Development of Automated Overhead Water Tank Cleaning Machine

[1]Shankarnag Shirashyad, [2]Sachin Kumar, [3]Imran Ansari, [4]Mallikarjun wale, [5]Robinson.P
[1,2,3,4]Student, [5]Assistant Professor
[1,2,3,4,5]School of Mechanical Engineering, REVA University, Bengaluru, India

ABSTRACT-*. Aim of this project is to develop a mechanical system for cleaning domestic cylindrical water tank. The mechanical system includes simple mechanism with centrifugal force. The principal involved in this mechanism is left hand Fleming rule, where a simple electric energy is converted into rotational energy. The motor shaft is connected to a long vertical arm with two PVC brushes and extended to the end of inner layer of water tank such that brushes gets contact with inner walls of the tank, as the power supply the shaft rotates with the help of gear motor, such a way that brush cleans inside walls of cylindrical water tank. The purpose of this project is to reduce human effort, time and avoid exposure to chemical influence on a health of person entering the water tank for purpose of cleaning*

Index Terms -. *Water Tank Cleaning, Cylindrical water tank, four bar linkage, motor shaft, rack and pinion, PVC brush*

I. INTRODUCTION

In recent studies it has been found that no automation-based machine used in cleaning of overhead tank. This is because of the irregular shape and various heights of the tank locations. With previous survey tried to make a machine by automation process for cleaning tank. An alternate solution has decided to solve this problem. In India, the usage of syntax tanks by the people is approximately 71% After studies made the information that have faced a lot of difficulties like continuous work in the dirty places, irregular payment and other various reasons. Continuous work and irregular payment may also be the major reason for this attempt. So concluded that cleaning the overhead tank using automation process can be useful to solve all these problems. In this case, machine has the capability to clean the tank easily and quickly. Designing of our machine is based on the survey report conducted. In this modern world, cleaning of overhead tanks manually is a tedious job. To overcome this, we have aimed at tackling the disadvantages of cleaning overhead tanks, so an automatic system overhead tank cleaning is designed to provide high safety, high efficiency, less time for cleaning and to avoid environmental pollution problems. Purpose of this project is to clean domestic cylindrical water tank with the help of mechatronics system. The mechatronics system consists of a grooved gear rod attached to two arms with brushes at ends. The two arms are connected to the gear rod by nut. By rotating the gear rod, the up and down motion of the two arms is achieved. The gear rod is rotated with the help of a D.C gear motor.

The main grooved shaft is powered by an A.C motor. The motor and the shaft are connected by a rubber belt. The clockwise rotation of the main shaft will make the arms move and vice versa. The whole operation is controlled by a circuit consisting of relay switches, buttons, and PIC microcontroller. The number of times for the operation to repeat can be fed into the circuit. The achievement of this project is reduction of cost and manual labor 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. This manual has been prepared as a guide for the persons who will be operating and maintaining your tank cleaning machine. The key to long life for your tank cleaning machine will always be a system of carefully planned maintenance; you will appreciate that a tank cleaning machine which has a rough and dirty job to do will need more frequent attention than one working in ideal conditions.

It is in your own interest to get the best and most economical performance from your tank cleaning machine. Neglect of maintenance means poor performance, unscheduled stoppages, shorter life and expense. Good maintenance means good performance, no unscheduled stoppages and better total economy. You will find the information contained in this manual simple to follow, but should you require further assistance, our Customer Service Department and world-wide net of Distributors will be pleased to help you. Please quote the type and serial number withal your enquiries; this will help us to help you. The type and serial number are placed on the Body of the tank cleaning machine**.**

II. LITERATURE SURVEY

G. BHASKAR, Y. CHANDU, S.B. FAZUL REHMAN, V. GANESH.R.SAI LOKESH

Aim of this project is to develop a mechanical system for cleaning domestic cylindrical water tank. The mechanical system includes simple mechanism with centrifugal force. The principle involved in this mechanism is left hand Fleming rule, where a simple electric energy is converted into rotational energy. The motor shaft is connected to a long vertical arm with two PVC brushes and extended to the end of inner layer of water tank such that brushes gets contact with inner walls of the tank, as the power supply the shaft rotates with the help of gear motor, such a way that brush cleans inside walls of cylindrical water tank. The purpose of this project is to reduce human effort, time and avoid exposure to chemical influence on a health of person entering the water tank for purpose of cleaning.

