

# Design and Fabrication of Compact Erection Cutter for Bore Well Casing Pipes

R. Thirupathi<sup>1</sup>, S. Udayaprathap<sup>2</sup>, N. Shanmuganathan<sup>3</sup>, K. Sriram<sup>4</sup>, G. Saravanan<sup>5\*</sup>

<sup>1</sup>Assistant Professor, Dept. of Mechanical Engineering, Sri Eshwar College of Engineering, Coimbatore, India

<sup>2,3,4,5</sup>Student, Department of Mechanical Engineering, Sri Eshwar College of Engineering, Coimbatore, India

\*Corresponding author: saravanan.g.mech@sece.ac.in

**Abstract:** When bore well is concerned for domestic and agricultural use, proper installation is also considered which is an important factor. In some cases where the casing pipes bend inside the bore well while installation due to the presence of rocks, it becomes complicated for the erection of bore well motor and pump inside the bore well. In order to overcome this situation, an equipment is made for bore well casing cutting which is compact and easy to operate. Some innovative ideas and concepts are implemented on this research project to cut bore well casing pipes.

**Keywords:** Bore well, Hole saw cutter, PVC pipes, Electric cables, Economical uses, Domestic uses.

## 1. Introduction

The most common problem during the summer season is water scarcity, especially for satisfying your thirst, domestic & for constructional use. In some of the areas where corporation water cannot be given; bore wells are put and is filtered through aqua guards and water doctors. Bore wells are drilled at the earlier stage of construction of buildings to overcome the need for water scarcity. Motor and pump are erected inside the bore well through PVC pipes, cables, and ropes for the suction of water and is stored in the ground level water tanks for later use. The bore wells consists of many layers of sand such as the gravel sand, bolters sand, core sand, loam sand, dry sand, parting sand, mature & immature sand, etc.,

The bore well consists of layers of rock such as;

- Weathered rock at the early stage of drilling the bore well which consists of granules of sand and rock.
- Partly weathered rock which is in the intermediate stage of the formation of a rock.
- And finally, the bed rock after which the water has arrived and the bore well cannot be drilled since the rock is very harder to drilled and the cutter may get wear if it is further drilled.

## 2. Problem Identification

- Water is a vital source for all known forms of life, even though it provides no calories or organic nutrients.
- Water covers 71% of the Earth's surface, mostly in seas and oceans. A small portion of water occurs as ground water with a percentage constituent of (1.7%).

- It is our duty to safeguard ground water to the next generations.
- Bore wells act as the primary source of water in areas where no corporation water facilities are available.
- It is observed that in most of the newly drilled bore wells, there occurs a problem of bending of casing pipes while inserting them inside the bore well due to rocks, improper drilling of bore wells due to the wear and tear of the cutter used.

## 3. Objective

- The main objective of developing this compact device for removing the bent piece of the casing pipe inside the bore well.
- Open sites in which the construction of building works has not started; this defect can be overcome with the help of a master bore well lorry or bed bore well lorry.
- Whereas, in areas where buildings are constructed our device has a scope of recovering of bore wells.
- It can be used in areas where the drilling machine setup cannot be done due to less surface areas.
- It can be used in 4 & 1/2 inch bore well and 6 & 1/2 inch bore wells.
- The input current supply can be taken from normal AC switch bore well setup.
- The pipes which are used for installation of motor can be used for holding the device.

## 4. Literature Review

In this chapter, a review of previous research project that are related of this project will be discussed. This kind of surveys was held as one of the tools to have some ideas on how this project works. It is based on other achievement and also to formulate the advantage of proposed solution. This may help in problem solving skills and options required for design and develop of compact erection cutter for bore well casing pipes.

## 5. Mechanism

- First of all, the cutter is attached to the electric motor using standardized nuts and bolts of required size, and

is tightened to its maximum.

- The PVC pipe, which is installed to the motor inside the bore wells is used for connecting the erection cutter for deep erection of the device inside the bore wells.
- The three core electric cable is jointed with the cable attachment which comes out from the erection cutter for the supply of Alternating Current supply.
- When the point to be cleared is reached, the total length of the bore well is calculated and extra cable of required size is allotted for connecting the plug with the socket provided in the external side of the bore well.
- The three pin plug top is connected at the end side of the cable for supply of AC current.
- The rope which is attached at the top bowl of the pump inside the bore well is attached to the erection cutter for a safety purpose
- The erection cutter is then erected inside the bore well for deep cutting of the casing pipe which is bent inside the bore well.
- Proper and experienced workers in the field of bore well is used for operating the erection cutter.
- The pipes are threaded to each other one by one till the point of removing the casing pipe arrives.
- When the alternating power supply is turned on the cutter which is attached to the electric motor starts rotating and starts cutting the bent piece of the casing pipe.
- After the piece is cut the erection cutter is removed from the bore well and proper blushing of the bore well is done since the water has got contaminated after cutting the bent piece.

