iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** V **Month of publication:** May 2018

DOI: http://doi.org/10.22214/ijraset.2018.5046

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

Design & Fabrication of Water Tank Cleaning Machine

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Abstract: ***Purpose of this project is to clean domestic cylindrical water tank with the help of mechanical system. This mechanical system consists of wiper motor, chain, sprocket, shaft, bearing, PVC brush. In this assembly open chain is welded to the square pipe and at the end of square pipe wiper motor is attached. The square chain welded square pipe is up and down with help of sprocket rotating with hand with the help of shaft rotating by hand with handle. The shaft is supported on the base with two pedestal bearing. Brush assembly is attached to the motor shaft.***
Keywords: wiper motor, chain sprocket (rack and pinion), PVC brush, bearing, battery

I. INTRODUCTION

Cleaning is the process of removing unwanted substances, such as dirt, infectious agents, and other impurities, from an object or environment. Cleaning occurs in many different contexts, and uses many different methods. Several occupations are devoted to cleaning.

Water is one of those natural resources, which is essential to each and every human being for many purposes, especially for drinking. We already know that earth is composed of water (three-fourth of the earth), but the entire three fourth isn't fresh water. Therefore, it is our duty to save water, keep the fresh water as much fresh as possible, and also to keep it free from water pollutants. The water that's pumped to our home is undoubtedly clean, but is the place where it gets stored clean as well? Yes, we are talking about the overhead water tanks. The health of your water largely depends on how clean your water tank is. Hence, cleaning overhead water tank is very necessary.

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 can eventually clog pipes. It is not hygiene which results damages the skin and it will effects on the health. Hence water tank cleaning is very important. Manual Cleaning water tank method is the traditional method of cleaning the water tank where a labour would get into tank and scrub the wall. 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. Tank cleaning is extremely hazardous activity. When working in confined space personnel are exposed to a number of hazards that in some cases have led to injury or even death. There are various definition of a 'confined space' through are consistently applied. "a place which does not have benefit of natural ventilation" and, "a place which difficult to enter therefore present hindrance to rapid escape in case of an emergency."

Cleaning overhead water tank on your own may be difficult because you need different types of tools, equipment and most importantly the time. But overhead water tank cleaning is important too and it must be cleaned at least once or twice a year. A Dirty overhead tank can be terrible because it will accumulate dirt that can easily dissolve in the water contained in it. Frequency of overhead water tank cleaning completely depends on the quality of the water being supplied in your area. If you are supplied with hard water or water containing solvents, then you need to clean your tank more often, at least more than once or twice a year. And to ensure better and effective cleaning you can hire professional water tank cleaners, because they have trained employees and proper equipment to clean overhead water tank.

A. Reasons for Cleaning Water Tanks

If you need to know some more important reasons to clean your water tank, then here are the five main reasons why cleaning your water tank is necessary:

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1) *Waterborne Internal Diseases:* If you keep your water tanks uncleaned for years, there are high chances that the water will get contaminated by many bacteria or virus. And if your tank water gets contaminated by harmful bacteria and virus, then there is a high chance for you to get sick along with your family. Internal water-borne diseases such as diarrhoea, typhoid and cholera are the most common type of diseases in India, that's caused by contaminated water. Usually, this happens in the case of drinking contaminated water from outside; but still, if your water tank remains untidy then these diseases can hit you through your overhead tank. Sometimes, malaria is also caused through water; therefore, keep the lid of your tank shut, so that mosquitoes can't breed there. This is the very first reason why cleaning overhead water tank once or twice a year make sense.
2) *Skin Diseases:* Why just internal diseases, contaminated water can also cause skin diseases. It is obvious that you wouldn't be using your tank water just for drinking right? You will bathe with it and also wash your clothes and utensils. Therefore, while you keep in touch with such contaminated water, you can definitely be attacked by some skin diseases. You must be knowing that hard water ruins your hair, right? Similarly, if your water contaminated by some toxic matter or some germs, don't you think it will harm your skin? Of course, it will! Don't think just ground water can cause skin diseases, an uncleaned tank may also result in contamination of water. But you could easily avoid such skin diseases by cleaning overhead water tank every 6 months or so
3) *Foul Odor:* If you water is uncleaned for ages, then it is obvious that it is going to smell as foul as drain water. This is the result of residues and sediments that is mixed in your drinking water. Sometimes foul odor in the water may not be harmful to your health, but you may not be able to drink it because of its foul smell.
4) *Bad Taste:* Usually, it is the iron content in the water that gives you a metallic taste, and you would also see the colour is slightly rusty or reddish. But, if you taste something completely different than the metallic taste then this could also be the result of sediments mixed with the tank water. Therefore, cleaning your water tank is necessary. And in any way, you cannot drink water that tastes bad
5) *Different Colour:* If you find your water to be rusty in colour and is staining your glass as well, then don't worry it's a case of iron content in water, that isn't harmful at all, in fact, it improves oxygen circulation in blood. But if you find some tiny sediment dissolved in water, or water that is foul collared then you might need to stop using it immediately and test it, and then take essential steps. If your tank is dirty, it can dissolve few particles; but if the water colour is extremely different, the water cleaning is necessary

