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Design and Fabrication of Borewell Pipe Lifting Machine

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ABSTRACT: Lifting and lowering borewell pipes is a time-consuming, labor-intensive, and frequently dangerous procedure. In order to streamline operations, boost productivity, and guarantee worker safety, this project focuses on designing and building a borewell pipe lifting machine. With little human effort, the machine firmly grasps and raises borewell pipes using a mechanical or hydraulic lifting mechanism. To ensure seamless functioning, the design includes a strong frame, lifting arms, a grasping mechanism, and a power source (hydraulic, electric, or manual). Load capacity, mobility, ease of use, and durability to endure field conditions are important design factors. In order to handle a range of pipe sizes and materials without causing damage to the pipes, the lifting mechanism has been modified. Under various circumstances, the constructed prototype is evaluated for lifting effectiveness, stability, and use. The findings show that the equipment speeds up the installation and retrieval of borewell pipes, improves safety, and drastically lowers worker effort. The goal of this project is to give the borewell installation and maintenance sectors a cost-effective and effective solution.

KEYWORDS: Borewell, Pipe Lifting Machine, Hydraulic Lifter, Safety, Labour Reduction, Efficiency

I. INTRODUCTION

Groundwater from borewells is crucial for household, commercial, and agricultural uses. Borewell pipes eventually need to be maintained, replaced, or removed because of obstructions, corrosion, or broken pumps. Because it requires manual work and crude equipment, the conventional technique of raising borewell pipes is labor-intensive, physically taxing, and prone to mishaps. By offering an automated and effective way to lift and lower borewell pipes safely and easily, the Borewell Pipe Lifting Machine is made to address these issues. To guarantee seamless functioning with the least amount of human labor, the machine has a strong frame, a grasping mechanism, and a lifting system driven by hydraulic, mechanical, or electrical components. The main goal of this project is to design, build, and test a prototype in order to confirm its dependability, efficiency, and usefulness. This machine's successful installation will greatly enhance borewell maintenance, making it quicker, safer, and more cost-effective.

II. LITERATURE REVIEW

[1] Gangula, Y., Kumar, S., & Kumar, T. IoT based Borewell Monitoring and Child Rescue System using Multi Sensor Fusion. *International Conference on Sustainable Computing and Smart Systems (ICSCSS)* A considerable portion of India's more than 27 million borewell have dried up and are no longer in service. Borewell are deep, narrow wells that are used to draw groundwater. When this occurs, the iron cast and pipe are frequently removed, leaving an exposed hole to indicate that the well is no longer in service. The current approach, the parallel pit method, is time-consuming and ineffective; the National Disaster Response Force (NDRF) reports that over 40 children have died since 2009 after unintentionally falling into borewell, and that over 70% of rescue attempts have failed. The suggested design uses cloud-based apps, communication devices, and multi sensor fusion to track the borewell condition and notify authorities in the event of an emergency. The device uses a mix of sensors, including movement, pressure, and temperature sensors, to determine whether a youngster is in the borewell.

[2] Barbadekar, A. Design of Gripper for Borewell Rescue Operations. *International Journal for Research in Applied Science and Engineering Technology*. This study presents a borewell rescue robot that can save a youngster who is stuck inside a borewell. Tragic outcomes can result from borewell incidents, which are all too prevalent and include youngsters falling into exposed bore holes. In this study, we built a gripper that would facilitate tasks like securely holding a child and raising them without injuring them. It differs from other grippers in that it has four degrees of freedom. The gripper is designed by keeping various factors in mind like as holding capacity, flexibility. 32 teeth make up the bevel gear supporting gripper, which increases flexibility and dependability.

