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AUTOMATIC DRAIN CLEANER RUN BY SOLAR POWER

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ABSTRACT:

Waste water is defined as the flow of used water from homes, businesses, industries, commercial activities and institutions which are subjected to the treatment plants by a carefully designed and engineered network of pipes. There are large no. of machines used for removing out the wastes from drains.Mechanical control techniques include the total or halfway evacuation of Plastic containers and Un-disintegrated solids by mechanical means, including: gathering, destroying, cutting, rototilling, rotating, and binding. Mechanical control techniques can likewise be utilized to speed up manual cleaning exercises, including hand cleaning, raking, and cut stump control, with the utilization of engine driven hardware. These administration strategies for A scope of hardware for overseeing and controlling amphibian vegetation is being used today, intended for particular plant sorts (floating, submersed, and new vegetation) and for operation in particular sea-going environments (untamed water, trenches, shorelines, and wetlands). A mechanical oceanic gatherer (reaper) is a sort of freight boat utilized for an assortment of undertakings, including amphibian plant administration and waste expulsion in seepage, lakes, coves, and harbours. Reapers are intended to gather and empty vegetation and flotsam and jetsam utilizing a transport framework on a blast, flexible to the suitable cutting stature, up to 3 feet underneath the surface of the water. Cutter bars gather material and bring it on board the vessel utilizing the transport; when the freight boat has achieved limit, slice material is transported to a transfer site. Management involves a given request for waste counteractive action and minimization.

Keywords: Automatic drain cleaner, solar power, Methodology, Design, Fabrication & Working of Automatic drain cleaner.

1.INTRODUCTION

Drain cleaner machine is the system installed in an open canal, river or drainage passage so that manual extraction of waste to be replaced through it. This helps us to prevent the spreading of diseases in between humans by manual working in garbage waste. Plastic & other waste dump & block the flow of water in Canal & Rivers near the bridges support pillars, so it can extract out from river & canal & allow the water to flow without any obstacle. Then, may pass through conveyors to recycling plant. A drain cleaner is a chemical-based consumer product that unblocks sewer pipes or helps to prevent the occurrence of clogged drains. The term may also refer to the individual who uses performs the activity with chemical drain cleaners or devices known as plumber's snake. Drain cleaners can be classified in two categories: chemical, or device. If a single sink, toilet, or tub or shower drain is clogged the first choice is normally a drain cleaner that can remove soft obstructions such as hair and grease clogs that can accumulate close to interior drain openings. Chemical drain cleaners, plungers, handheld drain augers, air burst drain cleaners, and home remedy drain cleaners are intended for this purpose. If more than one plumbing fixture is clogged the first choice is normally a drain cleaner that can remove soft or hard obstructions along the entire length of the drain, from the drain opening through the main sewer drain to the lateral piping outside the building. Electric drain cleaners and sewer jetters are intended for this purpose. It is generally used for removing from sewage water mechanical impurities. Water is a basic necessity of humans and all living beings. This project is designed to keep clean the drainage system and helps the smooth working of the system. This project automatically cleans the water in the drainage system each time any wastage appears and this form an efficient and easy way of cleaning the drainage system and preventing the blockage. It also reduces labour and improves the quality of water that is cleaned. If the garbage are allowed to flow that will end up flowing down to recreational beaches used for tourism purposes making a scene not pleasurable to the eyes else these garbage flow to residential sites where they are burnt in a way of getting rid of them, thereby causing climate change. The drainage systems are cleaned when there is no water in them i.e. when it is not raining, but when it is raining the drainage systems cannot be cleaned because of the harsh conditions of the rain which no one would volunteer to endure to ensure garbage does not enter into the drainage systems.

1.1 LITTER

Urban litter (alternatively called trash, debris, flotsam, jetsam, floatables, gross pollutants, rubbish or solid waste) has become a major problem in modern society. It typically consists of manufactured materials such as bottles, cans, plastic and paper wrappings, newspapers, shopping bags, cigarette packets and hypodermic needles, but it can also include items such as used car parts, rubble from construction sites and even old mattresses. It accumulates in the vicinity of shopping centres, car parks, fast food outlets, railway and bus stations, roads, schools, public parks, garbage bins, landfill sites and recycling depots. There it remains until either someone removes it, or it is transported by the wind and / or storm water runoff into the drainage system. Along the way, however, items frequently become entangled in the vegetation along the banks of the streams, rivers or lakes, or strewn along the beaches. Some of this debris is picked up - often at great expense. Most of it is probably buried in the river, lake or beach sediments.