### 6. Material Selection

- Mixer motor is used for the links since it has a high capability of cutting materials. Mixer motors when compared to other electric motors has a high cutting torque and excellent speed. This means it has high strength. Mixer blade steels usually shatter or crack the rock particles.

### 7. Design Calculation

#### A. Formulas Used

- The power loss is calculated by using the formula:  
 $P = I \cdot I \cdot R$
- The power transmitted is calculated by using the formula:  
 $\text{POWER transmitted} = I \cdot V$
- The frequency for an electric motor is found out by using the formula:  
 $\text{Frequency} = \text{No. Poles} \times \text{Speed of Motor (RPM)} / 120$
- The speed or Rpm of an electric motor is found out by

using the formula:

$$\text{Speed (RPM)} = 120 \times \text{Frequency} / \text{No. of Poles (Winding)}$$

#### B. Assumptions made

- Frequency: 50Hz - 60Hz
- Rpm: 1200 rpm
- Depth of cut: Depending upon the depth of the bore well.

#### C. Calculated values

- Diameter of the cutter= 5inch

To convert into standardized millimetres:

$$\text{WKT; 1inch} = 25.4\text{mm}$$

Therefore, for a five-inch cutter;  $25.4 \times 5 = 127\text{mm}$

- Diameter of the casing pipe used=127mm

(Since the diameter of the cutter and the casing are same)

- Overall length of the casing pipe used =  $6\text{inch} = 6 \times 25.4 = 152.4\text{mm}$

### 8. Components

- Single phase electric motor
- UPVC FTA
- PVC pipe
- Electric cables
- Electric plug and sockets
- Casing pipe
- AC power supply

#### A. Single Phase Electric Motor

A copper winded single phase electric motor which has a high torque and good high speed is used to rotate the cutter. We preferred a mixer motor because it has a high torque when compared to other electric motors.



#### B. UPVC FTA

A FTA which is also abbreviated as Female threaded adaptor is used for linking the PVC pipes with the electric motor. The FTA is a hybrid coupling which consists of thread on one side and plain end on other side such as a coupling.



**C. PVC Pipe**

The PVC pipes are used here for holding the cutter and the electric motor such that the motor or cutter has a better holding and there is no chance of slipping of the motor or cutter inside the bore well.



**D. Electric Cables**

The electric cables used for the equipment is a submersible cable. The maximum capacity of power required for an electric motor can be supplied by using a 1.5 sq.mm cable these cables are used to supply power to the electric motor.



**E. Electric Plug and Sockets**

The electric plug is attached to the dead end of the electric cable the phase and neutral are connected with the required terminals in the plug then the plug is connected to the sockets to obtain electric current for the electric motor through the electric cable.



**F. Casing Pipe**

The size of the mixer motors used by us is less than 4 inch so for protecting the electrical components out of damage a 4-inch casing pipe is used as the outer covering the electric motor.



**G. AC Power Supply**

The AC current is used for the power supply because the DC power supply cannot hold power for a long time cutting

especially inside the bore well.

**9. Fabrication**

- First of all, the cutter is attached to the electric motor using standardized nuts and bolts of required size, and is tightened to its maximum.
- The PVC pipe, which is installed to the motor inside the bore wells is used for connecting the erection cutter for deep erection of the device inside the bore wells.
- The three core electric cable is jointed with the cable attachment which comes out from the erection cutter for the supply of Alternating Current supply.
- When the point to be cleared is reached, the total length of the bore well is calculated and extra cable of required size is allotted for connecting the plug with the socket provided in the external side of the bore well.
- The three pin plug top is connected at the end side of the cable for supply of AC current.
- The rope which is attached at the top bowl of the pump inside the bore well is attached to the erection cutter for a safety purpose
- The erection cutter is then erected inside the bore well for deep cutting of the casing pipe which is bent inside the bore well.
- Proper and experienced workers in the field of bore well is used for operating the erection cutter.
- The pipes are threaded to each other one by one till the point of removing the casing pipe arrives.
- When the alternating power supply is turned on the cutter which is attached to the electric motor starts rotating and starts cutting the bent piece of the casing pipe.
- After the piece is cut the erection cutter is removed from the bore well and proper blushing of the bore well is done since the water has got contaminated after cutting the bent piece.

