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Paper Authors
Prof. Ashish B SamarthA, Tejas V Rajurkar, Sandip S Markand, Shubham A Shirbhate, Aniket V Shende, Sanket S Sathe, Akash S Jaiswal

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Design and Fabrication of Overhead Water Tank Cleaning Mechanism

Prof. Ashish B Samarth[A], Tejas V Rajurkar[1], Sandip S Markand[2], Shubham A Shirbhate[3], Aniket V Shende[4], Sanket S Sathe[5], Akash S Jaiswal[6],

[1,2,3,4,5,6] U.G. students, Department of Mechanical Engineering, jagadambha College of Engineering and technology yavatmal , SGBAU Amravati university.

[A] Assistant Professor, , Department of Mechanical Engineering, jagadambha College of Engineering and technology yavatmal , SGBAU Amravati university.
Email: samarth.ashish777@gmail.coms

Abstract— *Aim of this paper is to develop a mechanism for cleaning domestic cylindrical water tank. The mechanical system includes simple mechanisms which includes a main shaft (hollow MS pipe) to which linkages are welded and again extension pipes are connected to linkages by means of nut and bolt. Brushes are connected to the extension pipe. This whole mechanism is attached to the motor shaft. PVC brushes are attached to the ends of the extension pipe. Extension pipe 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.*

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 overhead tank cleaning mechanism is designed to provide high safety, high efficiency, less time for cleaning and to avoid environmental pollution problems. Purpose of this paper is to clean domestic cylindrical water tank with the help of this mechanism. The achievement of this project is 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.

Keywords—Water Tank Cleaning, Cylindrical water tank, motor shaft, PVC brush, eco-friendly , linkage, cost effective .

INTRODUCTION

In recent studies it has been found that no 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 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 the tank easily and quickly. Designing of our machine is based on the survey report conducted.

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. To find such an approach, there is need of studying the existing approaches and algorithms that had already been used for overhead water tank cleaning mechanism. This motivates us for the literature review.

The organization of this paper is as follows. In Section 2, systematic presentation of the literature review is done; which involves the list of the related approaches along with the summary of the related work that is more relevant to developed approach. Section 2 concludes with our findings from the literature review and motivation behind identified problems. Section 3 focuses on the

This section is subdivided into 5 sub-sections wherein the report presents the detailed working of overhead water tank cleaning system that is incorporated in our work along with our approach. Sub-section A includes the information about the main components

used in the project. The material and methods is mentioned in Sub-Section B. Working of system is explained in Sub- Section C with the aid of flowchart. Our proposed approach is introduced in Sub-Section D. Sub-section E provides detailed working of the proposed approach.

formulation of the identified problems. Section 4 is dedicated to the proposed approach. Section 5 emphasizes on the experimental results. Section 6 addresses the conclusions along with the future work.

I. LITERARURE REVIEW

This section presents the critical analysis of existing literature which is relevant to overhead water tank cleaning system and its mechanisms. Though, the literature consists of a lot many research contributions, but, here, we have analyzed around eight research and review papers. The existing approaches are categorized based on the basic concepts involved in the mechanisms. The emphasis is on the concepts used by the concerned authors, the database used for experimentations and the performance evaluation parameters. Their claims are also highlighted. Finally, the findings are summarized related to the studied and analyzed research papers. Section concludes with the motivation behind identified problem.

Table.1: Literature Review

Sr. No.	Ref. no. Concerned Author(s) and years	Concept used	Claimed by concern authors (s)	Our findings
1	Thonge Suraj , Shelke Prasad, Wakte Vaibhav ,Thonge Sharad , Prof. Shinde ,(2017)	A mechanical system which clean the tank mechanically using brush, rack and pinion , bar linkage and motor.	The authors observed that the Cleaning is done more effective than the conventional methods.	Adjustment of the system inside the tank is difficult.
2	S. Abhishek, D. Kiran, P.Praveen and Dr. K. L. Senthilkumar (2017)	A mechanical system which clean the tank mechanically using brush, rack and pinion , bar linkage and motor.	The authors observed thatthe Cleaning is done more effective than the conventional methods.	Cleaning of the tank using this system is not effective.
3	Prayosha innovative (2017)	Sedimclean water tank cleaning machine which clean sediments in the tank. It is a vacuum cleaner type system which clean the tank without removing the water from	Sedimclean water tank cleaning machine which clean sediments in the tank. It is a vacuum cleaner type system which clean the tank without removing the water from the tank.	Only clean the sediments in the tank not the scale and algae inside the tank.

