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Drainage System Cleaner
A Solution to Environmental Hazards

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Abstract:- The Drainage system cleaner is a machine which helps to protect the environment from different kinds of environmental hazards through the promotion waste management by the removal of garbage from the drainage system. These wastes when not removed end up settling in residential places where these wastes are burnt thereby causing climate change otherwise these wastes block the drainage systems thereby causing flooding. The machine is designed in such a way that it generates motion for its functions by itself through the action of running water thereby cutting out the dangers of the powering the machine by other sources of power because of the harshness of the rain on these other sources. The drainage system cleaner has three major parts which are the Propeller, the Cleaner and the Pan all make up for its effective functioning. The Drainage system cleaner was tested on three different days in the first day it rained in the months of September, October and November 2012 respectively. Based on the findings made after the test the Drainage system functioned well when there is maximum load. I therefore recommend the use of this system by various individuals, government companies and waste recycling companies for prevention of environmental hazards and also encouraging waste management.

Keywords:- Drainage system cleaner, Waste Management

I. INTRODUCTION

The problem of flooding and climate change has become outrageous because of its recent trends in our environs today. This has become a cause of major concern to the world, especially the developing countries (OECD, 2005). The common causes of flooding include incidents such as overflow of river banks and overflow of drainage systems. Flooding and climate change already has caused lots of damages to the world and people living in it, as millions of lives and properties have been lost to flooding (Eunomia Research & Consulting 2002). Damages caused by these environmental hazard range from people suffering from the misery of living in flooded regions; which entails the use of boats to various doors steps to the harmful effect of acid rain on crops and animals (WRAP 2006). The over flow of river banks accounts for less than 30% of flooding in our society today, thus the other greater percentage of the incident occur due to the over flow of drainage systems (ClimSoil 2008). Water running through a water drainage system mostly carries along waste materials most which are non biodegradable which not only cause flooding but also climate change (ClimSoil 2008). Overflow of water drainage system occurs when there is a blockage of an end of the drainage system forcing the water to find its way elsewhere apart from the mapped out drainage system, therefore the running water spills over the horizontal height of the drainage systems spreading to regions alongside the drainage system, thereby causing problems such as pushing down of structures such as fences, water logging of farm lands and residential buildings etc (WSN Environmental Solutions and Hyder Consulting PTY Ltd 2007).

Drainage systems are blocked most times by garbage like nylon, plastic bottles, and empty cans which cluster together and find their way into the drainage systems. If these garbage are allowed to flow the will end up flowing down to recreational beaches used for tourism purposes making a scene not pleasurable to the eyes (Larsen et al 2009) else these garbage flow to residential sites where the 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 can not 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 (Lacoste, et al 2006). There have been several attempts to develop equipment which would deal with the garbage when it is raining. The major examples of this include the net system which entails using a net to block the entrance or exit of the drainage system for the net to sieve out the net and the perforated metal sheet covering system using a protective metallic covering which is perforated on the drainage systems with the view of sieving out the garbage (Christensen et al 2009). But these methods proved less than 20% efficient. In severe

conditions, as the holes of the net and the perforated metal sheet continued sieving at some point it get blocked leading to flooding (Astrup, et al 2009b).

In developing countries the drainage systems are not free from waste materials. It is a dumping ground for most common men on the streets (Bahor, et al 2009). The problem of finding garbage in the drainage systems is inevitable, so the least thing to do is to resort to *waste management* (Chintan 2009). Waste management entails a given order for waste prevention and minimization.

Diagram 1: Waste hierarchy

The Drainage system cleaner is found to be a cost effective machine that can promote waste management, thus which can take care of the garbage without human intervening during the harsh conditions of the rain.

This drainage system cleaner reduces the incident of environmental hazards like flooding and climate change. It is more effective and efficient than the previous net and perforated metal sheet covering systems which failed when there is maximum load (PROGNOS 2008). The designed machine will be beneficial to the government, construction companies and general public worldwide enabling them to help avoid hazards resulting from blockage of the drainage system.