Fig.1: View of an SCS litter trap (near Springs, South Africa) being cleaned and repaired

The existence of such litter in the waterways and on the beaches has a number of impacts:

- Litter is aesthetically unattractive.
- There is a potential health hazard to humans associated with, for example, the putrefying contents of bottles and tins, or pathogenic organisms attached to discarded hypodermic needles.
- Pathogenic organisms or toxins, for example heavy metals, may be taken into the food chain poisoning aquatic life and possibly later impacting on humans.
- Local authorities incur significant costs in conducting clean-up operations.
- Litter in the waterways and on the beaches is a worldwide problem. In 1991 South Africa produced some 40 million tonnes of solid waste - mostly of domestic origin (President's Council Report, 1991). 780,000 tonnes of this was believed to enter the drainage system with 195,000 tonnes reaching the sea (CSIR, 1991). Local governments in Texas spend upwards of US$14 million per year to clean their beaches (Baur and Iudicello, 1990). Annually, an estimated 230,000m^3, or 1.8 billion items, of litter (approximately 60,000 tonnes of wet material) enter the waterways of greater Melbourne in Australia (Allison, 1997).

1.2 CONTROL OF LITTER

Drain cleaner machine includes set of vertical parallel rods forming filtering screen and it is mounted in frame with possibility of motion. Said rods are mounted with gaps normally relative to motion direction of liquid flow. Cross section of grid rods is in the form of wedge with rounded edges of its base turned towards flow of sewage water. Filtering screen of grid includes separate interchangeable sections secured to cross rigidity ribs of frame of grid. Two endless chains are driven to motion with use of sprockets at sides of grid together with rake arranged between them and being in the form of set of toothed plates whose teeth engage with said gaps. Rigidity rib arranged in sewage water is in the form of bent metallic plate to which rubber strip is secured. Lip of grid frame base is slightly raised over duct bottom by regulated height and it is in the form diffuser.

Guides for changing motion direction of rake are provided with centring gaskets arranged upstream and downstream filtering screen. The invention relates to mechanical grates rake type and may find use in the purification of wastewater from mechanical impurities.

Planning controls

Planning controls are aimed at adopting land-use policies which:

Preserve existing valuable elements of the storm water system, such as natural channels, wetlands and riparian vegetation by restricting the use of such areas. Minimise the risk of litter reaching the drainage system by situating litter-producing activities in areas where it is easier to contain and control litter accumulation. Require pollution control measures as part of any development application.

Source controls

Source controls are aimed at reducing the litter loads entering the drainage system by dealing with pollution at source. There are numerous options:

Upgrade cleansing operations by, for example; the better placement and design of litter bins, more frequent collections of litter, monitoring street sweeping methods to ensure that litter is not swept into catch pits, and ensuring that communal collection depots are appropriately placed. The latter may also be a way of promoting jobs in recycling. Control construction activity by ensuring that site management plans are in place to prevent contaminant spills and rubble from reaching the drainage.

Reducing the litter load

Much can and should be done to reduce the quantity of litter that finds its way into the storm water drainage system. The most sensible way of going about this is through the development of an integrated catchment litter management strategy. Two categories of litter reduction methods are available:

Planning controls (restricting litter-generating activities to areas where their impact can most effectively be controlled

and reduced). Source controls (reducing litter loads entering the drainage system through inter alia education and enforcement programmed).

A comprehensive integrated catchment litter management strategy will also include structural controls, i.e. the removal of litter from the drainage system

2. METHODOLOGY AND FABRICATION

2.1 METHODOLOGY

The device is place across a drain so that only water flows through the lower basement. Floating waste like bottles, plastic cans, covers…..etc. is lifted by lifters which are connected to the chain. The chain revolves with the sprocket wheel which is driven by the motor. The energy provided to the motor is electrical energy. When motor runs the chain starts to circulate making the lifter to lift up. The wastage material are lifted by lifter teeth and stored in storage or collecting bin. Once the collecting bin is full, the waste materials are removed from the bin. Methodology used for whole processing of drainage cleaning machine is given below; this methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner.

