Effective use of Solar Panel by Graphene material in Grass Cutting Machine.

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Abstract:

This is the new innovative concept mainly used for agricultural field. It is simple in construction and the working process is easy. And it is mostly used in the agricultural field for the cutting of grass. Here the blades are cutting through motor and this motor is getting the power supply from the battery. It is different from the machine which is used before. Our product is operated by single unskilled man power and it can remove the grass better compared to human work. Two main styles of blades are used in this and employing a single blade that rotates about a single vertical axis are known as rotary movers, while those employing a cutting bar and multiple blade assembly that rotates about a single horizontal axis are known as cylinder or reel movers.

Keyword(s): Blades, rotary movers & reel movers.

1. INTRODUCTION:

A motorized grass cutter is a machine that uses revolving blades, to cut a garden land spaces, at an even length. Grass cutters employing a blade that rotates about a vertical axis are known as rotary cutters, while those employing a blade assembly that rotates about a horizontal axis are known as cylinder or reel cutters.

Many different designs have been made, each suited to a particular purpose. The smallest types, pushed by a human, are suitable for small residential lawns and gardens, while larger, self-contained, ride-on mowers are suitable for large lawns, and the largest, multi-gang mowers pulled behind a tractor, are designed for large expanses of grass such as golf courses and municipal parks.Our product is operated by single unskilled man power and it can remove the grass better compared to human work.The components that we used are motor, Solar panel gear arrangement and blade setup.Gear arrangement is used to reduce and adjust the speed of the Blades. Blades are made up of Cast Iron which has more strength and Hardness

2. EXPERIMENTAL SETUP:

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite polarities attract, while like polarities repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

Let's start by looking at a simple 2-pole DC electric motor here a magnet or winding with a "North" polarization, magnet or winding with a "South" polarization

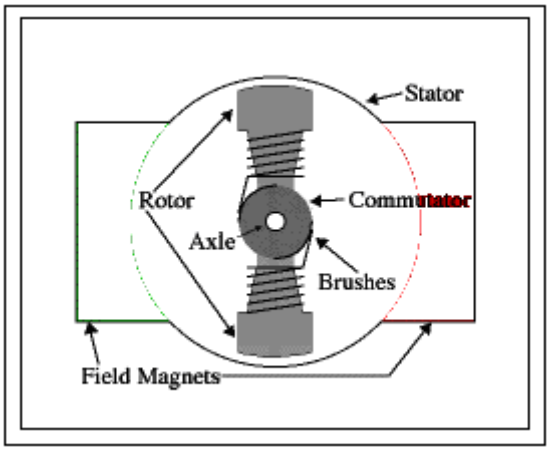


Fig.1 2-POLE DC ELECTRIC MOTOR

Every DC motor has six basic parts -- axle, rotor (armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings, the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator magnets.

The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, driving it to continue rotating.

In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets), it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply. This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque "ripple".

A few things from this -- namely, one pole is fully energized at a time (but two others are "partially" energized). As each brush transitions from one commutator contact to the next, one coil's field will rapidly collapse, as the next coil's field will rapidly charge up. We'll see more about the effects of this later, but in the meantime you can see that this is a direct result of the coil windings' series wiring.

There's probably no better way to see how an average DC motor is put together, than by just opening one up. Unfortunately this is tedious work, as well as requiring the destruction of a perfectly good motor.

The use of an iron core is quite common, and has a number of advantages. First off, the iron core provides a strong, rigid support for the windings a particularly important consideration for high-torque motors. The core also conducts heat away from the rotor windings, allowing the motor to be driven harder than might otherwise be the case. Iron core construction is also relatively inexpensive compared with other construction types. But iron core construction also has several disadvantages. The iron armature has a relatively high inertia which limits motor acceleration. This construction also results in high winding inductances which limit brush and commutator life.

In small motors, an alternative design is often used which features a 'coreless' armature winding. This design depends upon the coil wire itself for structural integrity. As a result, the armature is hollow, and the permanent magnet can be mounted inside the rotor coil. Coreless DC motors have much lower armature inductance than iron-core

motors of comparable size, extending brush and commutator life.