		the tank.		
4	Brown J. A(1989)	vacuum tanker for cleaning storage tanks which is an vaccine cleaning system for cleaning the water tank and also acts as a water pump to force water.	Powerful technology to clean Big water tank more efficient and in very less time.	Very expensive
5	M.S.Triantafillou and G. S.Triantafyllou, (2003)	An efficient swimming vehicle is a mechanical system to clean the swimming pool using	Fish-like underwater micro robot which clean the swimming pool effectively.	Good working

		motor, mechanical arrangements, brush andfloss.		
6	W. S. N. Trimmer and K. J. Gabriel (1987)	Design considerations forapractical electrostatic micro-motor	A high torque less speedmotor of very small in size.	Good perform-ance
7	Dr.R.K.Bansal (2011)	Kinematics of machine.	None	Good study
8	Shubham Shrivastav, HariOm Kumar (2016)	Design and Development of Cylindrical Water tankcleaner.	Easy to use and effectivecleaning of the water tank is done	It is large in size and heavy in weight.

II. PROBLEM FORMULATION

This section presents the formulation of the identified problem, which based representation of an overhead water tank cleaning system. All the reviews on theoretic approaches involve the same common terminologies.

The problem of cleaning the water tank by the conventional can be formulated as:

All methods of cleaning water tank as discussed above are time consuming and require more human efforts. So the 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.

There are many ways to generate electricity such as nuclear, thermal, diesel, solar, hydropower based generation system. In nuclear based generation there is always risk of nuclear radiation accident also it requires high initial cost and impacts on human life. In thermal based generation there is a huge production of CO2 in atmosphere and it depends on availability of coal as fuel. In diesel based generation running charges are more due to high cost of diesel and also cost of lubrication. These are the problems that occurs in generation of electricity

That's why we are using the 12 v battery dc supply and we are charging it with the help of solar plate. Also it does not have any impact on environment or human life.

III PROPOSED APPROACH

A) Main Components

Gear Motor

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Fig. 1 Gear Motor

Gear motor is used to produce high torque with low speed. Motor used has specifications as 12 V DC motor. which produces power of 0.35 HP and the shaft speed is 60 rpm.

linkage

Fig. 2 linkage

Linkages are nothing but a welded pipe to the main shaft (hollow pipe). They are welded in such way that they can easily go through the lead of tanks and further they are extended using extension pipe.

. **Extension pipe**

The extension pipe is made up of mild steel and are quite smaller in diameter compare to linkages or welded pipe. Due to sliding motion inside the welded pipe we can adjust the diameter of revolution of extension pipes. The same principle is used to adjust the height of mechanism according to height of tank .

Fig. 3 extension pipe

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Shaft

Fig. 4 shaft

Shaft made up of mild steel is used to transmit rotary motion from motor to the r linkage. Holes provided on the linkage, adjust the extension pipe according to the diameter of the tank.

Brush

Fig. 5 Brushes

The brushes are made up of Poly Vinyl Chloride (PVC) polymer. Brushes attached to the ends of extension pipe revolve due to rotation of motor shaft to clean the inner surface of the tank.

A) Materials and methods

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 DC Motor to clean the overhead tank. The two types of 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 small compression springs are used in between the brushes to maintain the pressure of brushes on the wall of tank. The 0.35 horse power electrical type 12 v DC motor is used to run the machine.

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 area. 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.

A) Working

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 extension pipes 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 linkage starts rotating along with the shaft. This causes scrubbing of inner wall of tank by the brush attached to the ends of linkage. In this way the tank gets cleaned within minimum time.