II. PROBLEM STATEMENT

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

III. LITERATURE REVIEW

A. shubham srivastav "design and development of cylindrical water tank cleaner", january 2016. In this work they design mechanical system consists of two main mechanisms which are gear mechanism and reciprocating four bar linkage mechanism. The gear used is worm gear which is used to reciprocate whole mechanical system up and down according to the height of cylindrical tank. Four-bar attach to the main shaft and its other end is attach to pvc brushes. Four bar linkage is designed in such a way that it adjust according to inside diameter of the tank. When the a.c motor is switch on the main shaft rotate in turn the linkage rotates and with the help of brushes, the wall and bottom of tanks gets cleaned. He conclude that overhead water tanks cleaning equipment's was conceived and developed. This equipment was found to be effective in cleaning cylindrical overhead tanks. During cleaning the rotating brush needs to move up and down manually for complete cleaning with the help of rotating handle of worm gear. The cleaning is carried out by rotating brushes at constant speed (120rpm).

B. Shelke prasad k. "automatic water tank cleaning machine" , feb 2017.in this design a 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.

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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. He concludes that the water tank cleaner was used to clean the water tanks by using rotating brushes. This method was more effective and safe than the conventional methods. This method is capable to clean water tanks within less time and human efforts.

C. S. Abhishekhet "design and fabrication of automatic system overhead tank cleaning" 4, april 2017.in this work present a concept of 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. He concludes that 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.

D. Ms.smitagourkhedeet, "design & fabrication of drain cleaning machine" in this work the construction of drain cleaning mechanism is very simple; the equipments required for the machine are less. It mainly consists of electric motor, bearing, belt and pulleys, and other small materials like angular bar, etc. Using this equipments the garbage is cleared from the drains which somewhat cleans the water. The main purpose of the machine is to clean the garbage from chocked drains and increase the flow of drain water from flowing through them. In our drain cleaning mechanism two electric motors are used, one electric motor which is used to rotate the pulley with the help of belt. The motor is used for uplifting the garbage from drain through a plate. An electric motor is an electrical machine that converts electrical energy into mechanical energy.

*E.*Pramod b jachaket "computerized underwater robot to clean water tank" 4, 2016.cleaning of storage water tanks is a tedious job. Entire work needs to be done manually, and when manual work is considered, it is a risky task. Considering height of water tanks the shortage of oxygen can be a major issue. Hence the need for use of underwater robotic systems has become more apparent. They are developing a system in which user will remotely navigate the robot the way he wants as well as control certain operations like cleaning, brushing, sucking etc. This paper surveys a state of art for underwater robotic technologies. This project aims to provide key reference for future development in automated underwater cleaning. Hence we are implementing a new idea for wireless robot control system which will clean water tank efficiently without any human intervention in addition to that it will also save manual work, avoid accidents. This automated task is efficient to brush up impure water or bacteria at the core of water tank and suck the impure water for proper reuse or disposal

F. Ahmad 'athifmohdfaudzi "clean water supply is important in ensuring good health of people ".. Water supply is distributed from water storage tanks. Sediment that accumulates over time in water storage tanks will deteriorate the water quality used by consumers. Water storage tanks are required to be cleaned once in every three years by water utility operators or tank cleaning service providers. Water supply disruption can be prevented and cleaning process will be more efficient and cost effective. An rov is built to operate underwater and vacuum out sediments from water tank. Rovs development has been an on-going research and development area. Several university students, researchers and even companies are constantly improving current rovs system that can be suitable to use in various tank-cleaning applications. Rov is able to suck out small amount of sediment from water tank with tank depth of 1 m. Lastly; future work on testing with bigger and thicker amount of sediment in real water tank can be done to further validate the rov cleaning effectiveness.

G. Dhiraj m. Bankar, "design and fabrication of floor cleaning machine" 4, issue: 3.mar 2017. In recent years, floor cleaning and fabrication of manually operated floor cleaning machine. The conventional floor cleaning and machines is most widel used in airport platforms, railway platforms, hospitals, bus stands, malls and in many other commercial places. These devices need an electrical energy for its operation not user friendly.

In india, especially in summer, there is power crisis and most of the floor cleaning machine is not used effectively due to this problem, particularly in bus stands. Hence it is a need to develop low cost, user friendly floor cleaning machine. In this project, an effort has been made to develop a manually operated floor cleaning machine so that it can be an alternative for conventional floor cleaning analysis of the floor cleaning machine was done using suitable commercially available software. The conventionally used materials were, considered for then components of floor cleaning machine. Manually operated floor cleaning machine is an alternative for an automated floor cleaning machine during power crisis.