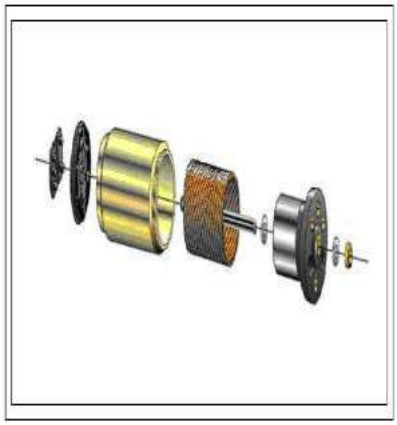


Fig.2 CORELESS MOTOR

The coreless design also allows manufacturers to build smaller motors; meanwhile, due to the lack of iron in their rotors, coreless motors are somewhat prone to overheating. As a result, this design is generally used just in small, low-power motors. Beamers will most often see coreless DC motors in the form of pager motors.

Again, disassembling a coreless motor can be instructive -- in this case, my hapless victim was a cheap pager vibrator motor. The guts of this disassembled motor are available (on 10 lines / cm graph paper). This is (or more accurately, was) a 3-pole coreless DC motor.

2.1. SPUR GEAR

A gear is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part in order to transmit torque. Two or more gears working in tandem are called a transmission and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine. Geared devices can change the speed, torque, and direction of a power source. The most common situation is for a gear to mesh with another gear; however a gear can also mesh a non-rotating toothed part, called a rack, thereby producing translation instead of rotation.

The gears in a transmission are analogous to the wheels in a pulley. An advantage of gears is that the teeth of a gear prevent slipping. When two gears of unequal number of teeth are combined a mechanical advantage is produced, with both the rotational speeds and the torques of the two gears differing in a simple relationship.

In transmissions which offer multiple gear ratios, such as bicycles and cars, the term gear, as in first gear, refers to a gear ratio rather than an actual physical gear. The term is used to describe similar devices even when gear ratio is continuous rather than discrete, or when the device does not actually contain any gears, as in a continuously variable transmission.

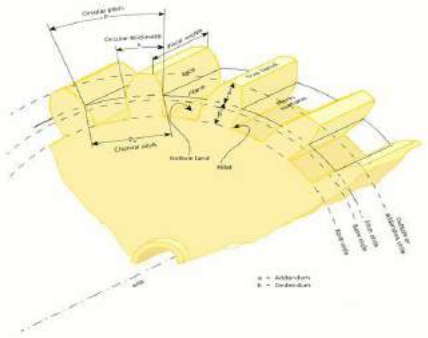


Fig.3 GEAR NOMENCLATURE

The definite velocity ratio which results from having teeth gives gears an advantage over other drives (such as traction drives and V-belts) in precision machines such as watches that depend upon an exact velocity ratio. In cases where driver and follower are in close proximity gears also have an advantage over other drives in the reduced number of parts required; the downside is that gears are more expensive to manufacture and their lubrication requirements may impose a higher operating cost.

An external gear is one with the teeth formed on the outer surface of a cylinder or cone. Conversely, an internal gear is one with the teeth formed on the inner surface of a cylinder or cone. For bevel gears, an internal

gear is one with the pitch angle exceeding 90 degrees. Internal gears do not cause direction reversal.

Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with the teeth projecting radially, and although they are not straight-sided in form, the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears can be meshed together correctly only if they are fitted to parallel shafts.

2.2 WHEEL

A wheel is a circular component that is intended to rotate on an axle. The wheel is one of the main components of the wheel and axle which is one of the six simple machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel and flywheel.

Wheels, in conjunction with axles allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Common examples are found in transport applications. A wheel greatly 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 application of another external force.