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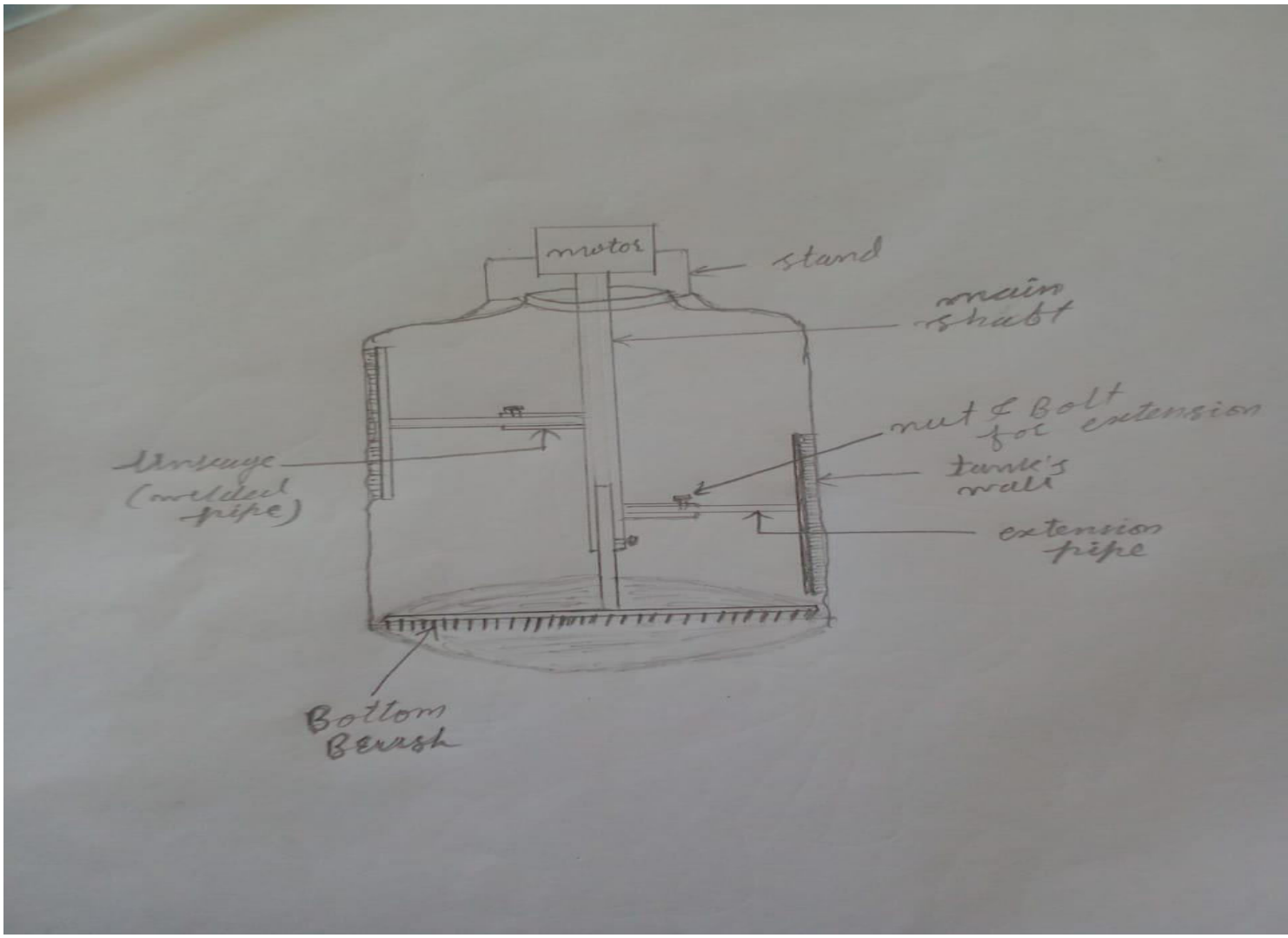
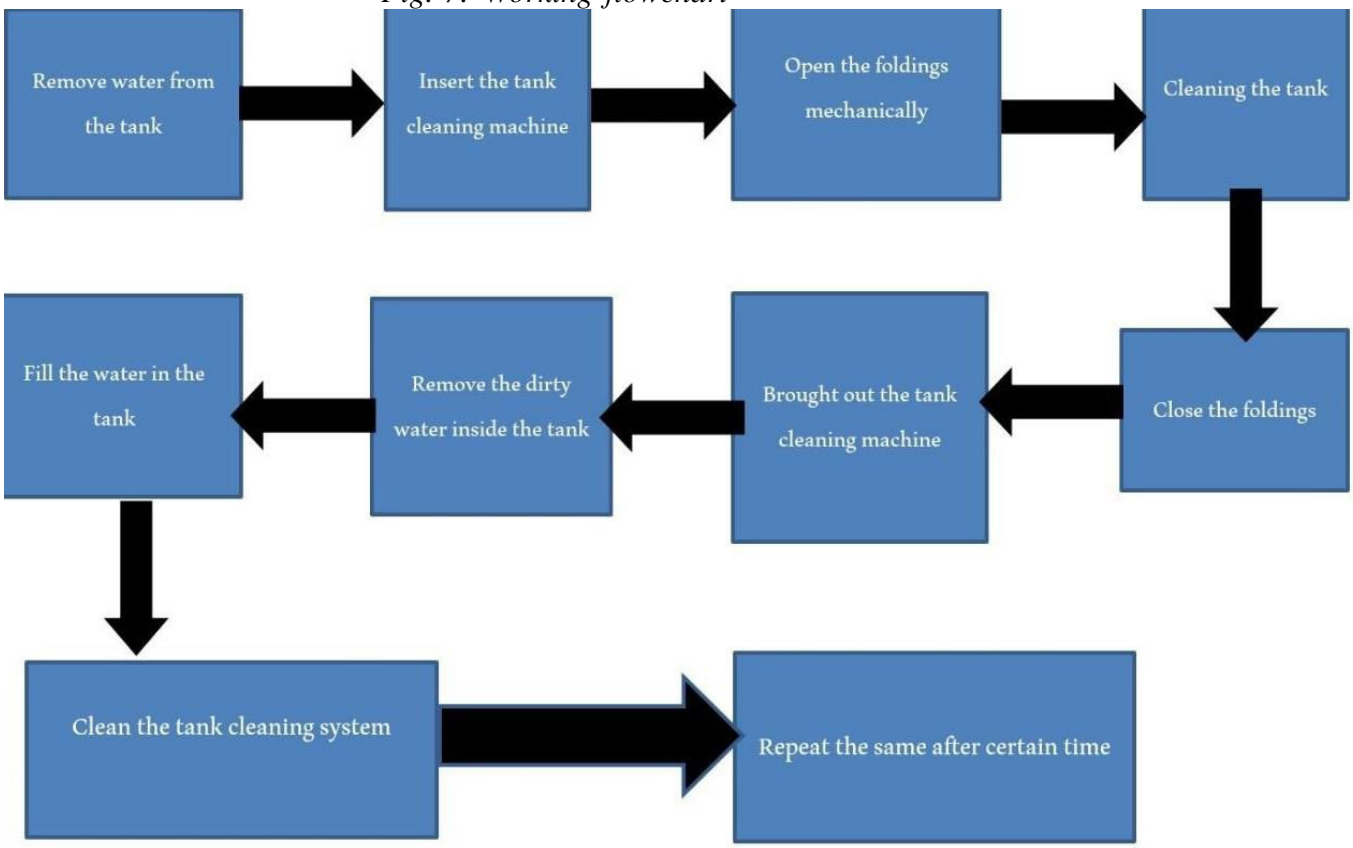


