

Review on Modeling of Mechanism for Installation and Lifting of Bore Well Pipe and Submersible Pump

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ABSTRACT

Bore well is major water source in ruler India for domestic as well as agriculture field. Installation and lifting of bore well pipe and motor is very tedious and time consuming job and required large number of labour to carry out process. So it is need to design and develop a suitable small mechanism to carry out installation and lifting process at low operating cost. In this paper modeling of such mechanism and its different parts is discussed. This mechanism is very simple and can be operated by single man with very low cost of operation.

Keyword: - Bore well, installation and lifting, mechanism, modeling.

1. Introduction

Now a day's Bore well is the very popular and major water source in India for domestic as well as agriculture fields. Highly cost machines are used to drill the bore wells. In India the size of bore well varies from 2 to 5 inches. But after the bore well drilling we required no. of components to lift the water. The components required may be bore well casing pipe, submergible water pump, water lifting pipes, electric cables, starter and many more. One of these component i.e. Bore well motor pump has a great importance and its installation in the bore well after drilling is a major task. While installing the bore well pump motor some major steps are need to be follow. Specially designed machines and mechanisms are required for the installation. More number of manpower is required to carry out the process. Now a day's number of labor required is reduced by automation of some of the activities that are involved. Due to the automation the operating cost of these big machines is high with great initial investment after some successive working days of bore well water pump, its maintenance should be done for its proper working

During the maintenance we have to again lift that motor, necessary action is to be carried out and again we have to install that successfully. These both procedure installation as well as lifting of bore well motor pump is very time consuming and large number of labours are to carry out process. There are various machines and mechanisms are available to carry out these process. But the major problem is that there operating cost is high and also in the restricted space they cannot be installed or unable to work due to his large size. So that the total integrated information and steps to be followed during Bore well installation and lifting is to be focused. Chain pulley mechanism is used to carry out this process in the ancient days. This is traditional method and very time consuming. This chain pulley mechanism also required number of labours to carry out the process. After some time there is a innovation took place of hydraulic and other machines which access in installation and lifting process. The major drawback of these machines is higher of operating cost, its huge structure and required high skilled labours to operate. So today's need is to design and develop a suitable small mechanism to carry out both installation and lifting process at low operating cost.

1.1 Relevance:

As we know we have to install a submergible motor pump to lift the water after bore well drilling. One by one water lifting pipes also have to be lower in the bore well drill. There are some steps need to be followed while installation of water pumps for its smooth and safe working. The procedure in the installation of bore well is one of the major tasks in the bore well water lifting mechanism. There are various machines and mechanism are available for installation. But here we are describing the detailed steps to be carried out in the chain pulley mechanism used in ancient days. This mechanism is very less costly but more time is required to carry out the whole process.

The pulling of chain continuously is monotonous task creates fatigue and also the workers health problem. After the long duration of service labour faces the pain in backbone. One of the important tasks in the installation process is to match the centre of bore well. All this problem can be solve by using the advanced technology but its drawback is its high operating cost. There are following major steps involved in the installation procedure that are shown by the block diagram. These all steps are carried out during the installation procedure with the help of chain pulley mechanism. One or more steps may be added in this during the installation process is carried out with the help of other machines and mechanisms.

1.2 Available Mechanism and Machines

A. Chain Pulley Block Mechanism:

This method is very traditional and ancient of installation and lifting bore well motor pump. Fig.1 shows chain pulley mechanism. The operating, cost of this is too low and it totally manually operated. All the activities during the installation and lifting process of bore well motor pump with this mechanism is carried out manually with mankind. There is no automation in the whole process. The major drawback of this mechanism is it requires large time to installing and lifting operation. Centre adjustment with bore drill is also the major and important task in this process. The table shows the chain to be pulled to lift a specific length of pipe. From the reading we come to know that number of times we have to pull the chain continuously to lift the pipe above. The ratio of pipes to lifted and chain to be pulled so less. It means for smaller lifting of pipe we have to pull the chain in a huge manner. In this process the large amount of rotation of chain pulley block is required.



Fig.1 Chain Pulley Block Mechanism

This mechanism is widely used in the bore well motor pump installation and lifting operation. This mechanism contain a tripod i.e. three metal pipes are kept inclined in angle and their top ends are bolted commonly. The chain block pulley is hanged with tripod and other end is used to lift the pipes and pump in bore well. But in this system the chain of pulley block is pulled manually and this works creates fatigue and health problem to worker. In this mechanism the continuous pulling of chain is monotonous task and boring to the workers. This method is widely used in the rural areas due to its low initial cost and operating cost. Most of the bore well motor installation

and lifting is carried out with chain pulley block mechanism. The major drawback in this process is time consuming, requires more number of labours and it also required the large area for installation of set up.