The research work is also meant to help recycling companies to get raw materials for production and energy production. This research would also help people in the educational field who will like to carry out research on drainage systems

SCOPE OF DESIGN

The designed drainage system cleaner has three parts. Problems were encountered powering the system with electricity or any other energy source as it was not ideal. The system is not dependent on electricity or any form of chemicals for power source because these sources could not stand the harshness of the effect of the rain and the running water, thus it,,s first part is The Propeller which generates energy from action of the running water which it converts to transmits it to The Cleaner which is the second part, the propeller being the power house of the machine also transmits motion to the third part The Pan which takes the waste materials into a safety trash can.

II. DESIGN SPECIFICATIONS

The Propeller

This mechanism generates energy needed for the entire machine system through the action of running water in the drainage system. The propeller constitute of eight arms which are flat and are connected to a center rod, also the center rod is rigidly fixed to the two rigidly fixed holding poles across the sides of the drainage system. The arms are interconnected and are being connected to the center rod through a central axis which ensures swift rotation of arms. The arms are of the same width with the drainage systems but only marginally different but is higher in length allowing the arms to easily oppose the running water. The arms also, due to its lightness are pushed by running water to cause rotation. The arms also have soles that are flat that help them to balance and resist motion from on coming water effectively. The motion is passed out through belts drives A and B. Belt drives A and B are connected to the second and third mechanism respectively.

The Belts Drives

The links in the drainage system cleaner consist of gears and belts drives, which transmit motion to other parts of the machine system. Belt drive A is connected to the cleaner which allows it to make a motion to

sieve out the waste materials in the drainage system. The cleaners move in opposite direction to the propeller, the motion provided by Belt drive A (gear A) is then linked to gear B which allows the Belt drive A to provide a mechanism in the cleaner that moves opposite the direction of the running water. While Belt B is directly linked to the third mechanism (The Pan).

The Cleaner

The cleaner sieves out the waste materials. Just like the propeller, the cleaner consist of eight arms which are also connected to a centre rod to allow motion. It receives it source of energy through Belt drive-A from the propeller. Unlike the propeller the cleaner does not wholly constitute of a flat metal but half of it is made of a net to effectively sieve the running water without any form of blockage. The soles of the arms are also made of nets which help the arms effectively sieve the water running in the drainage system.

The Pan and the Pan Mechanism

The pan is the third part of the system which helps to remove waste materials that has been removed by the cleaner to the trash can it is made of a light metal, it is receives its own energy through Belt B from the propeller and it is also connected to one of the holding poles of the cleaner. The is mechanism made up of two gears; gear 1 and gear 2. The gears are connected with the ratio of 4:1 which helps gear be to create a complete rotatory motion, gear 2 constitutes a flat curved "S" shaped metal connected on top of it and also attached in its center to the holding pole. It aides movement of the pan to and fro the axis. Also the pan itself is held by a smooth rod which allows it to spin thereby releasing material from the cleaner to a trash can. A trash can is dropped at a close distance allowing the pan to pour in the materials from the cleaner.

III. RESULTS OF EXPERIMENTS CARRIED OUT WITH THE DRAINAGE CLEANER SYSTEM

The Drainage system was tested three times during the day it rained in three different months, which are first day of rain in the months of September, October, and November respectively. It was tested at the drainage system in Health Centre Road World Bank Housing Estate. The height and width of the drainage system is 90cm and 86.5cm respectively. The drainage system is directly linked to the Main big drainage system in Umuahia, Abia State. The following results were obtained.

First day of rain fall in August 2012

VRW	SPC	SP
58	14	**16**
29	8	**10**
110	**190**	**127**

Source: Author's field Data, 2012

First day of rainfall in September 2012

VRW	SPC	SP
42	16	**20**
35	10	**13**
150	**215**	**148**

Source: Author's field Data, 2012

First day of rainfall in October 2012

VRW	SPC	SP
21	7	**9**
29	9	**10**
31	**11**	**13**

Source: Author's field Data, 2012

Note: VRW is the velocity of the running water in the drainage system measured in meters per second (m/s), SPC is the speed of rotation of the arms of the propeller and cleaner measured in revolution per minutes (rpm) while SP is the speed of the pan measured in radians per second.

IV. DISCUSSION

On the first day it rained in the month of September the rain increased and it lead to an increase in the velocity and volume of the running water, there were many garbage in the drainage system which made the arms

of the propeller to move at the same rate with the velocity of the running water but during the third test the waste materials have reduced and it allowed the arms of the propeller to move at a relatively slow velocity.

