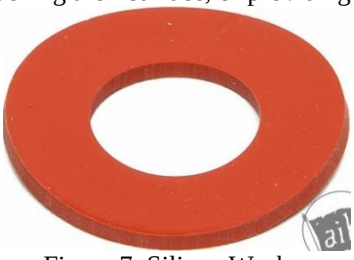

Figure 7: Silicon Washer

Square Pipe:

MS ERW Square & Rectangular Pipes are also called, Rectangular Hollow Section (RHS) or Square Hollow Sections (SHS). These are used for general engineering and structural purposes. The process or manufacturing is by ERW (Electric Resistance Welded). However, in some cases Square & Rectangular Seamless Pipes may also be used.

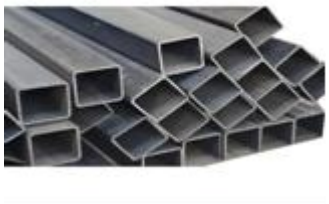

Figure 8: Square Pipe

The offered square tube is designed for fulfilling the wide demands of water conveying applications in residential, commercial and frame work. Offered square tube is checked on various parameters under the supervision of quality experts before the final dispatch. We offer this square tube in varied specifications keeping in mind the needs of usage.

Fabrication Process- Welding:

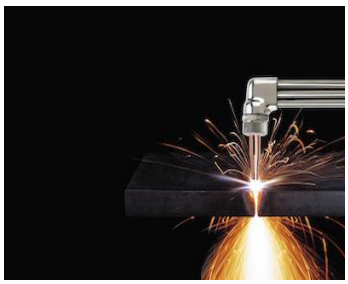

Figure 9: Welding Process

Welding is a process in which two or more parts are joined permanently at their touching surfaces by a suitable application of heat and/or pressure. Often a filler material is added to facilitate coalescence. The assembled parts that are joined by welding are called a weldment. Welding is primarily used in metal parts and their alloys. Arc welding is a method of permanently joining two or more metal parts. It consists of combination of different welding processes wherein coalescence is produced by heating with an electric arc, (mostly without the application of pressure) and with or without the use of filler metals depending upon the base plate thickness. A homogeneous joint is achieved by melting and fusing the adjacent portions of the separate parts. The final welded joint has unit strength approximately equal to that of the base material. The arc temperature is maintained approximately 4400°C. A flux material is used to prevent oxidation, which decomposes under the heat of welding and releases a gas that shields the arc and the hot metal. The second basic method employs an inert or nearly inert gas to form a protective envelope around the arc and the weld. Helium, argon, and carbon dioxide are the most commonly used gases.

Slider-Crank Mechanism:

This arrangement of mechanical parts designed to convert straight-line motion to rotary motion, as in a reciprocating piston engine, or to convert rotary motion to straight-line motion, as in a reciprocating piston pump. The basic nature of the mechanism and the relative motion of the parts can best be described with the aid of the accompanying figure, in which the moving parts are lightly shaded. The darkly shaded part 1, the fixed frame or block of the pump or engine, contains a cylinder, depicted in cross section by its walls DE and FG, in which the piston, part 4, slides back and forth. The small circle at A represents the main crankshaft bearing, which is also in part 1. The crankshaft, part 2, is shown as a straight member extending from the main bearing at A to the crankpin bearing at B, which connects it to the connecting rod, part 3. The connecting rod is shown as a straight member extending from the crankpin bearing at B to the wristpin bearing at which connects it to the piston, part 4, which is shown as a rectangle. The three bearings shown as circles at A, B, and C permit the connected members to

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rotate freely with respect to one another. The path of B is a circle of radius AB; when B is at point h the piston will be in position H, and when B is at point j the piston will be in position J. On a gasoline engine, the head end of the cylinder (where the explosion of the gasoline-air mixture takes place) is at EG; the pressure produced by the explosion will push the piston from position H to position J; return motion from J to H will require the rotational energy of a flywheel attached to the crankshaft and rotating about a bearing collinear with bearing A. On a reciprocating piston pump the crankshaft would be driven by a motor.

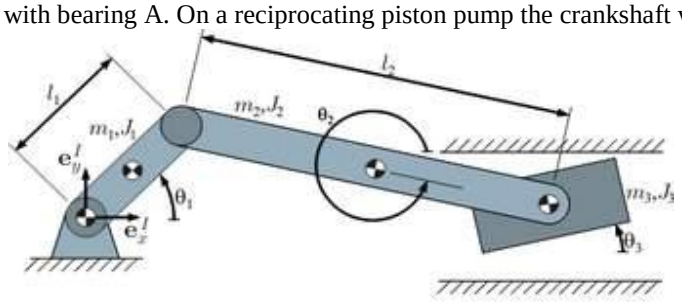

Figure 10: Slider Crank

4. Working Principle:

The cradle system works on the principle of slider crank mechanism, which is controlled by a cycle set up by the involvement of slider crank mechanism.

- When the power given to the motor then the wooden pulley rotates which is connected with the motor shaft.
- While it rotates, the connecting rod moves the basinet forward and backward.
- According to the principle of slider crank mechanism the basinet provide the oscillation degree with respect to the radius of the wooden pulley.
- The bearing provides the smooth oscillation to the basinet during the time of motion takes place.
- Whenever the infant is placed on the basinet the input supply is given with respect to the weight of that infant.
- This process is continued as cyclically untill cutoff the power.
- When the power is turned off the basinet get locked after that the basinet should be able to change in its motion until the power supply is given again.
- For the safety purpose the gear is placed within the DC motor itself. It provides the speed reduction function.

5. Conclusion:

The present work reduces the human effort and particularly mother's stresses in working times. The equipment includes a motor, and oscillating carriage. The overall portable mechanism is mobile which allows easy movement from room to room. The electric powered motor will actuate the links by shaft and the links actuates the bed in a constant speed which is attached to the carriage. The main advantage of this device is its low initial cost, and has allowed operating cost. The device affords plenty of scope for modifications for further improvements and operational efficiency, which should make it commercially available and attractive. The effective implementation of portable biogas digester for production of biogas by decomposing kitchen waste offers a relevant resource development solution and a rigid waste management system. Its low cost and its independent working conditions under suitable considered parameters prove that it is economic. It is a technology that can be surely assured for processing organic kitchen waste using a plastic biogas digester. It has suddenly experienced a significant positive vibe in the recent go and is a strong contender in becoming the next renewable energy source. Through the generation of biogas we can generate energy and satisfies the human energy needs.

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