[3] Nithyaprakash, R., , S., Kumar, R, Kumar, S., Seenivasa, R., & Prasath, S., **Semi-Automatic Child Rescuing BOT in Deep Borewell**. E3S Web of Conferences. Rescue operations for individuals trapped in deep borewell provide a significant challenge that requires both human competence and cutting-edge robotic technology. The development of a ground-breaking machine-human rescue robot intended especially to handle crises in deep borewell is the main topic of this abstract. the complexity of deep borewell rescues, including the need for quick and precise action, time-sensitive circumstances, and technological difficulties. It highlights the shortcomings of traditional rescue methods and encourages the development of an adaptable robotic system that can cooperate with human rescuers. The proposed robot is constructed as a hybrid system that blends autonomous capabilities with human control. The borewell within is connected with specialized sensors, cameras, and communication tools to provide real-time data and visual feedback. Two cylindrical pipes that serve as a holding platform for children's hands are part of the structural frame of the borewell rescue robot. These pipes are secured vertically with the aid of a T-shaped square rod. One of the most important aspects of its operation is the presence of mechanical straps at the lower end of the pipes, which are operated by BLCD motors.

III. PROBLEM IDENTIFICATION

Traditional methods of raising and removing borewell pipes need human labor and simple equipment, which makes the procedure very inefficient, time-consuming, and physically demanding. Heavy pipe handling frequently presents challenges for workers, which can result in undue tiredness and other safety risks including slips, falls, or pipe breakage. Lack of a suitable lifting mechanism slows down borewell maintenance and repair operations and raises the danger of accidents. Furthermore, human handling methods frequently result in pipe damage like bending or breaking, which shortens the lifespan of borewell infrastructure and raises maintenance expenses. Deep borewell make the issue much worse since they make it more difficult to physically carry lengthy, heavy pipes, especially in rural or isolated locations with little access to sophisticated machinery. Although there are some mechanical options, small-scale farms, businesses, and local borewell operators sometimes find them to be costly, cumbersome, or difficult to use.

IV. PROBLEM RECTIFICATION

The Borewell Pipe Lifting Machine is a safe, effective, and automated solution to the problems that come with lifting borewell pipes by hand. To lessen human labor and avoid mishaps, the machine incorporates a sturdy and robust frame, a safe grasping mechanism, and a power-assisted lifting system (mechanical, electrical, or hydraulic). The risk of pipe bending, breaking, and worker injury is greatly reduced by using a controlled lifting mechanism. The equipment guarantees quicker and more effective operation, cutting down on the amount of time needed for borewell installation and maintenance. It is also made to be affordable and portable, which enables small-scale farmers, businesses, and borewell operators to use it even in isolated locations. This machine offers a dependable, long-lasting, and user-friendly solution through appropriate design, construction, and testing, enhancing the borewell pipe lifting procedure overall while guaranteeing safety, effectiveness, and cost.

V. LIST OF COMPONENTS

S.NO	NAME OF THE COMPONENTS	QUANTITY NO	MATERIALS
1	Frame	1	Mild Steel
2	AC Motor	1	Powdered metal
3	Sprocket	2	Steel
4	Scooter wheel	3	Alloy & Rubber
5	Wheel roller	4	Steel & Rubber
6	Roller chain	1	Alloy steel
7	Bearings	6	Stainless steel
8	Hydraulics jack	1	Alloy Steel

VI. DESIGN

6.1 MODEL



MODEL

6.2 DESIGN CALCULATION

This chapter will include the mechanical design calculations required for the Selection of Motor used in the project

Motor Voltage = 24V

Current = 10 Amp

RPM = 45 RPM

Motor Weight = 400 gm Torque = 20 Kg

cm Efficiency = 80%

No-Load current = 300mA (max) Stall current =
900mA (max)

6.3 CALCULATING WEIGHT OF MACHINE

Weight (approx.) = (1 x AC motor weight) +(1xchassisweight) +(6 x bearing)+(1 x chain drive)+(2 x sprocket)+(3 x scooter wheel)+(4 x wheel roller)+ (1 x hydraulics jack) = (1 x 400) + (1 x 7250) +(6 x 100)+(1 x 350)+(2 x 250)+(3x800)+(4 x 100) +(1 x 2400) = 14300 grams