On the first day it rained in the month of October, the rain was not continually increasing which resulted to a low amount of flow of waste materials in drainage system. This made the arms of the propeller to move at a velocity that was too slow but during the third test the rain increased and it allowed the arms of the propeller to move relative to the velocity of the running water and hence the system was more effective.

On the first day it rained in the month of November the rain continually increased leading to an increase in the velocity and volume of the running water, but also a lot of particles in the drainage system made the arms of the propeller to move at the same rate with the velocity of the running water but during the propeller moved by the action of the wind as the velocity of the running water was not enough to fast motion in the propeller

V. CONCLUSION

1. It was found out that at the absence of some variables like heavy winds, the propeller moved at a rate relative to the velocity of the running water.
2. The cleaner functioned move effectively during the heavier rains which had more volume of running water with garbage and high velocity.
3. The pan functioned effectively. It moved at a rate relative to the velocity of the running water and at the rate of the propeller.

The results and findings have shown the scope of design and specifications of the Drainage system cleaner makes it work effectively. It has also highlighted how efficient the machine could be if called into action to reduce flooding and climate change.

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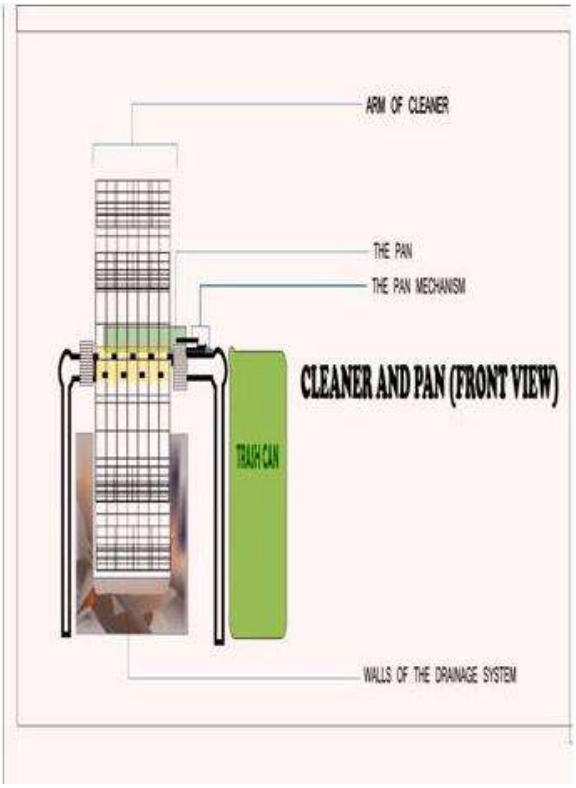

