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# AUTOMATED SAND FILTERATION

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## ABSTRACT

Here we demonstrate the fabrication system. Sand is used in construction,manufacturing and many industries. Sand needs to be filtered and separated from unneeded particles, stones and other large particles before it is put to use. Our system puts forward a fully automated sand filtering and separator system that automatically filters sand poured on it. Here we use a motorized shaft that is mounted horizontally using mounts. The shaft is connected to a filter frame with mesh below and enclosing frame on the sides. We now have a rod connected from the shaft to the filter frame in a way such as to achieve the best horizontal motion.

Also we have a frame to hold the filter frame in place while ensuring proper horizontal motion at the same time. On switching on the motor using our motor controller circuit, the system allows to operate the motor. This allows us to operate the sand filter motion for appropriate sand filtering needs.

## I. INTRODUCTION

Pedal power is the transfer of energy from a human source through the use of a foot pedal and crank system. This technology is most commonly used for transportation and has been used to propel bicycles for over a hundred years. Less commonly pedal power is used to power agricultural and hand tools and even to generate electricity. Some applications include pedal powered laptops, pedal powered grinders and pedal powered water wells. Some third world development projects currently transform used bicycles into pedal powered tools for sustainable development. This project concentrates on pedal powered sand filter and separation. An individual can generate four times more power (1/4 HP) by pedaling than by hand cranking. At the rate of ¼ HP, continuous pedaling can be served for only short periods, approximately 10 minutes. However, pedaling at half this power (1/8 HP) can be sustained for close to 60 minutes but power capability can depend upon age. As a consequence of the brainstorming exercise, it was apparent that the primary function of pedal power one specific product was particularly useful: the bicycle. Many devices can be run right away with mechanical energy. Sieving machine serves is to remove large grains with a small grain through a sieve. Separation occurs when the sand is placed on top of a filter having holes size. The first sieving is doneto get rid of the sand with a larger than standard with holding sand filter and thesecond sieving is done to get rid of the sand with a size too small means that the sand filter is ignored. A sieve is a device for separating wanted elements from unwanted material or for characterizing the particle size distribution of a sample, typically using a woven screen such as a mesh or net or metal.

### WHAT ARE SAND FILTERS?

Generally while preparing the concrete for construction purpose, the process of sieving and mixing is carried out separately. These processes are carried out manually. Sieving of sand is carried out using rectangular mesh which is inclined at certain angle. In the present sand sieving method, the sample is subjected to horizontal or vertical movement in accordance with the chosen method. This causes a relative motion between the particles and the sieve. Depending on their size the individual particles either pass through the sieve mesh or retained on the sieve surface.

### PREVIOUS WORK: PEDAL OPERATED MECHANISM

If we boost the research on pedal powered technology - trying to make up for seven decades of lost opportunities - and steer it in the right direction, pedals and cranks could make an important contribution to running a post-carbon society that maintains many of the comforts of a modern life. The possibilitiesof pedal power largely exceed the use of the bicycle. Pedaling a modern stationary mechanism to produce electricity

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might be a great workout, but in many cases, it is not sustainable. While humans are rather inefficient engines converting food into work, this is not the problem we want to address here; people have to move in order to stay healthy, so we might as well use that energy to operate machinery. The trouble is that the present

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approach to pedal power results in highly inefficient machines. Ever since the arrival of fossil fuels and electricity, human powered tools and machines have been viewed as an obsolete technology. This makes it easy to forget that there has been a great deal of progress in their design, largely improving their productivity. The most efficient mechanism to harvest human energy appeared in the late 19th century: pedaling. Stationary pedal powered machines went through a boom at the turnof the 20th century.

## II. LITERATURE REVIEW

**PEDAL ARRANGEMENT:**

"Sanjay N. Havaldar, Altaf Somani, Anushka Pikle, Yash Siriah & Samiksha Patil; International Journal of Current Engineering & Technology, 02 March 2016 (E-ISSN 2277 – 4106). This paper analyzes the design of a pedal operatedwater filtration system to be used by local dwellers.