Rohit R. Dab hade, Shubham V. Lanarkite, Saket P. Wankhede, Shubham G. Darker.

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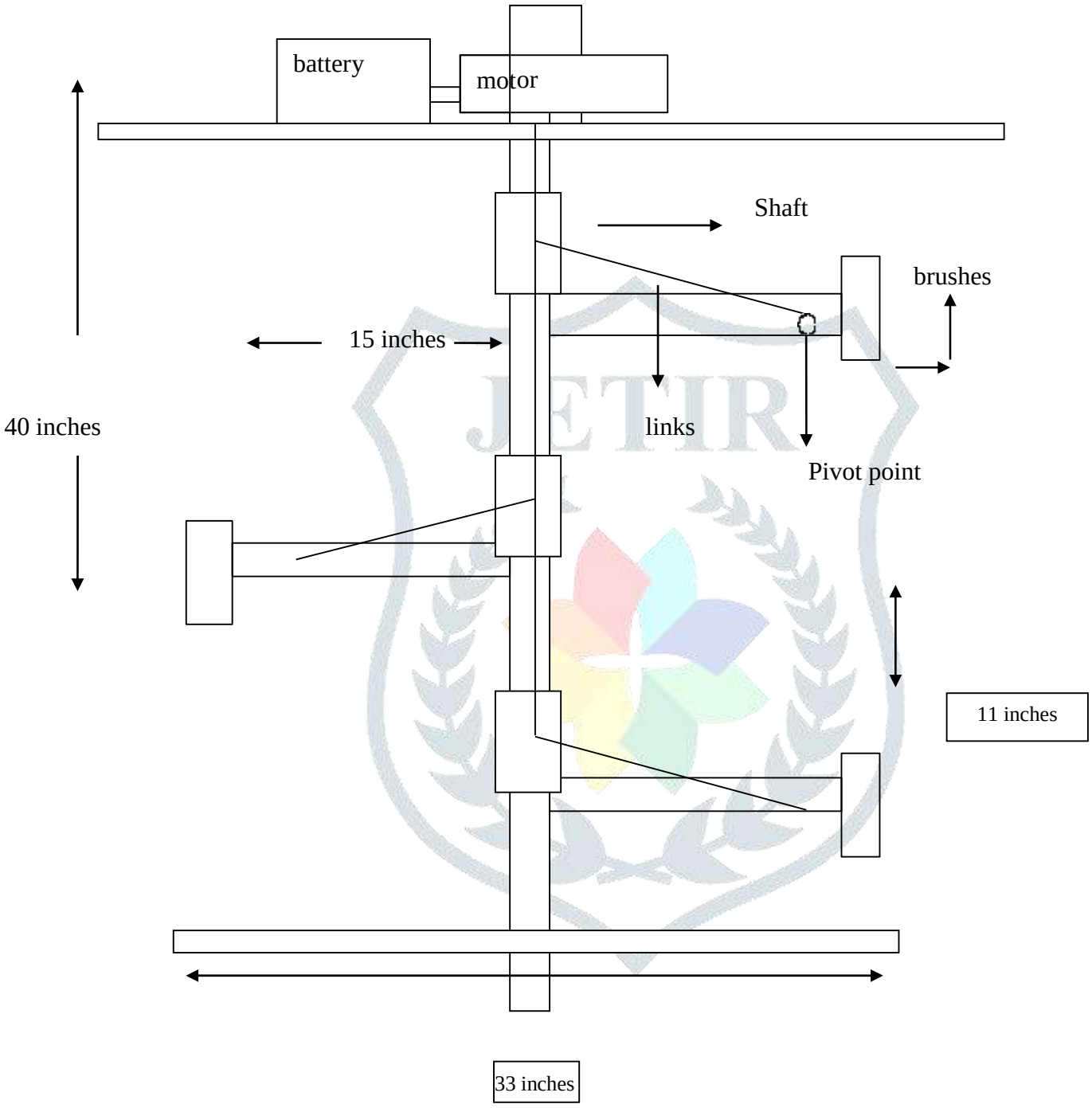
Mr. Shubham Samrat, Mr. Divyarajsingh Mandale, Mr. Ankit Bokade, Mr. Paresh Choudhary, Mr. Faisal Khan, Mr. Abhijeet Kongre, Mr. Saurabh Zada.

