

Design and Fabrication of Semi Automated Solar Powered Sand Sieving Machine

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Abstract- The design and fabrication of semi automated solar powered sand sieving system is done. As sand is used in construction, manufacturing and many industrial purposes, it needs to be filtered and separated from unneeded particles, stones and other large particles before put to use. The rotational motion of motor is converts to reciprocating motion of sieve box by means of Scotch Yoke Mechanism. To pour sand in sieve box a bucket conveyor is designed.

Key Words- Sieving, Solar Energy, belt conveyor

1. INTRODUCTION

Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost. Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt.

OBJECTIVE –

- 1) To design and build the Sand sieving machine working on renewable energy source.
- 2) To reduce human interference.
- 3) To design system which is efficient and cost effective?
- 4) To design belt bucket conveyor.
- 5) Time reduction.
- 6) Low maintenance and low cost.

Solar energy is freely available in nature. So that solar energy is convert into electrical energy to run the motor. The rotational motion of motor is converting into sliding motion of sieve box to segregate the fine sand from course sand. Also to pour the sand into sieve box the belt bucket conveyor is designed. Different types of sieves are used for the different size of sand particles.

2. COMPONENTS USED:

➤ **Solar panel-** A solar cell or photovoltaic cell is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon It is a form of photoelectric cell,

defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. In a solar panel battery, the solar cell is the smallest constituent unit of a device having the function of photoelectric conversion.



Fig. 2.1 Solar Panel

➤ **Battery-** A 12v 7Amps lead acid battery is used to store the electrical energy which is used to supply power to two 12v 40w DC motors. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to additionally include devices composed of a single cell.

Table 1 Specifications of Battery

Voltage	12 V
Current	7.2 Ah



Fig.2.2 Battery

➤ **DC Motor**- A 12v 40w 60rpm DC motors to drive the gear drive to operate the bucket conveyor and to slide the sand sieve box on guide ways. 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

Table 2 DC Motor Specifications

Voltage	12V
Speed	72 rpm



Fig.2.3 DC Motor

➤ **Spur Gear**- The spur gears, which are designed to transmit motion and power between parallel shafts. The two gears are rotate in 5:1 speed ratio to lift the sand in conveyor. Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Though the teeth are not straight-sided (but usually of special form to achieve a constant drive ratio, mainly involutes but less commonly cycloidal), the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts. Here this gear is used for rotational movement of dish collector, as the sun moves from one end to other thereby the gear helps to move the dish collector as sun moves and it is attached to motor of tracking mechanism. One drawback of this mechanism is that the collisions between each tooth cause a potentially objectionable noise since the entirety of each tooth meshes at once.



Fig. 2.4 Spur gear

➤ **Belt Conveyor**- A conveyor belt is the carrying medium of a belt conveyor system. A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys, with an endless loop of carrying medium the conveyor belt that rotates about them.

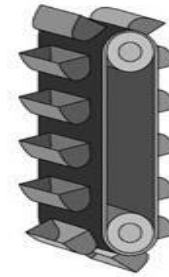


Fig.2.5 Belt Conveyor

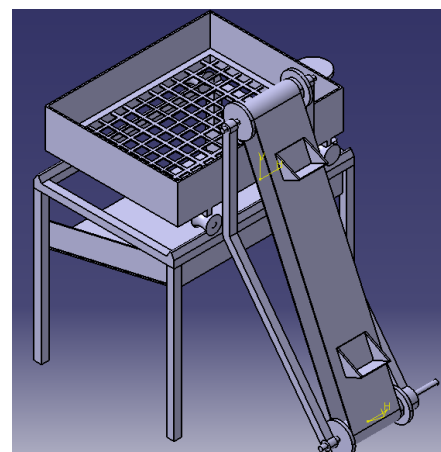
3. DESIGN

The subject of machine design deals with the art of designing machine of structure. A machine is a combination of resistance bodies with successfully constrained relative motions which is used for transforming other forms of energy into mechanical energy or transmitting and modifying available design is to create new and better machines or structures and improving the existing ones such that it will convert and control motions either with or without transmitting power. It is the practical application of machinery to the design and construction of machine and structure. In order to design simple component satisfactorily, a sound knowledge of applied science is essential. In addition, strength and properties of materials including some metrological are of prime importance. Knowledge of theory of machine and other branch of applied mechanics is also required in order to know the velocity. Acceleration and inertia force of the various links in motion, mechanics of machinery involve the design.

Table 3 Dimensions of sand sieving machine

Components	Dimensions
Main frame	610*475*505 mm
Belt conveyor	D1 & D2 = 60 mm, N1 & N2 = 12 RPM C = 831.26 mm, t = 3 mm
Sand sieve box	560*450*105 mm
Spur gear	Z=8&40, $\alpha = 20^\circ$, FD involutes

3D Model of sand sieving machine



Fabricated model of machine

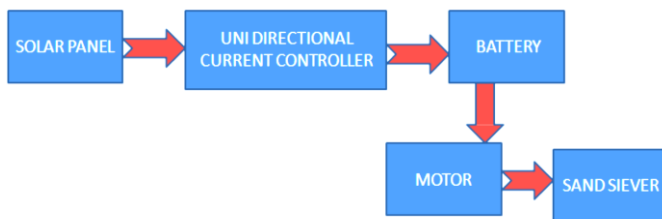


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4. WORKING PRINCIPLE

The working principle of the Sieving Machine mainly depends on converting rotary motion provided by D-C motor which runs either by 12 volt battery. The current in battery is converting from the solar energy to electrical energy. The motor is provided which different gears to provide the required motion as it rotates the shaft connected to the movable sand sieve box does back and forth motion as such the mesh attached to it when moves or slides separates the fine particles from course particles. The mesh is placed of required Particles size based on the size of mesh particles are separated. This process can be used for as many numbers of different sizes of sand. The lifting of sand is done with help of belt bucket conveyor. The spur gear of 5:1 speed ratio is connected to belt drive pulley.



5. CONCLUSION

The project can be continuing separation of different sizes of sands by changing several meshes. The manual separation of sand which is time consuming is eliminated. This project is run by DC motor. The rotary motion of DC motor is converted into sliding motion to the mesh as result of back and forth motion of mesh different types & sizes of sands can be separated. Thus this project in real time is providing easy way of separation of different sizes of sands. The lifting of sand also reduces human interference. Thus lifting action makes machine Semi Automatic but only one thing is to remove course particles from sand sieve box is to be done by manual.