It works on the principle of compression and sudden release of a tube by creating negative pressure in the tube and this vacuum created draws water from the sump into the pump while rollers push the water through to the filter where adsorption takes place to purify the water. "Technology (IJERT), 01 January 2013. In this paper, design and construction of pedal operated water pump which is used in small irrigation and garden irrigation.

The pedal operated pump can be constructed using local material and skill. A water system includes a Centrifugal pump operated by pedal power.

"Sanjay N.Havaldar, Altaf Somani, Anusha Pikle, Yash Siriah and Samiksha Patil", International Journal of Current Engineering and Technology (IMPRESSCO), 4 March 2016. This paper analyses the design of a pedal operated water filtration system to be used by local dwellers. It works on the principle of compression and sudden release of a tube by creating negative pressure in the tube and this vacuum created draws water from the sump intothe pump while rollers push the water through to the filter where adsorption takes place to purify the water. The design comprises of a peristaltic pump powered by pedaling, a filter and hose or flexible tube. As the operator sits on the seat and pedals, the pedal crank transfers the motion to the rotor thus therollers and the tube is squeezed by the set of rollers to move the fluid.

**Power window motor:**

**Motor Specification**

| | |
|---|---|
| Voltage | 12VDC |
| Speed (RPM) | 51 – 130 |
| Torque (kgf.cm) | 20.01 - 30.00 |
| Current | <15A |

Power window motors are mechanisms installed inside of the car door which control the function of the window glass enabling them to go up and down.

When the power window motor fails the window ceases to operate in whatever position it was in when the power window motor failed. It can be a security concern if the window is open when the motor fails.

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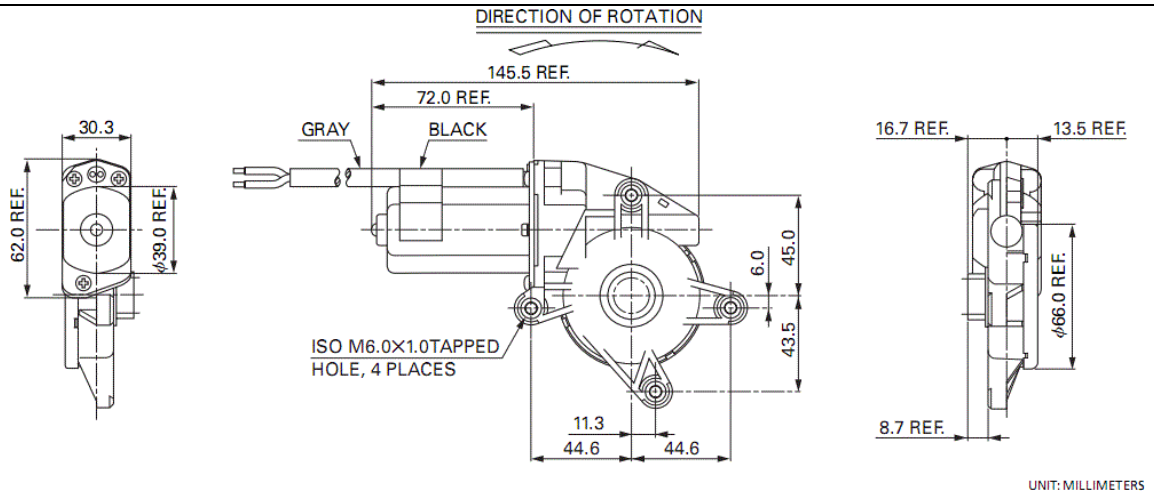


**Basic Specification**

The power window motor has four mounting hole positions. There is a workingvoltage of 12 volts DC current. The unit is waterproof and ISO 9001 certified.

**No Load Specification**

The no-load speed or speed when no torque is applied to the motor shaft is 95rotations per minute (rpm) and the no load current is less than 1.5 amperes.

