Semi-Automatic Overhead Water Tank Cleaning System

Malunjkar N.G[1], Pagar N.M[2], Shinde A.A[3], Pawbake A.T[4],Prof-M.K Shaikh

ABSTRACT

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.

Keywords-*cleaning, overhead, automatic.*

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 made an attempt to make a machine by automation process for cleaning tank. An alternate solution has made a plan to solve this problem. In India, the usage of sintex 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 came to a conclusion 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 thetank easily and quickly. Designing of our machine is based on the survey report conducted.

II. MATERIALS AND METHODS

In this chapter a detailed discussions had made about the selection of materials and methods that have been handled.

A. Selection of Materials

The machine setup is considered. The rows and columns of the machine are of mild steel material. The DC Motor are used to move the shaft from starting to end position of the brushes and the brushes rotates continuously based on the input power which it receives from the AC Motor to clean the overhead tank.

The two types of rotary brushes are used to clean the overhead tank in horizontal and vertical positions. A shaft is used to hold the brushes in side view and bottom positions in which the adjustable springs with tension are used in between the brushes to adjust the size of the side view brushes as per the tank's space requirement.

The 0.25 horse power electrical type single phase Ac motor is used to run the machine. The up and down motion of the shaft can be controlled with help of the microcontroller. The Microcontroller is used to set the total number of rotary motion of the shaft which is used rotate the brushes at the two ends of the machine. It is operated in a supply voltage range of (0-12) V ac. The vertical shaft is about length of 3.5 feet and the horizontal

shaft is about length of 3 feet which is eight in number. The setup stand is made up of mild steel such that all the components are easily made to fix upon it. A series of brushes are placed in shaft of the rotor in which the pulley gives the required speed, such that the distance between each brush from centre is exactly 40cm.

B. Selection of Motor

Two motors are used in the machine. The 0.25 horse power electrical type single phase Ac motor is used to run the rotatory brushes. Another 12V horse power DC motor is connected to the shaft to run the brushes and it is connected 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.

C. Selection of Springs

A spring is an elastic object used to store mechanical energy. Springs are usually made out of spring steel. There are a large number of spring designs; in everyday usage the term often refers to coil springs.

Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication. Some non-ferrous metals are also used including phosphor bronze and titanium for parts requiring corrosion resistance and beryllium copper for springs carrying electrical current (because of its low electrical resistance).

When a coil spring is compressed or stretched slightly from rest, the force it exerts is approximately proportional to its change in length (this approximation breaks down for larger deflections). The rate or spring constant of a spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve. An extension or compression spring has units of force divided by distance, for example lbf/in or N/m. Torsion springs have units of torque divided by angle, such as N•m/rad or ft•lbf/degree.

The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series.

D. Selection of Screw

A screw is a mechanism that converts rotational motion to linear motion, and a torque (rotational force) to a linear force. It is one of the six classical simple machines. The most common form consists of cylindrical shaft with helical grooves or ridges called threads around the outside. The screw passes through a hole in another object or medium, with threads on the inside of the hole that mesh with the screw's threads.

When the shaft of the screw is rotated relative to the stationary threads, the screw moves along its axis relative to the medium surrounding it; for example rotating a wood screw forces it into wood. In screw mechanisms, either the screw shaft can rotate through a threaded hole in a stationary object, or a threaded collar such as a nut can rotate stationary screw shaft. Geometrically, a screw can be viewed as a narrow inclined plane wrapped around a cylinder.

E. Selection of Nut

A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten two or more parts together. The two partners are kept together by a combination of their threads' friction, a slight stretching of the bolt, and compression of the parts to be held together.

The most common shape is hexagonal, for similar reasons as the bolt head - 6 sides give a good granularity of angles for a tool to approach from (good in tight spots), but more (and smaller) corners would be vulnerable to being rounded off. It takes only 1/6th of a rotation to obtain the next side of the hexagon and grip is optimal. However polygons with more than 6 sides do not give the requisite grip and polygons with fewer than 6 sides take more time to be given a complete rotation. Other specialized shapes exist for certain needs, such as wingnuts for finger adjustment and captive nuts (e.g. cage nuts) for inaccessible areas.

A wide variety of nuts exists, from household hardware versions to specialized industry-specific designs that are engineered to meet various technical standards. Fasteners used in automotive, engineering, and industrial applications usually need to be tightened to a specific torque setting, using a torque wrench. Nuts are graded with strength ratings compatible with their respective bolts.