B. Mechanically Actuated Motor Lifting Machine:

The installation and lifting process of bore well motor pump and pipes can be carried out with several machines that are available. The mechanisms and the power source for the machine may be different but the process to be followed during installation and lifting operation remains same. The power source may be hydraulic operated, mechanically actuating or pneumatically powered machines etc.



Fig.2 Mechanically Actuated Motor Lifting Machine

Fig. 2 shows the whole structure of mechanically actuated bore well pipes and motor lifting machine. In this process the motor is lifted by gear mechanism as shown. Some of the activities are automated by using electric motors. The whole mechanism is mounted on tempo or trucks for the operation. Its initial investment and operating cost of this machine is too high. It also required somewhat high skilled worker for carry out operation successfully. These machines are not useful in restricted space available like in the urban areas, large space is required for the bore set up. So due to its huge structure it cannot approach to that place. The cost of machine is 1.5 to 2.75 lacks without vehicle on which it need to be mount. If we add the cost of vehicle then this type of machine is not affordable to everyone as compare to their output

C. Hydraulic Submergible Motor Lifting Machine:

This is the modern technique available for installation and lifting of motor with the help of hydraulic power. Fig. 3 shows Hydraulic Submergible Motor Lifting Machine, In this machine the whole hydraulic mechanism is mounted on a vehicle. Now days in an urban areas bore well submersible pump-motors are lifted by using Hydraulic operated lifter mechanism. This system is also fastest method of installing and uninstalling the bore well.



Fig. 3 Mechanically Actuated Vehicles Mounted Motor Lifting Machine^[5]

Now day in an urban areas bore well submersible pump-motors are lifted by using Hydraulic operated lifter mechanism. This system is also fastest method of installing and uninstalling the bore well submersible pump-motor and pipes. But initial cost and running cost of this machine is very high. At restricted space areas this machine cannot be installed because of their bigger size. This machine has large initial cost about 12 to 15 lacks, which is difficult to invest as compare to output of the machine. This machine consists of hydraulic actuators mounted on lorry, and powered by engine power of the vehicle. The hydraulic pump is powered by engine and pressurized hydraulic oil is accumulating in the pressure tank. This stored pressurized hydraulic oil is directed by direction control valve, for the particular application. Double acting type actuators are used which enable to movement of piston in either direction. The pump may be a gear pump or a reciprocating pump. Due to such pump and continuous high oil pressure allow to leakages and power loss occurs during the operation. In the urban areas there is a very high population due to high population land is an important factor. During drilling the bore well it may be inside the building or inside compound walls at such places this hydraulic lifter mechanism cannot be installed.

2. Literature Review

“An Overview of Bore Well Motor Pump Installation and Lifting Machine” by Mayur N. Adhude, et. al. ^[8]

This paper discuss the innovations that took place in the Bore well motor pump installation and lifting process from the earliest time and also includes the future scope. The paper also shows the various machines and mechanisms available for Bore well motor pump installation and lifting with its advantages and limitation. Paper also provides the detail information and steps to be followed while installation and lifting process.

“Automation of Bore Well Pipe Lifter and Transportation” by Mr. Gajanan Patil, et. al. ^[2]

An innovative concept proposed in this paper is to handle bore well rescue operation. Children often falls down in bore hole which is left uncovered and get trapped. It is difficult as well as risky to rescue trapped child from bore hole. Hence we propose a system of designing robots for the rescue of a child in a bore hole. We aid the child by continuous monitoring and supply of necessary items to survive using technical methods. Bores which yielded water and subsequently got depleted are left uncovered and small children without noticing get trapped inside. To aid in such a life threatening situation we hereby propose ‘bore well pipe lifter’

“Design and Fabrication of Bore Well Rescue Robot” by Mr. Shivam Bajpai, et. al. ^[7]

In the past few years, there have been several accidents of children falling into abandoned bore wells in India. Abandoned bore wells that have turned into death pits for children. The problem is all over India. Rescue teams spend more time and sometimes days in futile attempts to save these little kids. A lot of money is also spent in this operation. In most cases they are unable to save the kids. Such cases have happened umpteen times in the past, and every time either the government or the bureaucracy is blamed. The rescue process to save the child from bore well is a time consuming and complicated process now. The rescue team tries to approach the victim from a parallel well that take about 20-60 hours to dig. This complicated process makes 70% of the rescue operations fail. The design of handling system is made in such a way that the child never gets hurt and the robot itself provides some pre-treatment to make the baby survive till the end of operation. Our Robot design constitutes a best Ergonomic Design and performs safest rescue operation.