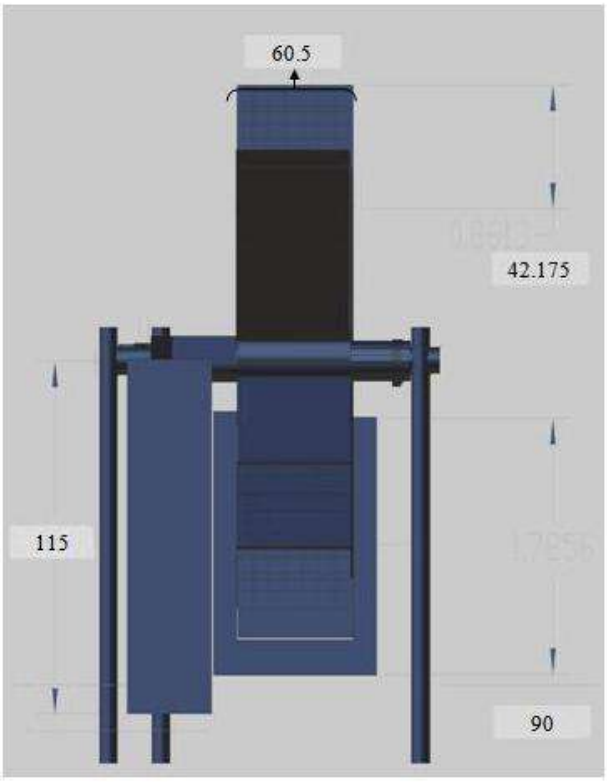

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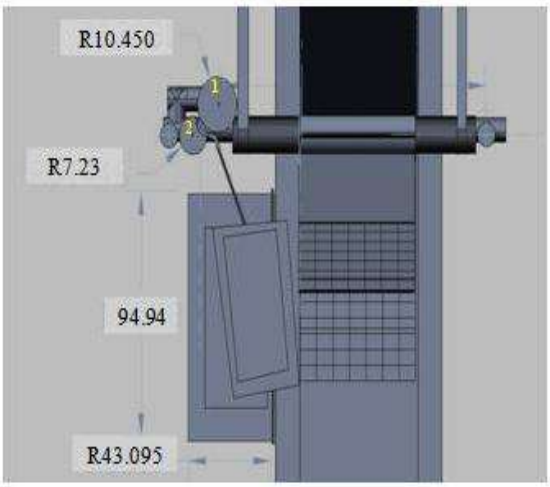