Table 1  
Cost of Materials

S. No.	Components	Quantity	Amount
1	Hole Saw Cutter	1	500
2	AC Motor	1	550
3	FTA	1	20
4	PVC Pipe	2M	50
5	PVC Boards	1	35
6	Insulation Tape	1	15
7	Electric Plug	1	25
8	Electric Cable	3M	60
9	Other Expenses	-	250
10	Fabrication Cost	-	250
11	Total Cost	-	1755

**A. Advantages**

Some of the advantages of Hole saw cutter includes;

- The main advantage over conventional drill bits is the

hole saw's efficiency, because very little of the total material being removed is actually cut, which ultimately reduces the overall power requirement.

- Another advantage over drill bits is the wider size capability.
- For example, a 100mm (3.9 inches) hole would require a huge twist drill or spade drill, unable to be properly driven by a pistol-grip drill or bench top drill press; but it can be cut with a hole saw with relative ease.

#### B. Disadvantages

Some of the disadvantages of hole saw cutter includes:

- The portable drill used must be capable of producing considerable torque at low speed.
- They tend to bind if choked with dust, or if allowed to wander away from the central axis of the planned hole.
- The kick-back from a powerful drill may be severe under some conditions, and long side-handles should be used, preferably with two operators for very large holes.
- The core plug often binds inside the hole saw, and often must be pried out after each hole is cut.
- Sometimes the core plug will twist apart mid-cut, creating a condition where the core inside the hole saw spins on the yet-uncut portion of the core still in the work piece.

### 10. Future Scope

The erection cutter which is operated by humans manually now can be operated with Arduino in future for avoiding the faults and mistakes caused by humans and most of the bore wells which cannot be recovered can be recovered by using the compact erection cutter.

### 11. Conclusion

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between the institution and the industries.

We are proud that we have completed the work with the limited time successfully. The "Design and Fabrication of Compact Erection Cutter for Bore Well Casing Pipes" is

working with satisfactory conditions.

The main function of this Compact Erection Cutter is it helps us to increasing the diameter of the casing pipes inside the bore wells which cannot be done by using bore well lorry at a minimum space. Thus, Compact Erection Cutter is a crucial purchase element for the one suffering from bore well erection problems.

This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task, which has also been provided.

### Acknowledgement

The success of a work depends on a team and cooperation. We take this opportunity to express our gratitude and thanks to everyone who have helped us in our project. We would like to thank the management for excellent facilities and the constant support provided by them to complete this project.

We are indebted to Head of Mechanical Engineering Department, Dr. R. Suresh Kumar, M.E., Ph.D., for having permitted us to carry out this project and giving the complete freedom to utilize the resources of the department.

We express our sincere thanks to our project guide Mr.R. Thiruppathi, M.E., Assistant Professor / Mechanical, for his valuable guidance and encouragement given to us for this project.

We express our sincere thanks to our project coordinator Mr. V. Naveen Prabhu, M.E., Assistant professor / Mechanical, for his valuable guidance and encouragement given to us for this project.

We solemnly express our thanks to all teaching and non-teaching staff of the Mechanical Engineering Department, family and friends for their valuable guidance and support which inspired us to work on this project.

### References

- [1] Degarmo, E. Paul; Black, J T.; Kohser, Ronald A, "Journal scheme for hole saw cutter" Materials and Processes in manufacturing (9th edition), October-28, 1999.
- [2] Barton, F.C. Victrolac, "Journal of the Society of Motion Picture Engineers" Motion Picture Re Records Vo. 192, pp. 452-460, August 2011.
- [3] Y. S. Kung, C. M. Liaw, and M. S. Ouyang, "Adaptive speed control for induction motor drives using neural networks," IEEE Trans. Ind. Electron., Vol. 42, pp. 25-32, February 1995.
- [4] M. A. Choudhury and M. Azizur Rahman, ZEEE, "Determination of Operating Conditions of Submersible Induction Motors," IEEE Transactions On Industry Applications, Vol. 28, No. 3, May/June 1992.