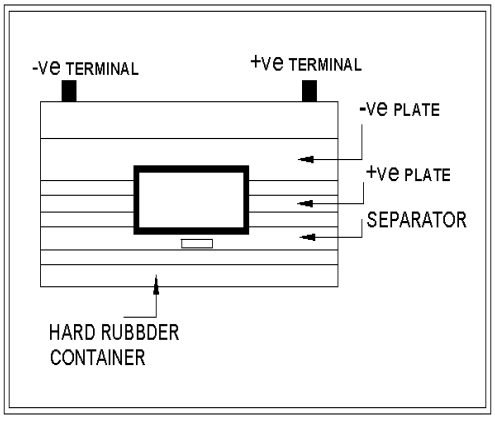
2.3 BATTERY

In our project we are using secondary type battery. It is rechargeable type. A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy. Primary batteries can only be used once because they use up their chemicals in an irreversible reaction. Secondary batteries can be recharged because the chemical reactions they use are reversible; they are recharged by running a charging current through the battery, but in the opposite direction of the discharge current. Secondary, also called rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled.

Batteries have gained popularity as they became portable and useful for many purposes. The use of batteries has created many environmental concerns, such as toxic metal pollution. A battery is a device that converts chemical energy directly to electrical energy it consists of one or more voltaic cells. Each voltaic cell consists of two half cells connected in series by a conductive electrolyte. One half-cell is the positive electrode, and the other is the negative electrode. The electrodes do not touch each other but are electrically connected by the electrolyte, which can be either solid or liquid. A battery can be simply modelled as a perfect voltage source which has its own resistance, the resulting voltage across the load depends on the ratio of the battery's internal resistance to the resistance of the load.

2.4 SOLAR PANEL

A solar panel is a device that collects and converts solar energy into electricity or heat. It known as Photovoltaic panels, used to generate electricity directly from sunlight Solar thermal energy collection systems, used to generate electricity through a system of mirrors and fluid-filled tubes solar thermal collector, used to generate heat solar hot water



panel, used to heat water. It is energy portal. A solar power technology that uses solar cells or

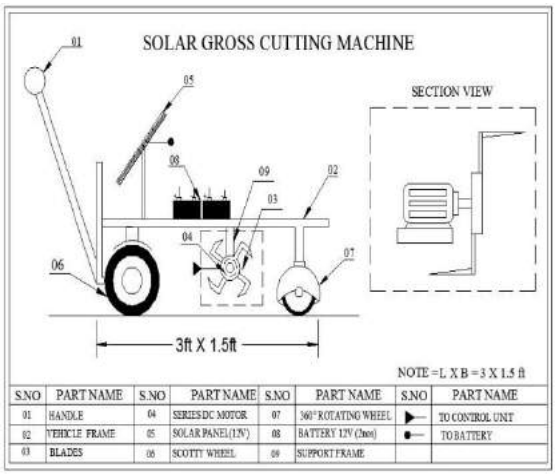
solar photovoltaic arrays to convert light from the sun directly into electricity. Photovoltaic, is in which light is converted into electrical power. It is best known as a method for generating solar power by using solar cells packaged in photovoltaic modules, often electrically connected in multiples as solar photovoltaic arrays to convert energy from the sun into electricity. The photovoltaic solar panel is photons from sunlight knock electrons into a higher state of energy, creating electricity.

Solar cells produce direct current electricity from light, which can be used to power equipment or to recharge a battery. A less common form of the technologies is thermophotovoltaics, in which the thermal radiation from some hot body other than the it is utilized. Photovoltaic devices are also used to produce electricity in optical wireless power transmission.

2.5 GRAPHENE MATERIAL

Graphene is an allotrope of carbon in the form of a two-dimensional, atomic-scale, hexagonal lattice in which one atom forms each vertex. It is the basic structural element, including graphite, charcoal, carbon nanotubes and fullerenes. It can be considered as an indefinitely large aromatic molecule, the ultimate case of the family of flat polycyclic aromatic hydrocarbons. graphene has many unusual properties. It is about 200 times stronger than the strongest steel. It efficiently conducts heat and electricity and is nearly transparent. Graphene shows a large and nonlinear diamagnetism, greater than graphite and can be levitated by neodymium magnets.