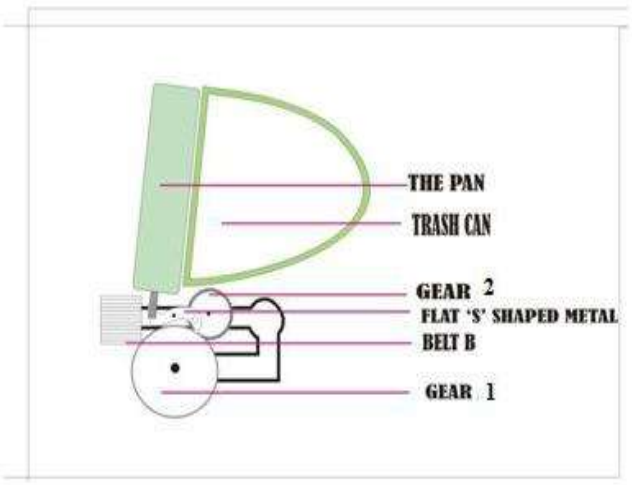

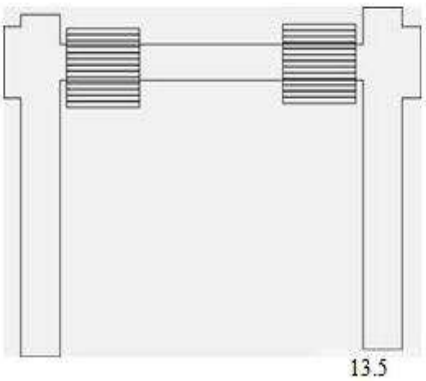

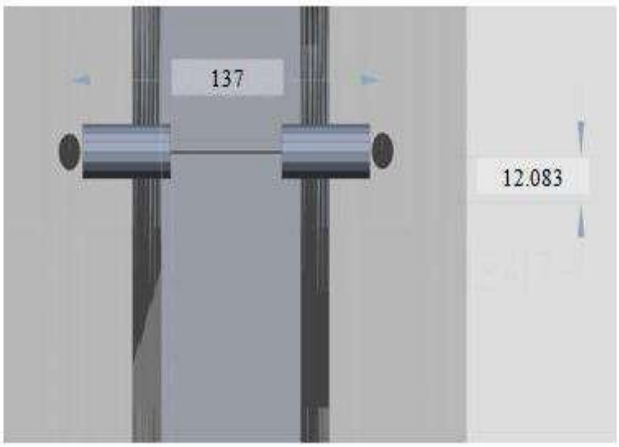

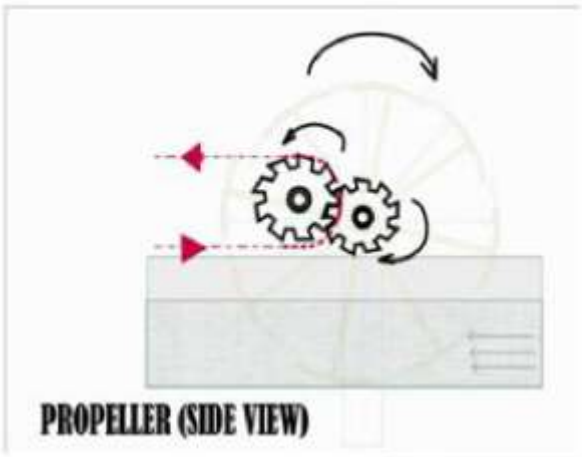
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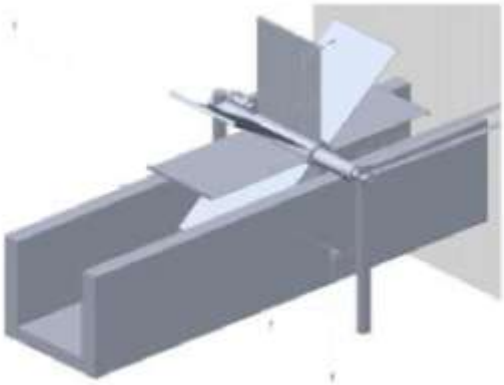

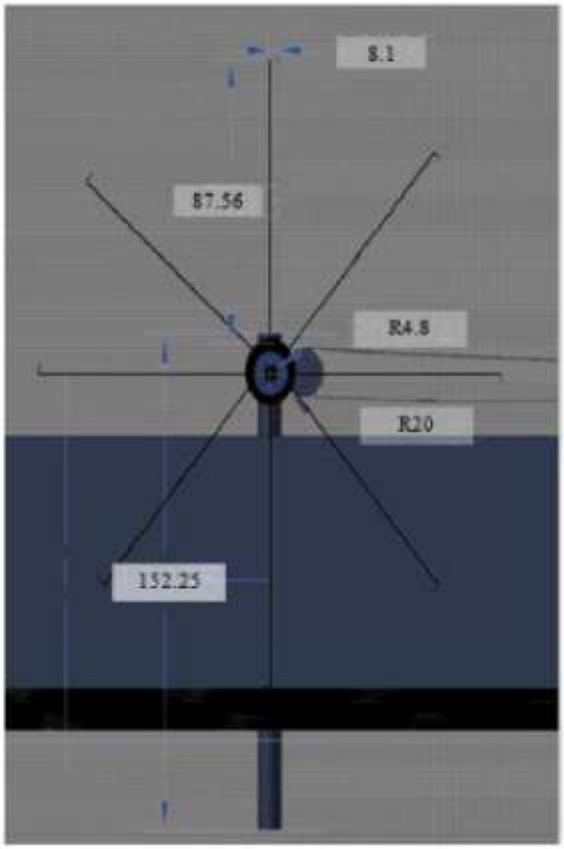
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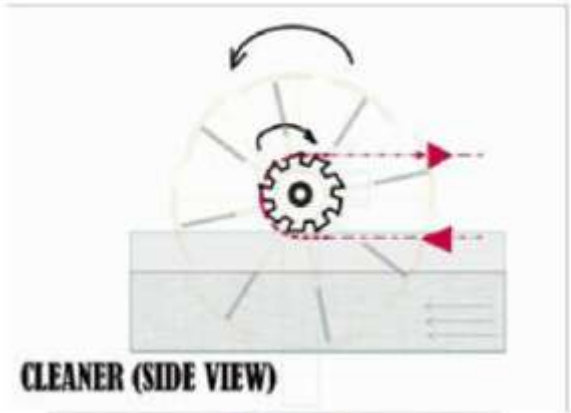
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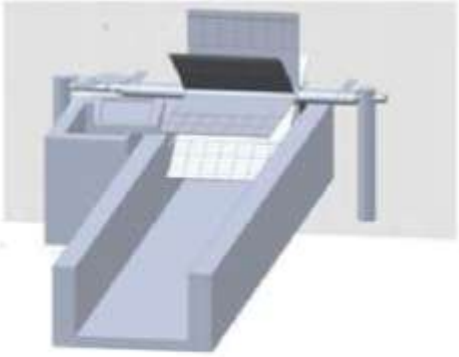