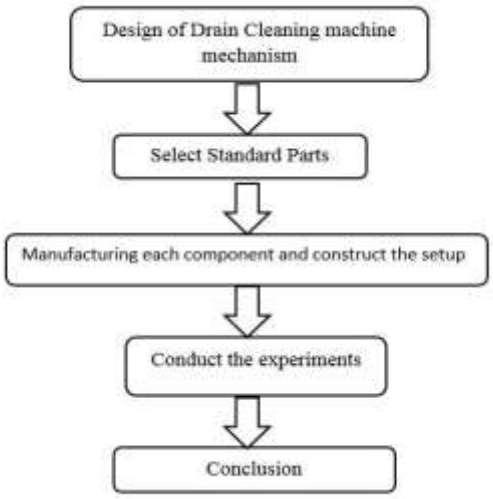

Fig.5: Methodology Block Diagram

2.2 BILL OF MATERIALS

Details of the major components and the materials used in automatic drain cleaner are listed below.

Table 1: Bill of materials

S.no.	Name of Component	Quantity	Specification	Price estimation
1	L-shaped Mild Steel rods	10 feet	NA	1000
2	Chain Set	2	Pulsar Bike	600
3	DC motor	1	12V, 65nm torque	1500
4	Sprocket	4	Pulsar bike	600
5	Metal Sheet	NA	NA	300
6	Universal Bearing	4	NA	800
7	Battery	1	12V	2500
8	Welding Cost	NA	NA	1000
9	Shaft Rod	2	Mild steel	200
10	Transportation and other miscellaneous expenses	NA	NA	1500
TOTAL				10,000

2.3 MATERIAL COMPOSITION

Mild steel

General purpose steel bars for machining, suitable for lightly stressed components including studs, bolts, gears and shafts. Often specified where weldability is a requirement. Can be case-hardened to improve wear resistance. Available in bright rounds, squares and flats, and hot rolled rounds. Can be supplied in sawn blanks, and bespoke size blocks.

2.4 MACHINE SPECIFICATION

DC MOTOR

Machines are a means of converting energy. Motors take electrical energy and produce mechanical energy. Electric motors are used to power hundreds of devices we use in everyday life. Motors come in various sizes. Huge motors that can take loads of 1000's of Horsepower are

typically used in the industry. Some examples of large motor applications include elevators, electric trains, hoists, and heavy metal rolling mills. Examples of small motor applications include motors used in automobiles, robots, hand power tools and food blenders. Micro-machines are electric machines with parts the size of red blood cells, and find many applications in medicine.

Electric motors are broadly classified into two different categories: DC (Direct Current) and AC (Alternating Current). Within these categories are numerous types, each offering unique abilities that suit them well for specific applications. In most cases, regardless of type, electric motors consist of a stator (stationary field) and a rotor (the rotating field or armature) and operate through the interaction of magnetic flux and electric current to produce rotational speed and torque. DC motors are distinguished by their ability to operate from direct current.

Fig.2: DC Wiper Motor

Electromechanical energy conversion

An electromechanical energy conversion device is essentially a medium of transfer between an input side and an output side. Three electrical machines (DC, induction and synchronous) are used extensively for electromechanical energy conversion. Electromechanical energy conversion occurs when there is a change in magnetic flux linking a coil, associated with mechanical motion.

Electric motor

The input is electrical energy (from the supply source), and the output is mechanical energy (to the load).

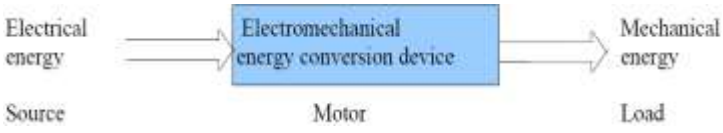

Fig.3: Conversion of electrical energy to mechanical energy

Electric generator

The Input is mechanical energy (from the prime mover), and the output is electrical energy.

Fig.4: Conversion of mechanical energy to electrical energy

Construction

DC motors consist of one set of coils, called armature winding, inside another set of coils or a set of permanent magnets, called the stator. Applying a voltage to the coils produces a torque in the armature, resulting in motion.