Fig. 6: overhead water tank cleaning system

Fig. 7: Working flowchart



III. RESULTS

A tank cleaning machine is a machine used to clean the overhead tanks such those EXPERIMENTAL 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.

The 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 rotates the side shafts continuously.. 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. 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.

Conclusion:

We study this method was more effective and safe than conventional method. This method is capable to clean water tank within less time and human effort the water tank cleaner was use to clean the water tanks by using rotating brushes. We know now day by day wastage of water is very important issue. To resolve this issue we made this machine at great priority.

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.

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THE AUTHORS:

	Prof. ASHISH B. SAMARTH Asst. Professor Jagadambha College Of Engineering And Technology, Yavatmal Maharashtra, India
	Mr. TEJAS VIJAY RAJURKAR BE Mechanical Engineering Student, Jagadambha College Of Engineering And Technology, Yavatmal Maharashtra, India
	Mr SANDIP SANTOSH MARKAND BE Mechanical Engineering Student, Jagadambha College Of Engineering And Technology, Yavatmal Maharashtra, India
	Mr. SHUBHAM ARUNRAO SHIRBHATE BE Mechanical Engineering Student, Jagadambha College Of Engineering And Technology, Yavatmal Maharashtra, India

	Mr. ANIKET VASANTRAO SHENDE BE Mechanical Engineering Student, Jagadambha College Of Engineering And Technology, Yavatmal Maharashtra, India
	Mr SANKET SAHILENDRA SATHE BE Mechanical Engineering Student, Jagadambha College Of Engineering And Technology, Yavatmal Maharashtra, India
	Mr. AKASH SUNIL JAISWAL BE Mechanical Engineering Student, Jagadambha College Of Engineering And Technology, Yavatmal Maharashtra, India