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 motion reversal mechanism. The rack and pinion arrangement are used to move whole mechanical system up and down for cleaning the cylindrical tank. The rack is fixed on the motor and the rotational 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.

Davis, J. and Lambert, R., 2002.

state there are three steps for conventional cleaning and disinfecting a water tank. Cleaning the tank Empty the tank. Open the outlet valve/tap and drain out any remaining liquid. Clean all internal surfaces. Use a mixture of detergent and water to clean all internal surfaces of the tank. Disinfecting the tank to effectively disinfect the tank, fill it with clean water up to ¼ level only. It is important to not fill the tank too much as this will reduce the concentration of the chlorine solution and limit the effectiveness of cleaning.

BLOCK DIAGRAM OF PROPOSED AUTOMATED OVER HEAD WATER TANK CLEANING MACHINE MODEL



III. WORKING PRINCIPLE

Motor draws power from the 12 volts, 7.5 ah battery and drives the shaft. Here the rotating motion of the motor is transmitted to shaft and then to the arms and brushes. the induced rotating motion cleans the inner walls of the tank. The links are included in order to make a lesser area during removal and to make the model induce inside the tank. There is also a water pump that is used to spray water or soap water to the inner walls of the tank so that the brushes work smooth and the dust or sediments on the wall fall down to the bottom and then can be sucked out of tank. The brushes help in removal of the salt and other waste materials inside the tank.

COMPONENTS USED:

- Low speed high torque dc motors
- Battery
- Nylon brushes
- Linkage mechanism
- Centre shaft
- Outer frame
- Switches
- Bearing
- Sintex Tank
- Bush

SYSTEM CALCULATION

DC GEARED MOTOR

12V DC motors with Metal Gearbox, 6mm shaft diameter, Shaft length 15mm, 10RPM
Stall Torque = 25kgcm torque, No-load current = 800 mA (Max), Stall current = upto 9.5 A(Max).

Considering brushes coming in contact with tank surface.
P=1.47N/mm2
P=1.47N/mm2
Pressure =Force/Area
Area of contact of blades to the soil considering.
Length of contact of blades 152.4 mm
Width 76.2mm
Area = 152.4 * 76.2
A= 11612.88 mm2
Pressure =Force/Area
Force =1.47*1161=1706N considering ≈ 1700N
Force =1700 N

HORSE POWER

For electric motors, power or horsepower can be calculated from the torque and speed.

Horse power is given by rpm*torque/63025

63,025 is a constant when using RPM for speed and in-lbf for torque units. 5,252 is another common constant if the speed is in RPM and torque is in ft-lbf. If the units are different than simply make the unit conversion.

So we are converting torque which is in kg/cm to in/lbf ie 25kg/cm will become 21.7 lb-in ..

So the power of the motor would be 10*21.7/63025

Which is equal to 3.44*10^-3 HP

= 0.00344 HP

If we use a motor of .128 HP the following calculations can be made-

0.00344 HP = 2.5353 Watts

Power Input, Pin = 2.5353 Watts

Power output, Pout = Pin x Efficiency

Efficiency of an electric motor to convert electrical energy to mechanical work done is assumed to be as 90%.

At 90 % efficiency

POWER OUTPUT, POUT = 2.5353 X 0.9 = 2.28177 WATTS

As we know that,

Power = Torque x angular velocity = T x ω

Power = Force x shaft radius x angular velocity

2.28177 = 1700 x r x ω

r x ω = 0.001342 m/sec ---------- Equation 1

ω = 2 x π x n/ 60

ω =2x π x 10/60

=1.0471 radians/SEC

IV: FABRICATION WORKDONE UNDER PROGRESS

FIG 1.7. Linkage mechanisms

FIG 1.7. Frame of model

V. CONCLUSION

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.

VI. SCOPE FOR FUTURE

- 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 lighter weighted and more user-friendly and efficient by improvement in the design and using some other advance equipment

VII. ACKNOWLEDGEMENT

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