**Stall Specification**

The stall torque or minimum torque needed to completely stop the motor shaft from rotating, or stall the motor, is less than 8 units or pound-feet (N.m) and thestall current is less than 20 amperes.

**DC motor**

Workings of a brushed electric motor with a two-pole rotor (armature) and permanent magnet stator. "N" and "S" designate polarities on the inside faces ofthe magnets; the outside faces have opposite polarities. The **+** and **-** signs show where the DC current is applied to the commutator which supplies current to thearmature coils.

The Pennsylvania Railroad's class DD1 locomotive running gear was a semi- permanently coupled pair of third rail direct current electric locomotive motors built for the railroad's initial New York-area electrification when steam locomotives were banned in the city (locomotive cab removed here).

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or bychanging the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

**Electromagnetic motors**

A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. The direction and magnitude of the magnetic field produced by the coil can be changed with the direction and magnitude of the current flowing through it.

A simple DC motor has a stationary set of magnets in the stator and an armature with one more windings of insulated wire wrapped around a soft iron core that concentrates the magnetic field. The windings usually have multiple turns around the core, and in large motors there can be several parallel current paths. The ends of the

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wire winding are connected to a commutator. The commutator allows each armature coil to be energized in turn and connects the rotating coils with the external power supply through brushes. (Brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes.)

The total amount of current sent to the coil, the coil's size and what it's wrappedaround dictate the strength of the electromagnetic field created.

The sequence of turning a particular coil on or off dictates what direction the effective electromagnetic fields are pointed. By turning on and off coils in sequence a rotating magnetic field can be created. These rotating magnetic fields interact with the magnetic fields of the magnets (permanent or electromagnets) in the stationary part of the motor (stator) to create a force on the armature which causes it to rotate. In some DC motor designs the stator fields use electromagnets to create their magnetic fields which allow greater control over the motor.

Different number of stator and armature fields as well as how they are connected provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems which adjust the voltage by "chopping" the DC current into on and off cycles which have an effective lower voltage.

Since the series-wound DC motor develops its highest torque at low speed, it is often used in traction applications such as electric locomotives, and trams. The DC motor was the mainstay of electric traction drives on both electric and diesel-electric locomotives, street-cars/trams and diesel electric drilling rigs for many years. The introduction of DC motors and an electrical grid system to run machinery starting in the 1870s started a new second Industrial Revolution. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles and today's hybrid cars and electric cars as well as driving a host of cordless tools. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines. Large DC motors with separately excited fields were generally used with winder drives for mine hoists, for high torque aswell as smooth speed control using thyristor drives. These are now replacedwith large AC motors with variable frequency drives.

If external power is applied to a DC motor it acts as a DC generator, a dynamo. This feature is used to slow down and recharge batteries on hybrid car and electric cars or to return electricity back to the electric grid used on a street car or electric powered train line when they slow down. This process is called regenerative braking on hybrid and electric cars. In diesel electric locomotives they also use their DC motors as generators to slow down but dissipate the energy in resistor stacks. Newer designs are adding large battery packs to recapture some of this energy.

**Brush**

Main article: Brushed DC electric motor A brushed DC electric motor generating torque from DC power supply by using an internal mechanical commutation. Stationary permanent magnets form the stator field. Torque is produced by the principle that any current-carrying conductor placed within an external magnetic field experiences a force, known as Lorentz force. In a motor, the magnitude of this Lorentz force (a vector represented by the green arrow), and thus the output torque, is a function for rotor angle, leading to a phenomenon known as torque ripple) Since this is a single phase two-pole motor, the commutator consists of a split ring, so that the current reverses each half turn (180 degrees).

The brushed DC electric motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary magnets (permanent or electromagnets), and rotating electrical magnets.

Advantages of a brushed DC motor include low initial cost, high reliability, andsimple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the carbon brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor. Brushes consist of conductors.