III. FABRICATION AND TESTING MODEL

In this chapter a detailed discussions had made about the selection of materials and methods that have been handled.

A. Software View

An animated design of the prototype has been made with the Solid works and Creo 2.1.0 version software's.

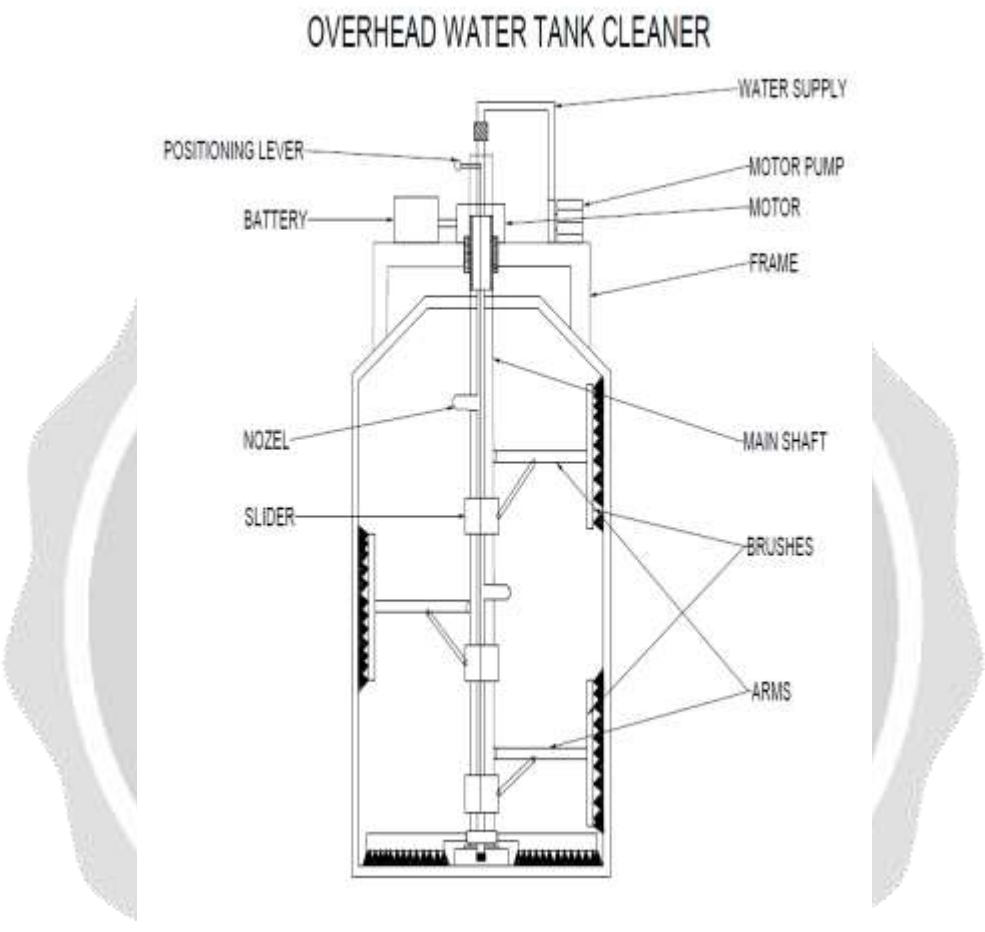

Fig 3.1 Assembled design of Prototype Model

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. The main reason is to clean the tank is allow to gets fungus. Thus the tank is to be inspected or maintenance to be performed regularly.

B. Fabrication and Testing

Automated tank cleaning machines work in a manner similar to a wall cleaner. A D.C motor of about 12V which runs at 60rpm is used in this project to move the side shafts up and down continuously. A AC motor of about 0.25HP which runs at 1440rpm is used for rotating the shaft at the fixed speed. The shaft is mounted on the motor in the T- shape rod. The machine is attached at the top of the tank. Then the brushes are mounted at the three end of the shaft through a surface of the tank. A PIC Microcontroller and LCD display Timer is used to set the number of rotation times of brushes and movement of shaft. After the complete setup, the motor rotates and the brushes rotate at the surface of the tank. A spring compression is mechanism is attached between the brush and shaft. Finally the water gets drain by the outlet of the tank. Portable water washing systems are widely used, but tanks that are cleaned frequently may have a fixed system installed.

IV. CONCLUSION

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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