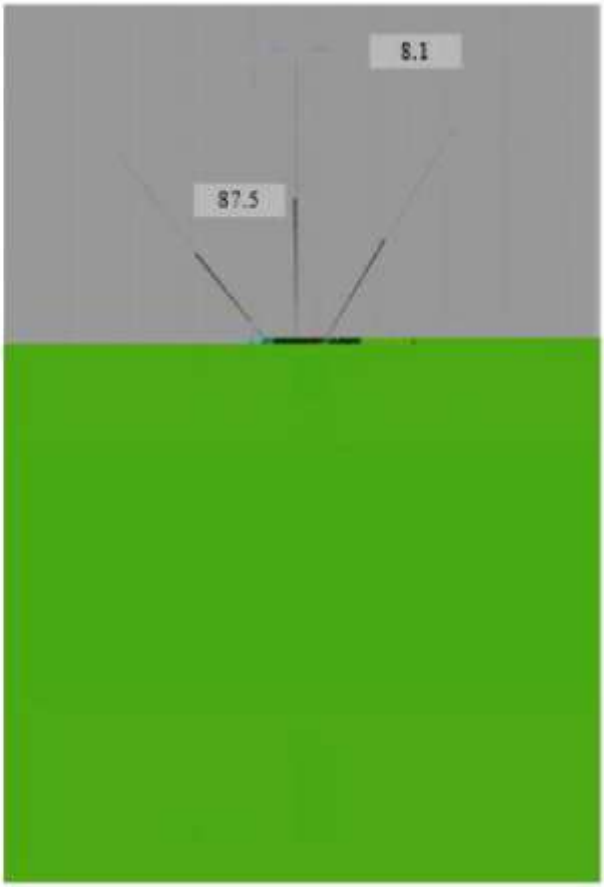
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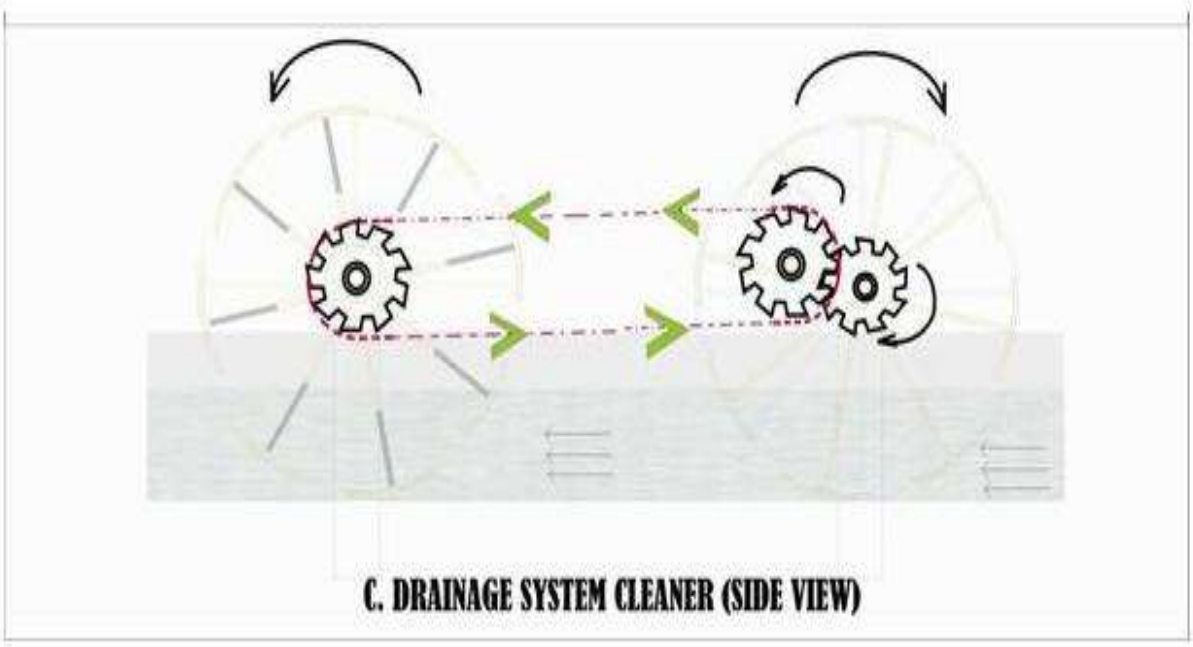

C. DRAINAGE SYSTEM CLEANER (SIDE VIEW)