**Brushless**

Main articles: Brushless DC electric motor and Switched reluctance motor Typical brushless DC motors use a

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rotating permanent magnet in the rotor, and stationary electrical current/coil magnets on the motor housing for the stator. A motor controller converts DC to AC. This design is mechanically simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. The motor controller can sense the rotor's position via Hall effect sensors or similar and precisely control the timing, phase, etc., of the current in the rotor coils to optimize torque, conserve power, regulate speed, and even apply some braking. Advantages of brushless motors include long life span, little or no maintenance, and high efficiency. Disadvantages include high initial cost, and more complicated motor speed controllers. Some such brushless motors are sometimes referred to as "synchronous motors" although they have no external power supply to be synchronized with, as would be the case with normal AC synchronous motors.

**Uncommutated**

Other types of DC motors require no commutation.

- Homopolar motor – A homopolar motor has a magnetic field along the axis of rotation and an electric current that at some point is not parallel to the magnetic field. The name homopolar refers to the absence of polarity change. Homopolar motors necessarily have a single-turn coil, which limits them to very low voltages. This has restricted the practical application of this type of motor.
- Ball bearing motor – A ball bearing motor is an unusual electric motor that consists of two ball bearing-type bearings, with the inner races mounted on a common conductive shaft, and the outer races connected to a high current, low voltage power supply. An alternative construction fits the outer races inside a metal tube, while the inner races are mounted on ashaft with a non-conductive section (e.g. two sleeves on an insulating rod). This method has the advantage that the tube will act as a flywheel. The direction of rotation is determined by the initial spin which is usuallyrequired to get it going.

**Permanent magnet stators**

Main article: Permanent-magnet electric motor A PM motor does not have a field winding on the stator frame, instead relying on PMs to provide the magnetic field against which the rotor field interacts to produce torque. Compensating windings in series with the armature may be used on large motors to improve commutation under load. Because this field is fixed, it cannot be adjusted for speed control. PM fields (stators) are convenient in miniature motors to eliminate the power consumption of the field winding. Most larger DC motors are of the "dynamo" type, which have stator windings. Historically, PMs could not be made to retain high flux if they were disassembled; field windings were more practical to obtain the needed amount of flux. However, large PMs are costly, as well as dangerous and difficult to assemble; this favors wound fields for large machines.

To minimize overall weight and size, miniature PM motors may use high energy magnets made with neodymium or other strategic elements; most such are neodymium-iron-boron alloy. With their higher flux density, electric machines with high-energy PMs are at least competitive with all optimally designed singly fed synchronous and induction electric machines. Miniature motors resemble the structure in the illustration, except that they have at least three rotor poles (to ensure starting, regardless of rotor position) and their outer housing is a steel tube that magnetically links the exteriors of the curved field magnets.

**Wound stators**

A field coil may be connected in shunt, in series, or in compound with the armature of a DC machine (motor or generator)

Main article: universal motor See also: Excitation (magnetic)

There are three types of electrical connections between the stator and rotor possible for DC electric motors: series, shunt/parallel and compound (various blends of series and shunt/parallel) and each has unique speed/torque characteristics appropriate for different loading torque profiles/signatures.[1]

**Series connection**

A series DC motor connects the armature and field windings in series with a common D.C. power source. The motor speed varies as a non-linear function of load torque and armature current; current is common to both the stator and rotor yielding current squared (I^2) behavior[citation needed]. A series motor has very high starting torque and is commonly used for starting high inertia loads, such as trains, elevators or hoists.[2] This speed/torque characteristic is useful in applications such as dragline excavators, where the digging tool

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moves rapidly when unloaded but slowly when carrying a heavy load.

With no mechanical load on the series motor, the current is low, the counter- EMF produced by the field winding is weak, and so the armature must turn faster to produce sufficient counter-EMF to balance the supply voltage. The motor can be damaged by overspeed. This is called a runaway condition.

Series motors called "universal motors" can be used on alternating current. Since the armature voltage and the field direction reverse at (substantially[clarification needed]) the same time, torque continues to be produced in the same direction. Since the speed is not related to the line frequency, universalmotors can develop higher-than-synchronous speeds, making them lighter than induction motors of the same rated mechanical output. This is a valuable characteristic for hand-held power tools. Universal motors for commercial utility are usually of small capacity, not more than about 1 kW output. However, much larger universal motors were used for electric locomotives, fed by special low-frequency traction power networks to avoid problems with commutation under heavy and varying loads.