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ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

IV. COSTRUCTION AND WORKING

This mechanical system consists of motor, shaft, bearing, chain, sprocket, handle, brush, square pipe. An open chain is welded on the square pipe which vertical. Low speed high torque wiper motor is attached at one end of square pipe. Square pipe is placed in between stand. The sprocket which is misalignment with chain is attached at one end of the shaft with the help of key. Two pedestal bearing are used for supporting the rotating shaft. The bearing is attached on stand at same distance with nut and bolt. Handle are attached at other end of the shaft. The stand is placed on the tank. When handle is rotating by hand the shaft and sprocket are rotating. The sprocket is misalignment with the chain which is welded on the square pipe. The rotating motion of the sprocket is converted into up and down motion of square pipe. The motor attached also up and down. Required size brush is attached each other which is attached to the motor shaft. Rotary motion of brush is getting through motor and up and motion of the brush is through sprocket.

The tank which we want to clear has a capacity of 500 litters. First water in the tank is removing by the outlet pipe. Tank wall and bottom is wetted by same water and detergent mixture. Keep the machine in such way that the brush is in tank and stand torched on the tank manhole. Check the stand place properly or not on the tank. Then turn on the motor button motor start rotating at low speed and high torque and brush also rotating. When the brush rotates, the cleaning process will start. The bottom is cleaning through horizontal brush and wall cleaning is through side brush. Sprocket spindle is rotated by hand with the help of handle which is attached at the other end. Rotation of sprocket engages with the chain. The rotary motion of the sprocket is converted to linear motion due to rotation of sprocket forward reverse the cause linear motion of chain and motor is up and down. For side wall cleaning the up and down motion of brush and rotary motion of the brush is necessary. Proper cleaning is done when the handle rotates forward and reverses and rotary brush up and down.

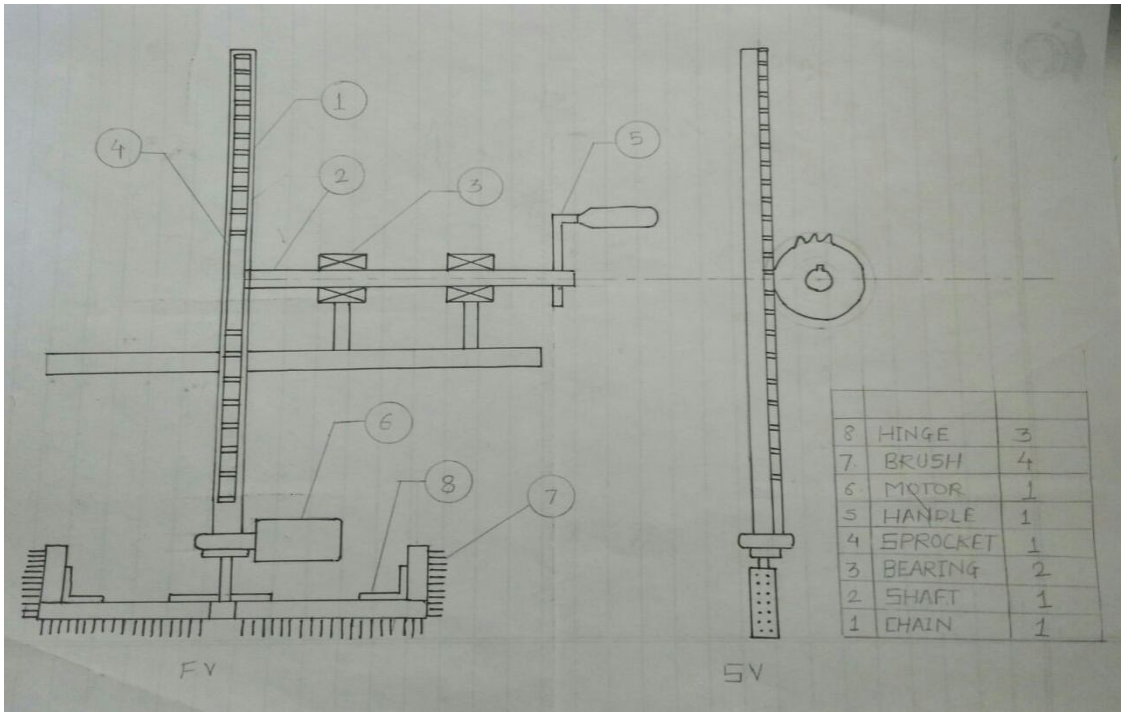


Fig.1 Water Tank Cleaning Machine

V. CONCLUSION

This equipment was found to be effective in cleaning cylindrical water tanks. During cleaning the rotating brush needs to move up and down manually for complete cleaning with the help of rotating brush'. This method was more effective and safe than the conventional methods. This method is capable to clean water tanks within less time and human efforts. By using that water tank cleaning machine we can reduce the time consumption for water tank cleaning.