Stator

The stator is the stationary outside part of a motor. The stator of a permanent magnet dc motor is composed of two or more permanent magnet pole pieces. The magnetic field can alternatively be created by an electromagnet. In this case, a DC coil (field winding) is wound around a magnetic material that forms part of the stator.

Rotor

The rotor is the inner part which rotates. The rotor is composed of windings (called armature windings) which are connected to the external circuit through a mechanical commutator. Both stator and rotor are made of ferromagnetic materials. The two are separated by air-gap.

Winding

A winding is made up of series or parallel connection of coils.

Armature winding - The winding through which the voltage is applied or induced.Field winding - The winding through which a current is passed to produce flux (for the electromagnet).Windings are usually made of copper.

DC Gear motor

Table 2: DC Motor specification

Parameters	Specifications
Nominal Voltage	12V
Nominal Power	50W
Nominal Current	1.0-1.5A
High Speed	75-76 rpm
Low Speed	50 rpm
Noise	No gear noise
Rotational Output	CW/CCW

Collecting bin

- Length - 400m
- Breadth - 170mm
- Height - 200mm

Area of collecting bin = ½ x L x B = 68000mm.

3. DESIGN OF 3-D MODEL
CATIA V5

CAM (Computer Aided Manufacture) allows manufacturing processes to be designed for 3D model manufacture. CAE (Computer Aided Engineering) allows verification through analysis of 3D models

