

# Smart water tank cleaning machine for household applications

Chaudhary Parth<sup>1</sup>, Darji Biren<sup>2</sup>, Patel Harsh<sup>3</sup>, Gautam Singh Rajput<sup>4</sup>

<sup>1,2,3,4</sup> Students, Dept. of Mechanical Engineering, Government Engineering College, Patan, Gujarat, India

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**Abstract** - Aim of this project is to develop a mechanical system for cleaning domestic cylindrical water tank. The mechanical system includes two main mechanisms which are rack and pinion gear mechanism and reciprocating four bar linkage mechanism. The rack and pinion arrangement is used to move whole mechanical system up and down for cleaning the cylindrical tank. The rack is fixed on the motor and the four-bar mechanism is attached to the motor shaft. PVC brushes are attached to the ends of the four-bar linkage. Four bar linkage is made in such a way that it can be adjusted according to inside diameter of the tank. When the motor is started the linkage rotates and with the help of brushes, cleaning of wall and base of tank takes place. The purpose of this project is to reduce the human efforts and to avoid the chemical influence on health of person entering the tank for cleaning.

**Key Words:** Cylindrical water tank, AC and DC motor, Motor shaft, Bevel gear, PVC brush, Spring compression arm to join brushes and main shaft, Spray nozzle.

## 1. INTRODUCTION

In India, the use of tanks by the general population is about 71% after the examinations have made data that have faced a significant amount of problems, such as persistent work in disordered places, sporadic delivery and different reasons Constant work and unpredictable installation can also be the important purpose behind this effort. So, we came to the conclusion that cleaning the upper tank using the mechanization process can be invaluable for tackling each of these problems. For this situation, the machine has the ability to clean the tank effortlessly and quickly. The planning of our machine depends on the direct study relationship. In this avant-garde world, the physical cleaning of air tanks is a repetitive activity. To overcome this, we have tried to solve the disadvantages of cleaning the overhead tanks, so the automatic cleaning of the upper tank of the system is designed to provide high safety, high efficiency, less time for cleaning and avoid problems of environmental contamination. The aim of this project is to clean the domestic cylindrical water tank with the help of a mechanical system. The mechanical system consists of a bar attached to the arms with brushes at the ends. The two arms are connected to the rod with a nut. By rotating the pole, you can move the arms up and down. The auction is rotated with the help of a D.C. This manual has been prepared as a guide for people who will operate and maintain your tank cleaning machine. The path to a long life for your tank cleaning

machine will, reliably on maintenance that has be a precisely organized for varies part like framework; You will appreciate that a tank cleaning has a dirty and difficult task requires more consideration than one that works in perfect condition. Every day we use the tank water for brushing abating, for cleaning and moping, for washing clothes and in other household chores. With the passage of time, sediments scale and algae get deposited on the walls, ceiling and floor of the water tank. This deposition contaminates the water and makes is unfit for use. With time algae and bacteria grow and breed in this water infect it and could make us fall sick eventually. Hence water tank cleaning is very important. The aim of the project is the reduction of cost and manual labour because there will be harmful diseases for the person who will go inside and it will affect the health as well as the other human being who consumes water from the tank.

## 1.1 Necessity of Cleaning Water Tank

Every day we use the tank water for brushing and bathing, for cleaning and moping, for washing clothes and in other household chores. With the passage of time, sediments scale and algae get deposited on the walls, ceiling and floor of the water tank. This deposition contaminates the water and makes is unfit for use. With time algae and bacteria grow and breed in this water infect it and could make us fall sick eventually. Hence water tank cleaning is very important.

## 1.2 Methods of water tank cleaning

Manual scrubbing in which wall and floor of tank are scrubbed to remove dirt, sediments, fungus and stains, but this method is more tedious and time consuming. The water tank can also be cleaned by using chemicals to remove the dirt and sediments. The chemicals used may affect the human health. Pressurized water can be sprayed on the walls of the tank which will remove the dirt from the tank surface. These methods are time consuming and require more efforts for cleaning.