Scientists have theorized about graphene for years. It has unintentionally been produced in small quantities for centuries, through the use of pencils and other similar graphite applications. The University of Manchester Research was informed by existing theoretical descriptions of its composition, structure, and properties. This work resulted in the two winning the Nobel Prize in Physics in 2010 "for groundbreaking experiments regarding the two-dimensional material graphene.



Layout for Solar Grass Cutting Machine

3. CALCULATIONS

It is very important to measure different electrical and mechanical parameters of your motor and calculate unknown values using the following helpful formulas.This formula could be used in many cases. You may calculate the resistance of your motor by measuring the consumed current and applied voltage. For any given resistance (in the motors it is basically the resistance of the coil) this formula explains that the current can be controlled by applied voltage.

Electrical power of the motor is defined by the following formula:

$$Pin = I * V$$

Where,

Pin – input power, measured in watts (W)
I – current, measured in amperes (A)
V – applied voltage, measured in volts (V)

Motors supposed to do some work and two important values define how powerful the motor is. It is motor speed and torque – the turning force of the motor. Output mechanical power of the motor could be calculated by using the following formula

$$Pout = T * \omega$$

Where,
Pout – output power, measured in watts (W)
τ – torque, measured in Newton meters (Nm)
ω – angular speed, measured in radians per second (rad/s).
Calculate angular speed if you know rotational speed of the motor in rpm:

$$\omega = N * 2\pi / 60$$

Where,

ω – Angular speed, measured in radians per second (rad/s);

π – Mathematical constant pi (3.14).
60 – Number of seconds in a minute.
Efficiency of the motor is calculated as mechanical output power divided by electrical input power:

$$E = Pout / Pin$$

Therefore

$$Pout = Pin * E$$

After substitution we get

$$T * \omega = I * V * E$$

$$T * N * 2\pi / 60 = I * V * E$$

Connect the motor to the load. Using the motor from generator kit is the best way to do it. Now you can calculate the torque for this load at this speed assuming that you know efficiency of the motor.. The motor starts to consume more current to overcome this resistance and the speed decreases. If you increase the load at some point motor stops (this is called stall). When it occurs the torque is at maximum and it is called stall torque. While it is hard to measure stall torque without special tools you can find this value by plotting speed-torque graph.

3.1. SOLAR PANEL CALCUALTION**:**

VOLT = 12 V
WATT = 5 W
W = V X I
5 = 12 X I
I = 5/12
I = 420ma

3.2 BATTERY CALCULATION:

B_{AH}/C_I = 2.7 ah/420ma
= 6.43 hrs

To find the Current
Watt = 18 w
Volt = 12v
Current =?

P= V x I
18 =12 x I
I = 18/12
= 1.5 AMPS

BATTERY USAGE WITH 1.5 AMPS
B_{AH}/I
2.7/1.5 = 1.8 hrs

4. WORKING PRINCIPLE

In our project we are using the motorized grass cutter for cutting the grass in the field. It consists of simple arrangements such as motor, blades, battery etc. Here the motor is working using with the help of battery power supply, the battery is getting charged by the suns light through the solar panel; on the motor shaft we are fixing the arrangement of bearing system for the smooth rotation of shaft. On the below of the shaft is fixed with the attachment of cutting blade for to cutting the grass. When the motor to start running the shaft is rotate and it's rotating cutting blade and the cutting process is carrying out by this machine.

4.1 MERITS:

- The process is low cost
- Quickly cutting process in grass
- It is very useful in the agricultural field

4.2 DE MERITS:

- Doesn't work in absence of sunlight
- Manpower need.

4.3 APPLICATIONS:

- Applicable in road side parks
- Applicable in gardens
- Applicable in agricultural lands
- Applicable in many agricultural areas, etc,...

5. CONCLUSION:

Innovation has made the more desirable. This project is designed with the hope that it is very much economical and help full to many agricultural areas.

The solar panel made of grapheme material extract more compare to normal solar panel is used effectively for cutting the unwanted grass in sugarcane field. Hence increase in yield and reduce of manpower is achieved by this concept.

This concept can be used in other areas for cutting grass in garden and other fields like turmeric and chili.

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