Development & Fabrication of Water Tank Cleaning Machine

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***Abstract*—: The goal of this project is to develop a mechanical device for cleaning cylindrical domestic water tanks. As we know that earth is made of water (three-fourth of the earth), but the whole three fourth is not fresh water. In this way, it is our obligation to spare water, keep the new water as fresh as might be expected. This project's objective is to develop a mechanical system for cleaning domestic water tanks. The mechanical system includes the brushes with spiral bevel gear, shaft arms. With help of spiral bevel gear we rotate the shaft at prescribed speed and brushes mounted on the arm start scrubbing the tanks inner wall with high torque. The reason for the project is to provide healthy and fresh water to users & keep away chemical impact on the health of someone who entering the tank for cleaning. To overcome this we have developed with help of some mechanism manually operated water tank cleaning machine.**

***Index Terms*— Arms, Brush, Gear, Scrub, Torque etc.**

I.INTRODUCTION

According to the recent research, there is no feasible solution available for water tank cleaning; this is due to irregular shape and variable heights of the tank placements. Using the result of various surveys, an attempt was made to create an manually operated water tank cleaning machine which is portable in use.

Everyday water store in the tank is used for domestic and industrial purpose. The vessel used to store water for various purposes can be made up of plastic fiber glasses, concrete or stone. Over the period of time residues sludge and scale deposition gets formed on the inner walls and floor of the tank. The sediments contaminate the water make it unfit to use. Bacterial growth in water can cause infection and can spread diseases.

Hence, we have made an attempt to replace the motor with the spiral bevel gear to eliminate electric consumption and handle attached to the bevel gear so we can easily operate by manually.

II. LITERATURE 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 consistsof 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 alsohighlighted. Finally, the findings are summarized related to the studied and analyzed research papers. Section concludes with the motivation behind identified problem.

Davis,—J. And Lambert, R., [2002] states that there are three conventional steps to disinfect a water tank. Cleaning the tank keeps the tank empty. Open the valve / tap socket and remove any remaining liquid. Clean all surfaces at the inside. Using a combination of detergent and water to purify all the tank's internal surfaces. Chlorine testing refill the tank with clean water and allow for 30 minutes of standing.[1]

Pramod B Jachaket "Computerized robot to clean water tank underwater" [2016].Cleaning up water tanks for storage is a tedious job. Entire work needs to be done manually, and this is a risky task when manual work is considered. Considering theheight of water tanks, oxygen shortage can be a big problem. Therefore the need for the use of robotic systems underwater has become more apparent. They create a

program in which the user navigates the robot remotely as he wants, as well as monitors other operations such as washing, brushing, sucking, etc.[2]
Shubham Srivastav "Cleaner CylindricalWater Tank Design and Production," January [2016]. They build mechanical system in this work consists of two main mechanisms which are gear mechanism and reciprocate four bar connection mechanism.[3]
Guha, A., Ronald, M.Barron, and Balachandar, R., [2011] "Process of water jet cleaning experimental and numerical analysis. This paper investigated the water jet cleaning process in experimental, numerical and theoretical terms. In such cleaning operations very high-speed water jets (80-200 m / s) are typically used.[4]
Ms. Smitagourkhedeet, "Design and manufacture of drain cleaning system" Building drain cleaning mechanism is very simple in this work, the equipment needed for the system is less. It consists primarily of electric motor, bearings, belt and pulleys, and other small materials such as angular bar etc. The garbage is cleaned from the drains using this equipment, which cleans the garbage somewhat.[5]
Ahmad stated that the provision of clean water is critical for people's health. Water supply is distributed through tanks for water storage. Sediment that accumulates in water storage tanks over time will deteriorate the quality of water used by the consumers. Water storage tanks are required by water utilities operators or tank cleaning service providers to clean once in every three years.[6]
Thonge Suraj , Shelke Prasad, Wakte Vaibhav ,Thonge Sharad ,Prof. Shinde ,(2017) A mechanical system which clean the tank mechanically using brush, rack and pinion , barlinkage 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.[7]
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 waterpump to force water. Powerful technology to clean Big water tank more efficient and in very less time.[8]
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 the tank.[9]
W. S. N. Trimmer and K. J.Gabriel (1987) Design considerations for a practical electrostatic micro-motor A high torque less speedmotor of very small in size.[10]

III. DESIGN AND CALCULATION

Calculation: Here we have calculated the power, force and torque of the bevel gear.
Torque - we have considered the torque of 25 NM as per persons initial effort capacity.
T = 25Nm, N = 36Rpm, R = 0.075M
POWER
Power = $2\pi NT/60$
Power = 2π (36) *25/60
Power = 94Watt.