## 1.3 Alternate Method

All methods of cleaning water tank as discussed above are time consuming and require more human efforts. So alternate method is required for cleaning purpose which will overcome the drawbacks of all other methods. Therefore we are developing water tank cleaning equipment which requires less time and human efforts for cleaning.

## 2. MAIN COMPONENTS

### 2.1 AC AND DC motors

Automatic tank cleaning machines that work the same way as a wall cleaner. In this project, a DC motor of about 12 V, which operates at 60 rpm, is used to rotate the lateral axes continuously. An AC motor of about 0.25 HP operating at 1440 rpm is used to rotate the shaft at a fixed speed. The shaft is mounted on the motor on the T-shaped rod. Two motors are used in the machine. The 0.25 horsepower electrical type single phase AC motor is used to run the rotary brushes. Another 12V horse power DC motor is connected to the shaft to run the brushes and it disconnected to the connecting rod to transfer the rotary motion into linear motion by means of reciprocating motion is achieved. This is used for up and down motion of the shaft which is the last step carried in the machine. The mechanism used is spring compression mechanism.

### 2.2 Shaft

Shaft made up of mild steel of diameter 15mm is used to transmit rotary motion from motor to the four bar linkage. Holes provided on the shaft, adjust the four bar linkage according to the diameter of the tank. In the hollow shaft, the material at the centre is removed and spread at large radius. Therefore, hollow shafts are stronger than solid shaft having the same weight. The stiffness of the hollow shaft is more than the solid shaft with the same weight. The hollow shaft is costlier than a solid shaft.

### 2.3 Brush

A brush is a common tool with bristles, wire or other filaments. It generally consists of a handle or block to which filaments are affixed in either a parallel or perpendicular orientation, depending on the way the brush is to be gripped during use. The material of both the block and bristles or filaments is chosen to withstand hazards of its intended use, such as corrosive chemicals, heat or abrasion. It is used for cleaning, grooming hair, makeup, painting, and surface finishing and for many other purposes. It is one of the most basic and versatile tools in use today. The brushes are made up of Poly Vinyl Chloride (PVC) polymer. Brushes attached to the ends of four bar linkage revolve due to rotation of motor shaft to clean the inner surface of the tank.

Advantages of PVC brushes:

PVC's abrasion resistance, light weight, good mechanical strength and toughness are key technical advantages. PVC can be cut, shaped, welded and joined easily in a variety of styles. Its light weight reduces manual handling difficulties.

Advantages of nylon brushes:

Nylon brush offers a number of advantages over other brushes, including higher durability, chemical resistance, and excellent bend recovery. Nylon brushes also have the advantage of a high absorption rate and high wet stiffness that make synthetic fibres a good choice for wet conditions.

### 2.4 Bevel gears

Bevel gears are the gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. Here pair of bevel gears are fitted on motor and main shaft in order to transmit better rotary motion.

### 2.5 Spray nozzles

A spray nozzle is a precision device that facilitates dispersion of liquid into a spray. Nozzles are used for three purposes: to distribute a liquid over an area, to increase liquid surface area, and create impact force on a solid surface. A wide variety of spray nozzle applications use a number of spray characteristics to describe the spray. Spray nozzles can be categorized based on the energy input used to cause atomization, the breakup of the fluid into drops. Spray nozzles can have one or more outlets; a multiple outlet nozzle is known as a compound nozzle. Spray nozzles range from heavy duty industrial uses to light duty spray cans.

### 2.6 Spring compression arm to join brushes and main shaft

Compression Spring Uses. Compression springs are devices made up of helically formed coil with pitch in between used to push back on an applied force or load in order to return to its original position when the force or load is released.

## 3. METHODOLOGY

Firstly whole water is removed from the tank. Detergent is then sprayed on the inner wall of the tank for easy removal of dirt. The whole system is inserted in retracted position into the tank. The four bar linkage is then adjusted according to the tank diameter in such a way that brush at end of the shaft touches the bottom of tank. Now the motor is switched ON. The four bar linkage starts rotating along with the shaft. This causes scrubbing of inner wall of tank by the brush attached to the ends of linkage. For cleaning upper portion of the tank the whole mechanism is reciprocated along the guide ways with the help of handle connected to the rack and pinion arrangement. In this way the tank gets cleaned within minimum time.