“Bore Well Motor Pump Installation and Lifting Machine” by Dr. Sharad S. Chaudhari et. al. ^[1]

An Apparatus for pulling a well pipe down hole pump from a hole and it constructed of relatively lightweight material to enable the apparatus to be easily moved to well site by the provision of a frame structured supported by relatively large wheels and a handle structure which enables the apparatus to be pushed, pulled or lifted for movement to an orientation in relation well site and well casing with the appears providing a solid connection with The well casing for safe and efficient operation. The apparatus includes appose belt structures for engaging opposite surfaces of well pipe with the belt pipe driven by motor and to worm gear speed reducers having outputs that turn drive axles in opposite directions which are drivingly connected to the belt and fork arms associated with the axles enable the adjustment of contact area of the belt with the well pipe or other equipment which may be encountered when pulling a pump from a well.

3. Modeling

3.1 Principle of Operation:-

Load pipe between the pressure roller and feed rollers. Adjust the contact pressure using pressure adjuster screw. Select the direction of rotation of motor depending upon the raising or lowering operation using two directional prime mover. Motor rotates the pinion which drives the gear. Then gear drives the roller shaft 1. The rotation of roller shaft 1 transferred to the roller shaft 2. The rotation is transferred via Gear drive/chain drive. Motion of the fed rollers will cause the pipe to move up or down simultaneously the pressure rollers will also rotate. Stop the motion of the motor when desired height of the pipe is reached.



Fig.4 Principle of Operation

3.2 Construction:-

When using Gear type drive to Roller, it consists of following component-

1. Roller with rubber pad is used to guide the pipe upward or downward. The rubber pad is used to reducing chances of damaging to pipe.
2. Pressure Adjuster is used to adjust the contact pressure on the pipe by roller which is moved by the pressure applied by the adjusting screw.
3. Pinion and Gear drive are used to transfer the motion.
4. Motor is used to give initial torque.

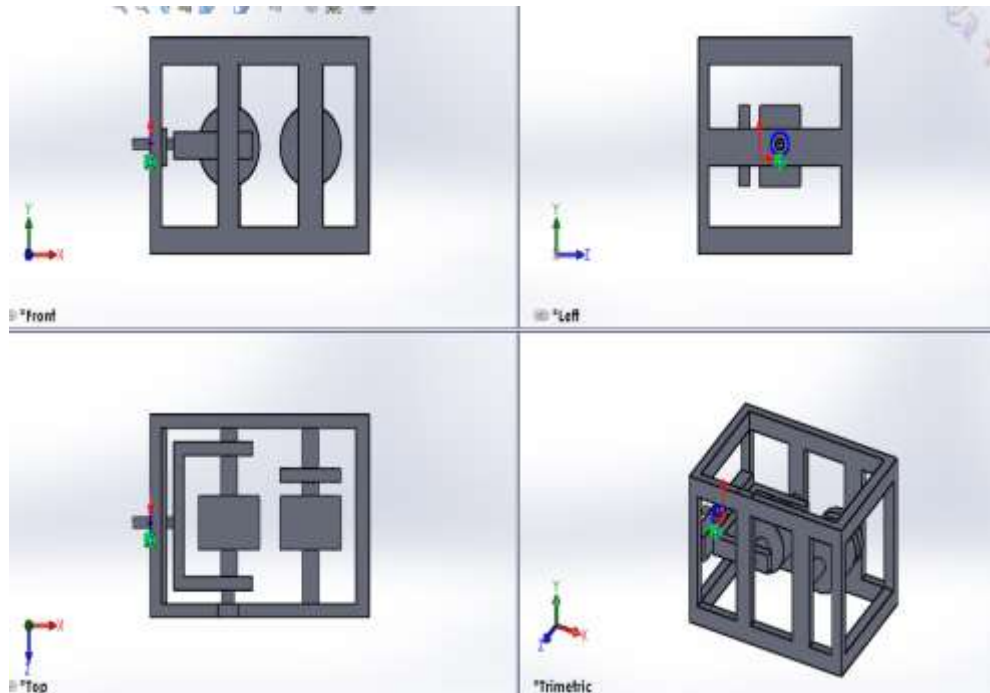


Fig.5. Mechanism Construction Diagrams

Start the motor which rotates the pinion. Then pinion drives the gear which drives the roller shaft 1. The rotation of roller shaft 1 is further transferred to the roller shaft 2 via Gear drive/chain drive. Motion of the fed rollers will cause the pipe to move up or down simultaneously the pressure rollers will also rotate. Stop motion of the motor when desired height of the pipe is reached.