**Shunt connection**

A shunt DC motor connects the armature and field windings in parallel or shunt with a common D.C. power source. This type of motor has good speed regulation even as the load varies, but does not have the starting torque of a series DC motor.[3] It is typically used for industrial, adjustable speed applications, such as machine tools, winding/unwinding machines and tensioners.

**Compound connection**

A compound DC motor connects the armature and fields windings in a shunt and a series combination to give it characteristics of both a shunt and a series DC motor.[4] This motor is used when both a high starting torque and good speed regulation is needed. The motor can be connected in two arrangements: cumulatively or differentially. Cumulative compound motors connect the series field to aid the shunt field, which provides higher starting torque but less speed regulation. Differential compound DC motors have good speed regulation and are typically operated at constant speed.

**SUPPORTED FRAME:**

The supported frame is used to support the components. The total arrangement is depends on this frame. This frame is made of iron or mild steel.

**SHAFT:**

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to machine which absorbs power. The various members such as pulleys and gears are mounted on it.

**BEARINGS:**

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 areclassified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts

**METALLIC NET:**

A metal net is a barrier made of connected strands of metal, fiber, or other flexible or ductile materials. A mesh is similar to a web or a net in that it has many attached or woven strands.

**WORKING PROCESS :**

The figure shows the sand filter and separator. In this the whole work is based on the mechanism of pedal operated mechanism. The rotation of the pedal transfers the motion to the movement of rectangular shape filter.

It consists of the pedal arrangement which rotates the crank and through itslider consists of oscillating mechanism. The power is transmitted to the crank and slider mechanism. This mechanism is used to rotate the crank disc; the disc which is having an extended rod is connected to the sliding portion of the rectangular plate

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directly by means of a linkage. The rectangular plate is passed through the guide ways by means of maintaining the cutting axis. As the user operated the pedal, the plate moves linearly on guided path. The dead weight is for compressive force while the user operated the foot pedal.

The pedal is connected to the flywheel which is transfer the motion from one to another. The flywheel is connected to another wheel which is connected to the rectangular filter plate through chain/belt. The rotating motion of the electrical pump converts to the sliding motion using two flywheels and chain/belt. The sliding crank mechanism is used in this project. The flywheel which is placed atthe top is used as crank and connecting rod in between the rectangular plate and flywheel. When the flywheel is rotating, the rectangular plate slides linearly.

**OPERATIONS INVOLVED**

1. Turning (facing, plain turning, step turning, threading etc.)
2. Facing (flat surface)
3. Boring
4. Gas cutting (flat plate, cylindrical rods)
5. Shaping
6. Welding
7. Tapping
8. Thread cutting

**TURNING**

Turning is the operation of reducing a cylindrical surface by removing material from the outside diameter of a work piece. It is done by rotating the work piece about the lathe axis and feeding the tool parallel to the lathe axis. Due to this operation screw rod and head are done by the turning operation to get the required shape.

**FACING**

Machining the end of the work piece to produce flat surface is called facing. Due to this, the plate can get flat surface have done by the facing operation.

**BORING**

Boring is the operation of producing cylindrical hole in work piece. It is doneby rotating the cutting edge of the cutter known as boring bit. In this Project thejig plates require holes for locating indexing plate and screw rod, boring bush assembly. These holes are done by conventional vertical boring machine.

**THREAD CUTTING**

Thread cutting is the operation of forming external thread of required diameter of rod by using a multipoint tool is called thread. This process is used in screw clamp to done on the rod which is used for the movement of the movable plate

**FINE GRINDING**

It is nothing but the grinding process, which is done as smooth with fine grains. This is done as the each plate and base plate for good surface finish. It is done by conventional grinding machine.