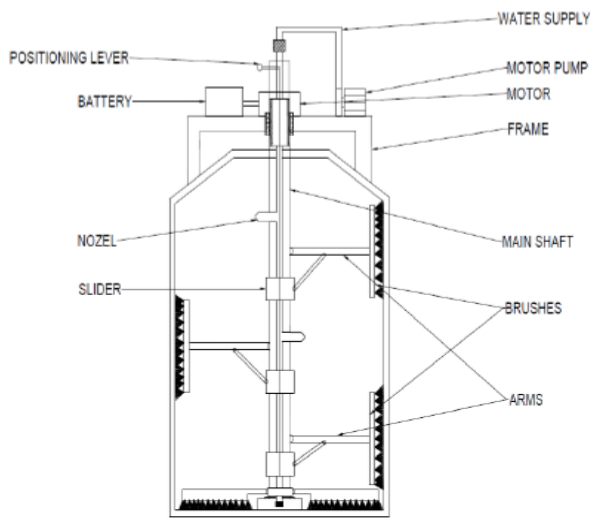


Fig 1: Schematic diagram of machine

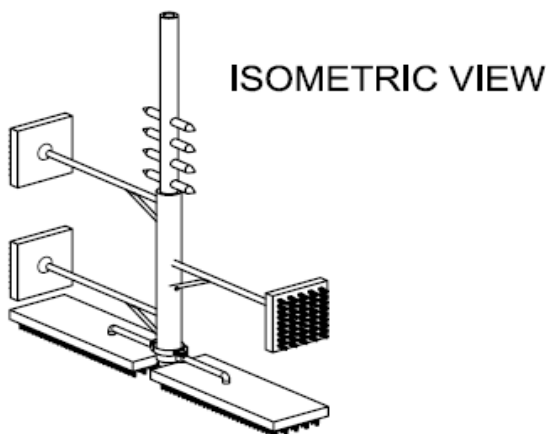


Fig 2: Isometric view of machine

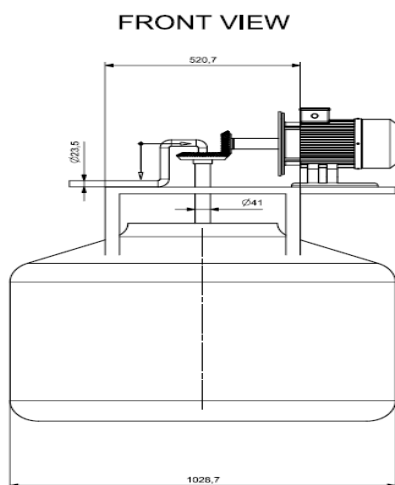


Fig 3: Schematic diagram of assembly

#### 4. 3D MODEL

An animated design of the prototype has been made with the NX11.0 version software's. An automated tank cleaning machine is a machine used to clean the overhead tanks such those found to store the water. Tanks must be cleaned from time to time for various reasons.