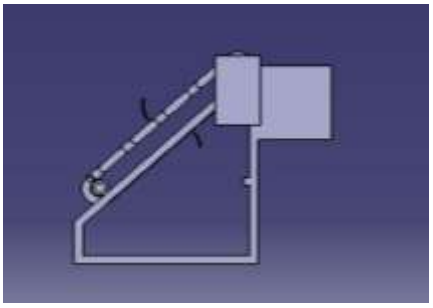

Fig.6: Motor Side View

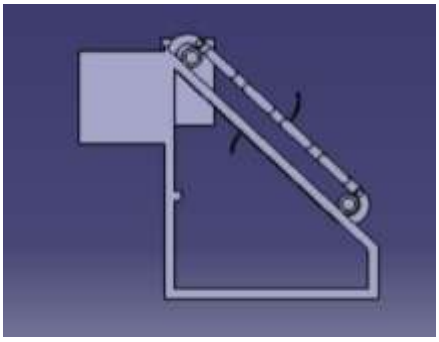

Fig.7: Side view

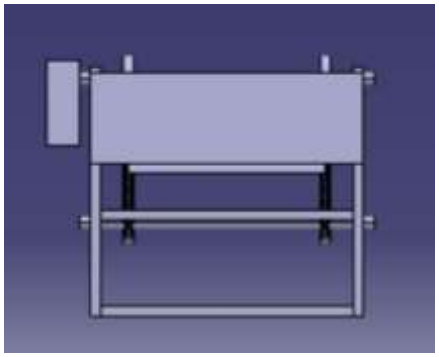

Fig.8: Back View

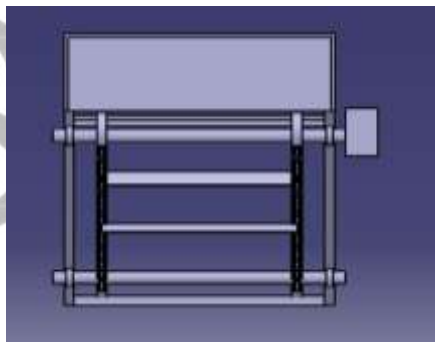

Fig.9: Top View

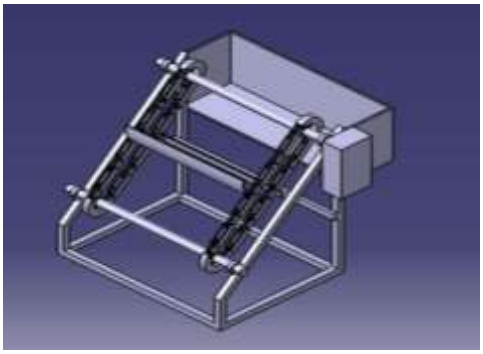

Fig.10: 3-D Model of automatic drain cleaner

3.1 FABRICATION

Basically during fabrication of the model the basement part is prepared by welding the metal bars by electric welding. Then the supporting rods are welded at an angle of 90 degree from the basement, the pillow block bearings are fixed to the supporting rod and the front part of the basement. Cylindrical shafts are fixed to the bearings and also chain drive are also fixed to the shaft in order to fix the shafts the factor of safety of the chain is calculated. The two lifters are fixed to the chain by gas welding at an equal distance from each. Then the collecting bin is fixed at backside by welding.

Equipment used

Table 3: Equipment used

S.no.	Name of Equipment	Purpose
1	Bosch handheld Cutter	For cutting mild steel pipes
2	Bosch handheld grinder	For grinding edges and protruding welds
3	Drill Machine	For drilling holes
4	Lathe Machine	For turning of center shaft
5	Sand paper	To remove rust from the bars
6	Filler	Filling of different parts of the project
7	Arc Welding machine	For welding the base frame and other parts

Fig.11: Drain cleaner - Top view

Fig.12: Drain cleaner – Isometric view

3.2 WORKING

Chain Drive mechanism

In automatic drain cleaner the lifting pans are lifted by the chains which are in-line with the sprockets. This mechanism is known as chain drive mechanism.

Working Procedure

The drain cleaner machine helps us to clean small or big sewage through its mechanical design and functioning. This machine consists of parts such as motor, shaft, chain, sprocket, lifter, collecting bin etc. When we give power to this machine then motor starts functioning which gives rotation to the shaft and through the help of shaft, the sprockets which are fixed to the shaft rotates.

Due to the rotation of the sprocket, the chain connected to the sprocket rotates. As the chain rotates the two lifters which are connected to the chain at half length of the chain starts rotating as well. When one lifter completes one round from down to upward direction, it takes all the garbage material like waste bottles, plastic, tins, etc, on the grid and drops it in the collecting bin attached at the back. Since there are two lifters, the collection rate of garbage will be more. This is how this machine helps us clean sewage or any garbage from water.

The devices is place across drain so that only water flow through lower grids, waste like bottle, Etc. Floating in drain are lifted by teeth of lifters which are connected to chain. This chain is attached by gear driven by motor. When motor runs the chain starts to circulate making teeth to lift

up. The waste materials are lifted by teeth and are stored in waste storage tank.

The technical essence and the achieved effect is known technical the solution is closest to the claimed. The device is a prototype can be used for fine purification of wastewater from mechanical impurities, however, maintenance and operation process manifests a number of disadvantages. For example, a complex is the installation process of the rake with teeth due to the increasing inaccuracy of the location of the teeth; the filter screen grid has a high hydrodynamic resistance; the accumulation of long fibres that are in the water on the transverse ribs and at the bottom of the lattice is the settling of sand and stones that leads to the formation of bottom sediments and the occurrence of stagnant zones. The basis of the invention is to create a mechanical grate rake type, allowing to simplify its installation, repair and maintenance.

The problem is solved in mechanical grate rake type, fixed on the frame with the ability to move, including a set of vertical parallel rods forming a filter screen mounted with openings perpendicular to the direction of flow of waste water, two endless chains installed by asterisks on each side of the lattice can move together with placed between them with a rake, made in the form of plates with teeth coming in plot is, guide for changing the direction of movement of the rake; according to the invention the cross section of the rods of the lattice has the form of a wedge with rounded edges of the base facing towards the flow of waste water, filter screen grid recruited from separate interchangeable sections, mounted on the transverse ribs of the frame of the lattice.