FORCE
T = F * R
25 = F * 0.075
F = 25/0.075
F = 333.4 N

Specification of bevel gear
Horizontal bevel gear has 29 teeth and vertical bevel gear has 15 teeth.
T1 = No of teeth on horizontal bevel gear
T2 = No of teeth on vertical bevel gear
N1 = Rpm of horizontal spiral bevel gear
N2 = Rpm of vertical spiral bevel gear
The gear teeth ratio is
N1 = 36Rpm T1 = 29 T2 = 15 calculate N2
N1/N2 = T2/T1
36/N2 = 15/29
N2 = 36 * 29/15
N2 = 70Rpm.
The catia V-5 R-2 programme was used to create the project design. It is displayed a cleaning mechanism for a cylindrical water tank. Spiral bevel gear drives will be used to control the entire device. The spiral bevel gear drives allow the slider to stretch both horizontally and vertically, and the arms can move in both directions. any size of water tank the machine was designed to accommodate up to 300 liter water tank to 1500 liters water tank. The extending shaft consist of a rotating brush are mounted on it. The spiral bevel gear is fitted on square frame. One cleaning brush attached at bottom. Hence we can completely clean the tank through this process.

IV. WORKING PRINCIPLE

The power is drawn from the handle via a spiral bevel gear, which is manipulated by hand, and the gear powers the vertical shaft. The rotating action of the bevel gear is communicated to the shaft, then to the arms and brushes, which produce rotating motion clean the inner wall of the water tank. The entire system is inserted into the tank in a retracted configuration, with the arms adjusted to the tank's various sizes. The arms are adjusted to the diameter of the tank, such that the brush at the end of the shaft reaches the tank's bottom. . Because of nut and screw mechanism shaft can go up and down according to the tank requirements.[12]

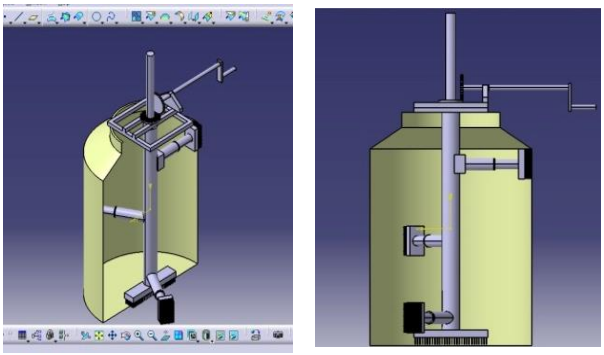

Fig. 2D and 3D figure of water tank cleaning machine.

V FABRICATION

At the initial stage of a fabrication process the frame structure of the machine as we made using square hollow pipe grade 12 of the mild steel material. Mild steel has been used considering its ductility and hardness. The long mild steel pipe were cut into desire dimension after that the pipes were welded together using electric arc welding after the completion of welding we got the frame area of 635 * 635 mm. sq.

The two hollow square pipes of size 241mm are welded on the square frame and circular plate is placed between the center of square pipes. Bearing is welded to the flat circular plate and the spiral bevel gear has mounted on bearing and the spline shaft of 300mm inserted inside the bearing and bevel gear and the 600mm hollow circular pipe are fitted with the help of nut and bolt arrangement to the lower side of spline shaft. The arms are attached to the vertical hollow circular pipe and brushes are attached to the arms.

The hollow circular pipe are welded to the one and other end are locked with the roller bearing are fitted the screw mechanism.

V. SELECTION OF COMPONENTS

Sr. No	Components	Quantity
1	WATER TANK	1
2	HOLLOW SQUARE PIPE (MS)	6
3	HOLLOW CIRCULAER PIPE (MS)	6
4	NUT AND BOLT	12
5	SPIRAL BEVEL GEAR	2
6	SPLINE SHAFT	1
7	HANDLE	1
8	ROLLER BEARING	4
9	BRUSH	3
10	SLIDER AND LINKAGE	1

VI. RESULTS

The testing of the project has been successfully carried out with help of mechanism what we have attached. We have designed the system considering economic factor and we have replaced the motor with spiral bevel gear. We are able to operate spiral bevel gear at 70RPM manually. We have cleaned the water tank without electricity. After cleaning the side and bottom of the tank the drain water supply is used for final washing of the tank.

VII CONCLUSION

The designed tank cleaner cleans the tank walls using a spinning brush. This new system is more efficient and secure than the old one. The mechanism used to move components for cleaning purposes is basic in design and straightforward to repair if it fails. The use of a manually operated water tank cleaning machine prevents humans from suffocating while inhaling harmful agents throughout the cleaning procedure. The machine has been thoroughly tested and rebuilt in order to fulfill modern tank cleaning procedure standards. As a result, our project's design is capable of minimizing both human work and time spent cleaning the tank.

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[12] Fabrication of Water Tank Cleaning Machine Mr. Shubham Samrit1, Mr.Divyarajsingh Mandale2 ,Mr. Ankit Rokade3, Mr.Paresh Choudhary4, Mr.Faisal Khan5, Mr.Abhijeet Kongre6, Mr.Harshal dalvi7, Mr Saurabh Zade8 Prof. M.S.Giripunje For cleaning the tank we need one worker which take more time as well as water.