All the fig.5 shown in above is drawn by using solid Work and CATIA Software, by team member. Which shows actual working of project it also shows the principle of operation? Fig shows the how project look after completing Work.

3.3 Working:-

When electric supply given to the motor the motor starts rotating. The motor shaft and worm shaft are connected due to this the worm also starts rotating. And further worm give motion to the worm wheel and worm wheel starts rotating. The power from worm wheel is further transferred to the pinion. And pinion and gears are connected to each other so gear also starts rotating. The power of gear is transferred to the fixed roller. The sprocket is attached to the fixed roller. The shaft 1 on which sprocket is mounted and shaft 2 on which fixed roller 2 is mounted are connected to each other by chain drive. In opposite side the adjusting rollers are placed which is adjusted by pressure adjusting screw.

The pipe is held between fixed rollers and adjusting rollers. The pressure on the pipe is adjusted by the pressure adjusting screw. When rollers starts rotating the pipe move upward and downward and the installation of bore well pipe and pump is done by this mechanism.

4. CONCLUSIONS

Automation in the installation and lifting procedure of bore well motor pump will improvement in time economics, i.e. Time reduction is required in the procedure of installation and lifting. Mechanism will cause in reduction in the labour required for the installation as well as lifting of bore well motor pump. It also avoids the monotonous working task like continuous pulling of chain to pull the bore well pipe.

5. REFERENCES

- [1]. Choure Bhagvanta, kale Ganesh, Dhanwate Prashant, Dhat Prashant, Ghatode Rajendra, "Review on Bore Well Pipe Lifting and Transportation Machine", IJARIE-ISSN(O)-2395-4396, Vol-4 Issue-2 2018.
- [2]. Mr. Gajanan Patil, Mr. Chetan Patil, Mr. Abhijit Lagar, "Automation of Bore Well Pipe Lifter and Transportation", International Journal of Advance Research in Science and Engineering (IJARSE), Vol. No. 6, Issue No. 04, April 2017.
- [3]. S.Gopinath, T. Devika, L. Manivannan, Dr. N. Suthanthira Vanitha "Rescue Child from Bore well using Embedded System" International Research Journal of Engineering and Technology (IRJET) Volume: 02, Issue: 03, June-2015.
- [4]. A. Ramees, P. Pratheesh, G. Ajeesh krishnan, Akhil Sudhakaran, Rony. B. Chandran "Effective and Efficient Robotic System in Human Rescue Operation and War Field" IJIIE-International Journal of Innovations & Implementations in Engineering Edition Volume 1, April 2015.
- [5]. RHR Products, owner's manual, pump traxwell pump puller operation and maintenance.
- [6]. R. Shah Vrunda, Chirag S Dalal, Rajeev Dubey "Automate Machine for Rescue Operation For Child" International Journal Of Research in Engineering and Technology (IJRET), Volume 04, Issue 02, Feb 2015.
- [7]. K. Mohankumar, D. Venkatesan "Design Of Multifingered Rescue Hand Robot with Tele operation" International Journal Of Innovative Research in Science(IJRSET), Engineering and Technology, Volume 4, Special Issue 6, May 2015.
- [8]. Mayur N. Adhude, Dr. Sharad S. Chaudhari IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 08, 2015 | ISSN (online): 2321-0613
- [9]. S. Prithviraj, S. Ravikumar, "Modeling, Analyzing and Fabrication of Lifting for Bore well Pipe", IJEDR | ISSN: 2321-9939,| Volume 2, Issue 1, 2014.
- [10]. Dr. C.N. Sakhale, D.M. Mate, Subhasis Saha, Tomar Dharmmpal, Pranjit Kar, Arindam Sarkar, "An Approach to Design of Child Saver Machine for Child Trapped in Borehole" , Volume 1, Issue 2, October-December, 2013, pp. 26-38, © IASTER 2013