That water tank cleaning machine is easy to operate as compare to manual cleaning. The weight of that machine is low and as compare to manual cleaning cost for cleaning is low. The main outcome of that machine is reduced the time consumption for the process and it gives the quality result.

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Volume 6 Issue V, May 2018- Available at www.ijraset.com

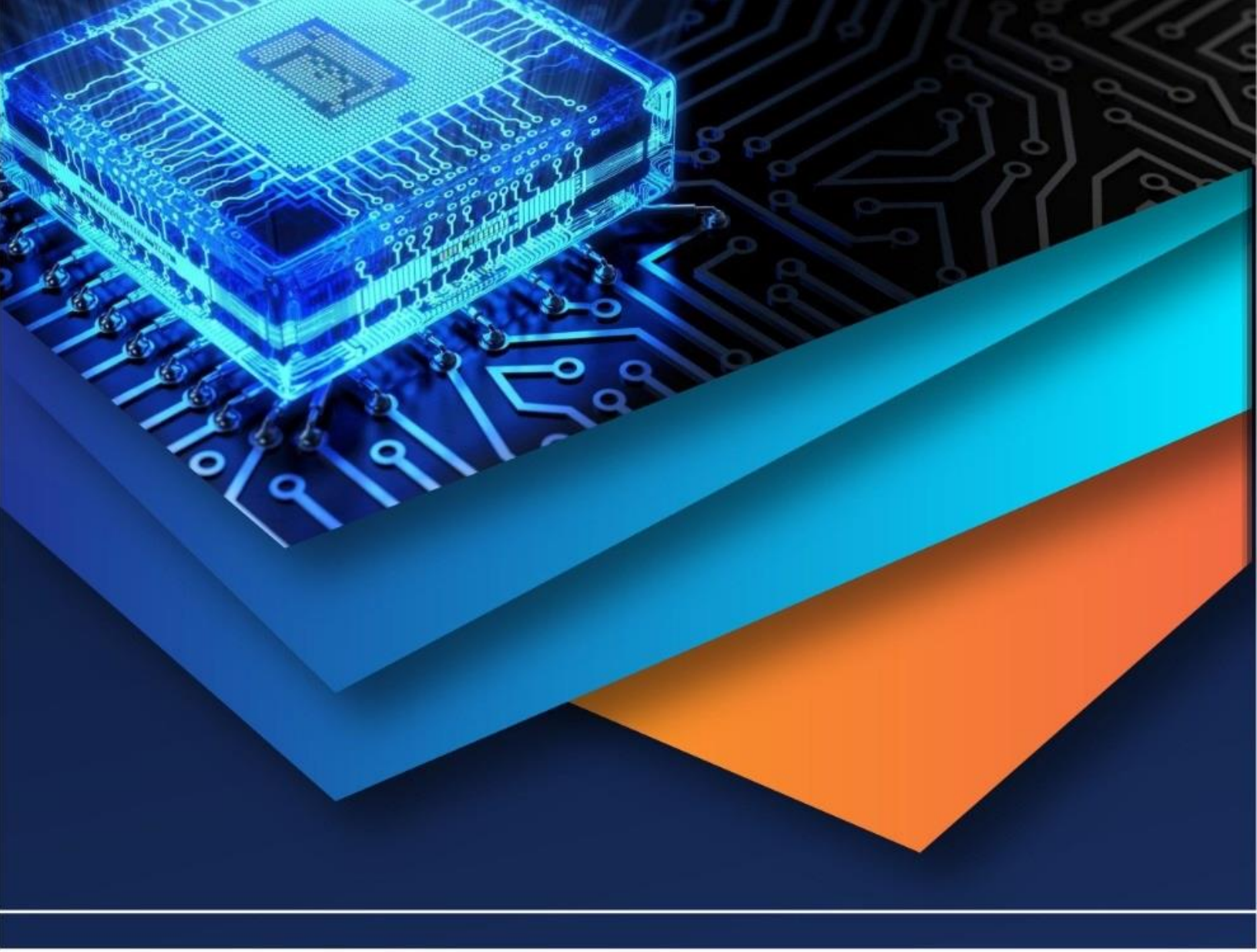
VI. ACKNOWLEDGEMENT

We wish to express our gratitude to all those who provided help and cooperation in various ways at the different stages for this research paper. Also, we would like to express our sincere appreciation to principal of Loknete Gopinathji Munde Institute of Engineering Education & Research Prof. T. H. Sutar, Head of Mechanical Department Prof. R. R. Chakule, collage classmates Mr.Sachin A.Khangal, Yogesh K. Chaudhari, Nitesh B. Patil, Nisar S. Shaikh

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