VII. WORKING PRINCIPLE

By automating and streamlining the lifting and lowering of borewell pipes, the Borewell Pipe Lifting Machine minimizes human labor while maintaining safety. A sturdy lifting system, a regulated operating procedure, and a secure grasping mechanism are the three main components of the functioning concept. The gripping mechanism, which may consist of threaded locks, hydraulic jaws, or mechanical clamps, securely grips the pipe to avoid slippage while the machine is operating. The machine is first placed above the borewell. After the pipe is fastened, the lifting mechanism is turned on. It uses a hydraulic, mechanical, or manual system to apply force and elevate the pipe smoothly. A mechanical method may use winches, gears, or pulleys to gradually raise the pipe, whereas a hydraulic system uses cylinders to apply pressure. Long or numerous pipe segments may be removed safely and methodically because a locking mechanism makes sure that each portion is retained in place when the pipe is raised and then detached. The procedure is reversed when the machine is used for installation; the pipes are gently lowered and securely fastened into the borewell without causing any harm. By providing consistent control and minimizing jerks or abrupt movements, the machine helps avoid pipe bending, breaking, or Misalignment. To improve operating security, safety measures including load control valves, pressure regulators, and emergency stop capabilities may also be incorporated. This gadget greatly increases productivity, lowers the danger of workplace accidents, and speeds up borewell maintenance by doing away with the need for superfluous manual effort. Its affordability and mobility make it the perfect choice for companies, farmers, and borewell operators, guaranteeing dependable and trouble-free pipe handling operations.

VIII. APPLICATIONS

- **Borewell Maintenance and Repair:** For cleaning, repairing, or replacing borewell, this tool is used to raise and remove pipes.
- **Pump Removal and Installation:** Makes it simple to remove and replace submersible pumps in borewell.
- **Agricultural Borewell:** Agricultural borewell assist farmers in effectively managing and maintaining water delivery systems.
- **Industrial water supply system:** Industries that depend on deep borewell for a steady supply of water use industrial water supply systems.
- **Maintenance of Municipal Water Supplies:** Assists in the upkeep of public borewell water supplies in both urban and rural regions.
- **Construction Sites:** Used for projects involving the extraction or upkeep of deep borewell water.
- **Geological and Groundwater Surveying:** Helps survey teams and researchers remove equipment and pipelines from test borewell.
- **Irrigation Systems:** Assists in the setup and maintenance of irrigation systems that rely on borewell.

IX. FUTURE SCOPE

To improve its applicability across a range of sectors, the Borewell Pipe Lifting Machine's future scope includes developments in automation, efficiency, and sustainability. Enhancing accuracy and safety, real-time monitoring, remote operation, and data analysis may be made possible by integrating IoT and automated controls. In order to boost lifting capacity and streamline operations, future designs could use sophisticated hydraulic and pneumatic systems. Creating models that are fold able, lightweight, and portable will improve mobility and increase the machine's accessibility for small-scale and remote users. To further increase the machine's versatility, multifunctional features like pipe threading, cleaning, and cutting may be added. Models that run on electricity and solar power might be developed to promote sustainability by lowering dependency on fossil fuels and physical labor. Additionally, load balancing, automated pipe identification, and emergency alarms are examples of AI-based safety features that may lower hazards and increase operational efficiency. These developments will increase the Borewell Pipe Lifting Machine's intelligence, effectiveness, and environmental friendliness, broadening its use in municipal services, construction, industrial water management, and agricultural.

X. FINAL ASSEMBLY



SIDE VIEW



FRONT VIEW

XI. CONCLUSION

The Borewell Pipe Lifting Machine's design and construction offer a cost-effective, safe, and effective way to raise and lower borewell pipes. Compared to conventional techniques, the machine greatly decreases manual work, lowers safety concerns, and improves operating efficiency. It guarantees seamless and regulated pipe handling by combining a strong frame, a dependable grasping mechanism, and a mechanical or hydraulic lifting system. This machine's successful development and testing show how useful it is for managing water supplies, installing pumps, and maintaining borewell in

a variety of industries, including municipal services, industry, and agriculture. The machine may become more widely used and have more features with additional improvements in automation, portability, and power economy. All things considered, this project provides a long-lasting and creative way to enhance borewell maintenance procedures, making the procedure quicker, safer, and easier for users to access.

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