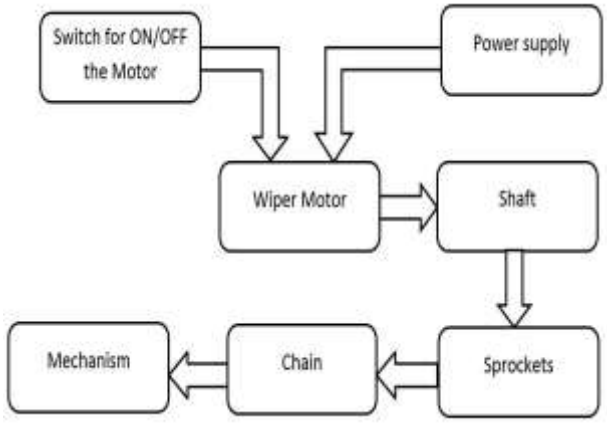

Fig.13: Working Flow Chart

With the rib being in water, made in the form of a curved metal plate attached to it with a rubber band, the threshold base frame grid elevated above the bottom of the channel at an adjustable height and is made in the form of a cone, each rake consists of a set of plates with teeth, and guides for changing the direction of movement of the rake supplemented centring plates installed before and after the filtering screen.

3.3 DISCUSSION /DISTINCTIVE FEATURES OF THE PROPOSED DEVICE ARE

- Section rods of the lattice has the form of a wedge with rounded edges of the base facing towards the flow of waste water;
- Filter screen grid recruited from separate interchangeable sections, mounted on the transverse ribs of the frame of the lattice;
- Rib, located in waste water, made in the form of a curved metal plate attached to it with a rubber band;
- Threshold base frame grid elevated above the bottoms the m channel at an adjustable height and is made in the form of a diffuser;
- Each rake consists of a set of plates with the teeth;
- Guides for changing the direction of movement of the rake supplemented centring plates installed before and after the filtering screen.

3.4 ADVANTAGES

Advantages of electric drain cleaners include the ability to clean long sections of sewer drain, the ability to remove solid objects such as tree roots and jewellery, and ready availability through hardware stores and tool rental counters. Machines using springs can easily negotiate multiple 90-degree bends while maintaining their effectiveness and without damaging the pipe. Low-cost drain-off solution if drains already exist. Construction materials are often locally available. Creates employment (construction and maintenance).It is Portable. These cleaners are easy cheapest way to fix drainage problems. Easy to operate as no special skill is required. Reduction of labour oriented method of cleaning, thus upgrading dignity of labour. Light weight and

easily portable. Requires nearly 12-24 volts of power.

3.5 DISADVANTAGES

Disadvantages of electric drain cleaners include high relative cost and weight, and the considerable physical effort that may be required to control .Small vibration will occur. In order to avoid vibration the machine should be properly foundation with the floor.

3.6 APPLICATIONS

- It is used almost in all types of drainage (Large, Small, and Medium).
- Project to use this in efficient way to control the disposal of wastages and with regular filtration of wastages.
- Cleaning and maintenance of sewer lines drains of mechanical drainer.

4. CONCLUSION AND FUTURE SCOPE

4.1 CONCLUSION

Automation is a technology concerned with the application of mechanical, electronic and computer based systems to operate and control production. This system is used to operate automatic sewage cleaning equipment. This project may be developed with the full utilization of men, machines and materials and money. Also we have followed thoroughly the study of time motion and made our project economical and efficient with the available resources. This system was designed, fabricated successfully and also tested. It works satisfactorily. We hope that this will be done among the most versatile and interchangeable one even in future. Thus we can able to obtain automatic drainage cleaning equipment.

Water is a basic necessity of humans and all living beings. There is a plenty of water on earth but that is not suitable for human use. Clean water is more important if it is used for some purpose. The impurities present in water can prove hazardous and can cause diseases. As long as the drainage system is considered the function of the main drainage system is to collect, transport, and dispose of the water through an outfall or outlet. The drain waste water cleaner machine is designed and manufactured by using gear changing and shaft coupling principle. It consist mainly DC geared motor, shafts, waste removal plates, dust bin, bearings, sprocket and chains. Construction materials are easily available, creates employment (construction and maintenance), simple to construct.

4.2 FUTURE SCOPE

Our project is simply a drainage water cleaner machine, which is automatically operated. Further modifications can be done to improve the performance of the machine.

Modifications are as follows

1. Instead of battery power, the motor can be run using solar power, by fitting solar panels to the setup.
2. During the real time application, the size of the machine will be big so that more lifter pans can be fixed to the chain and a bigger motor can be used to increase performance and rate of collecting waste.
3. A sensor can be placed in the collector bin. As the collecting bin becomes full, it gives an alert.

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