**GAS CUTTING**

It is used to break are cut the plates. In this project it is used to cut the raw materials such as plates. This done by gas cutting machine.

**SHAPING**

Shaping operation is used to reduce the dimensions of the plates. In this project the plates are in need of shaping process. It is done by shaping machine.

**WELDING**

It is the process, which is used to join two, is more similar materials as well as dissimilar materials. In this project it is used to join the jig plate one to another. This is done by arc welding machine.

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**ADVANTAGES**

1. Time saving as compared.
2. Cheap
3. Easy to use
4. Low power required
5. Safe

**DESIGN CONSIDERATIONS**

1. The device should be suitable for local manufacturing capabilities.
2. The attachment should employ low-cost materials and manufacturing methods.
3. It should be accessible and affordable by low-income groups, and should fulfil their basic need for mechanical power.
4. It should be simple to manufacture, operate, maintain and repair.
5. It should be as multi-purpose as possible, providing power for various agricultural implements and for small machines used in rural industry.
6. It should employ locally available materials and skills. Standard steel pieces such as steel plates, iron rods, angle iron, and flat stock that are locally availableshould be used. Standard tools used in machine shop such as hack saw, files, punches, taps & dies; medium duty welder; drill press; small lathe and milling machine should be adequate to fabricate the parts needed for the dual-purpose bicycle.
7. It should make use of standard bicycle parts wherever possible
8. The device should adapt easily to as many different bicycles as possible. No permanent structural modification should be made to the bicycle.
9. Though the device should be easy to take off the bicycle, it is assumed that it would usually remain attached to facilitate readiness and ease of transport from site to site. The device, therefore, should not interfere with the bicycle's transportation mode.
10. The broad stand, which provides stability during power production mode,can be flipped upward during the transport mode. This stand/carrier would be a permanent fixture of the dual purpose bicycle.
11. The power take-off mechanism should be as efficient as possible, and should develop relatively high RPM (close to 200) for versatility of application. Wehad seen designs for devices that take power from the rear tire by means of a friction roller pressed against it, but we had doubts about the efficiency of this arrangement. In order to improve efficiency we used hard bearing surfaces suchas roller chains, sprockets and ball bearings. We decided that the most appropriate location for this power take-off mechanism would be at the front of the bike near the fork tube Care must be exercised to insure that the power take- off assembly is far enough forward so as not to interfere with pedaling. Most standard adult bicycle frames have plenty of room for the power take-off mechanism and pulley. Power is supplied to the shaft by means of a chain from the bike's chain wheel (crank) to attached sprocket on the shaft. During the prime-mover mode, the bike's regular chain is slipped off of the chain-wheel, and the specially sized chain to the power take-off mechanism is slipped on.
12. The device should be able to transmit power to a variety of machines, andchanging drive ratios should be as simple as possible. We decided that a V-belt and pulley arrangement would be most appropriate for this. Belts do not require the precise alignment that chains do. Belts can even accommodate pulleys that are slightly skewed with respect to each other. Changing drive ratios is as easy as changing pulleys. Also, belts are reasonably efficient.
13. The device should contain a ratcheting mechanism that would let the operator "coast" periodically to rest and conserve energy. A free wheel fromany bicycle can be easily adapted for this purpose.

Excessive weight should be avoided, as durability is a prime consideration.

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## III. CONCLUSION

Thus a low cost and simple design pedal operated sand filter and separated machine is fabricated. This machine reduces the human effort and hence we don't need multiple persons to filter the sand. This simple design of conventional design which can enhance day today household needs and daily day to day purposes and it can be also used in for industrial applications during power shut down scenarios. By using this method we cando any operation as per our requirement without the use of electricity. So wecan save the electrical power.

## IV. FUTURE SCOPE

Following all types of operation can be carried out by the proper pedalattachment as per the requirement. Here are some operations

1. Rice Threshing
2. Winnowing
3. Corn Shelling
4. Peanut Shelling
5. Operating a Circular Saw
6. Water Pumping from a Shallow Well
7. Operating a Wood Working Lathe

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