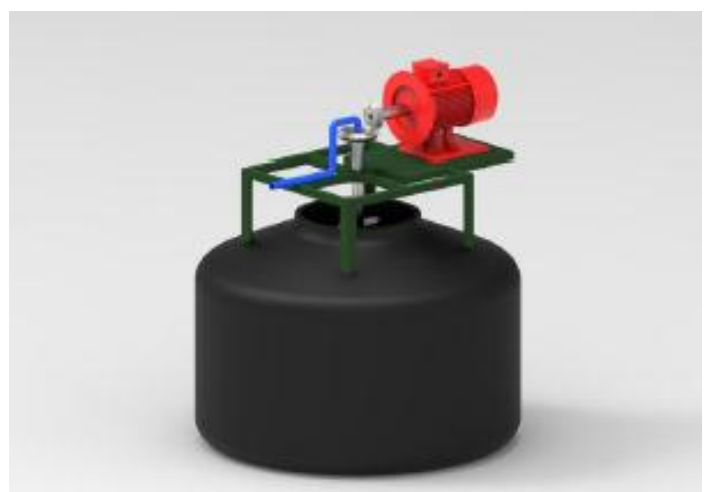
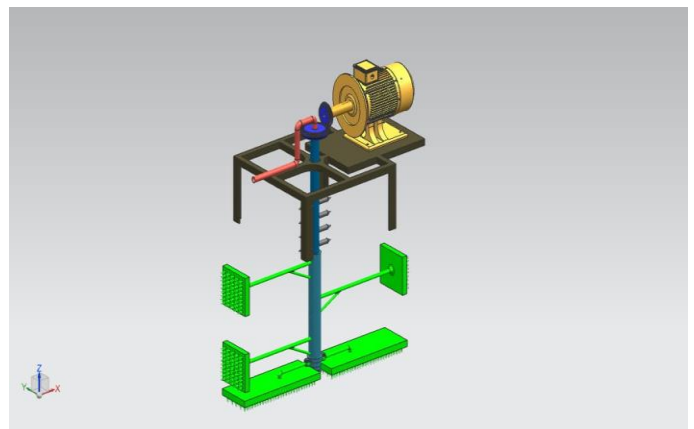
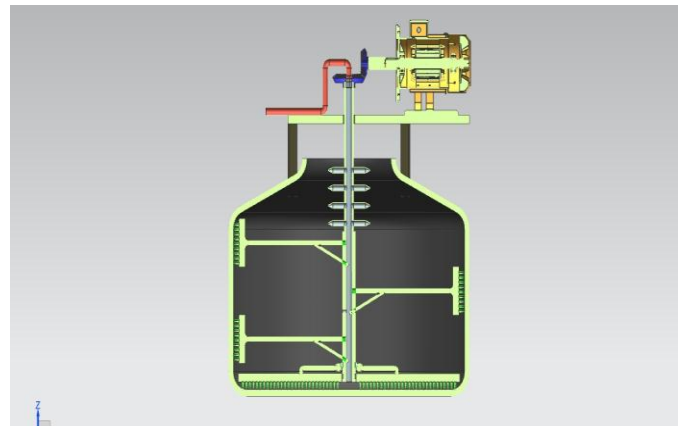


Fig 4: 3D model of the cleaning machine

## 5. POTENTIAL IMPACT

At present, no automatic tank cleaning machine is available in market. Tank cleaning is a major problem in cities where water has higher TDS so cleaning is mandatory. It is smart system hence; it does not require any careful inspection or any skilled person. After cleaning alarm and SMS sent hence, users easily understand that tank is clean.

## 6. COST

SR NO	COMPONENTS	COST(Rs.)
1	Single phase 200V motor	6000
2	PVC Brushes	400
3	Bevel gear	800
4	Nozzles	150
5	Hollow shaft	800
6	Spring loaded arm	1800
7	Others	4000

From the above analysis of cost we found that the total approximate cost is Rs.15000

## 7. FUTURE SCOPE

This system is user friendly and time saving also the cost is less hence it can be used in the future water tank cleaning purpose. In future the advance system may also be invited like the vacuum cleaner type system that can clean the tank without removing the water from the tank. The system could be more compact and light weighted and more user friendly and efficient by improvement in the design and using some other advance equipment. To add a system when tank is overflow then before overflow alert is sent to user.

## 8. CONCLUSIONS

The water tank cleaner was used to clean the water tanks by using rotating brushes. This method was more effective and safer than the conventional methods. This method is capable to clean water tanks within less time and human efforts advanced model for tank cleaning system is cleaning the tanks thus making the operation user friendly. The working prototype is promising both in terms of imparting cleanliness and avoiding excess manpower. The future scope of the project is to extend it with auto feeding mechanism by which the manpower involved in feeding gets removed. Through the help of the auto feed mechanism, it is easy to clean the tanks without excess man power. The project can

be even extended to increase the cleanliness of the tank by insulating the frame and other components using stainless steel.

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