2020

Mechanized Percussion Well Drilling

Nathan A. Henry

Nate Harnish

Nathan D. King

Chris Martin

Tommy Denlinger

See next page for additional authors

Authors

Nathan A. Henry, Nate Harnish, Nathan D. King, Chris Martin, Tommy Denlinger, Darren J. Heisey, and Griffin M. Means

Introduction

The goal of the Mechanized Percussion Well Drilling project is to develop an engine powered system that reduces the labor required to manually drill shallow garden wells, while retaining portability and low capital investment. Percussive well drilling technology is currently used by our client in Burkina Faso, West Africa, to drill wells that provide access to water during the dry season for agricultural purposes.

This project was started by Matt Walsh after he met a group of men in Burkina Faso who had been forced out of their homes for becoming Christian. He created a well drilling business to allow them to still earn an income. The hand auguring system they currently use is slow and has issues with hard soils and rocks. The drilling rig we are working on will eventually be used by these drillers.

Clients

Joseph Longenecker, Open Door Development, SIM

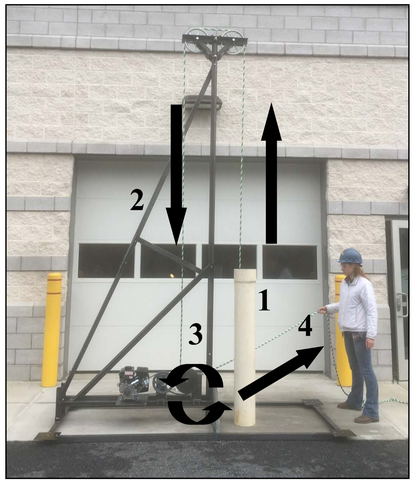
Joseph Longenecker is the liaison between ODD and Messiah College. He is a Messiah College alumni and he currently lives in Ouagadougou, Burkina Faso.

Open Door Development

ODD was officially founded by Dale Johnson and Matt Walsh in 2012 as an SIM community development ministry based in Mahadaga, Burkina Faso. Their mission is to share the gospel by equipping the local church for community service and by ministering to human needs.

Joseph and Erin Longenecker with their children

Mechanized Percussion Drilling



1. A 150 - 200 lb. drill bit is attached to one end of the rope
2. The rope comes out of the hole and over the pulleys
3. The rope is wrapped around the cathead
4. When the driller pulls on the rope, the bit is lifted
5. The driller releases the tension on the rope, allowing the bit to fall
6. Steps 4 and 5 are repeated to break up material at the bottom of the hole
7. The material is removed from the hole, increasing its depth

The cathead is connected to the engine through a gear-reducing transmission. When the rope is pulled, it tightens around the cathead, allowing the cathead to wind up the rope using the power of the engine. When the tension is released, the rope loosens and slides freely over the cathead.

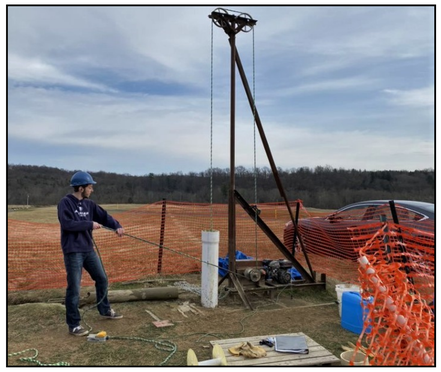
Our Team

Dr. Philip Tan, Nate Harnish, Darren Heisey, Nate Henry, Nate King, Chris Martin

Volunteers: Tommy Denlinger, Griffin Means

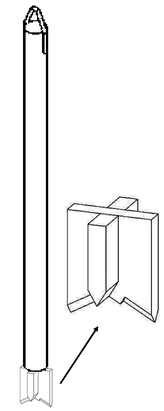
Steel Cathead Testing

- New steel cathead produced spring 2019 to counter wear issues
- 40 hours of testing completed
- Negligible wear resulted—our client was satisfied with the outcome
- Further use in testing ropes, driving hole casing, and collecting additional bit data increased tested hours to 50
- Cathead performance and wear remained unchanged

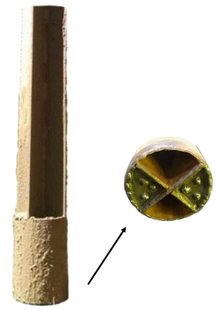


New Rock Bit Design

- Client requested a weight of approximately 200 lb., a small cross-section, a length under 2.5m, and a bit head better suited for rock layers
- Planned to be used in testing effectiveness of heavier bits with smaller impact areas than previously used
- Upon discussion with our client, our final design includes a solid steel shaft and a hybrid star/chisel bit based on other proven bit designs
- Designed for simple manufacture, as its main purpose for us is testing



Rock bit design



Current clay cutter bit (bottom portion) for comparison

Conclusions

- Goal: Create a mechanized drilling system that reduces the labor required by manual well drillers while retaining the benefits of low capital investment and portability.
- Progress: Completed cathead testing, made significant progress on rock bit design
- Future Goals: This fall, our team will finalize the rock bit design and begin manufacture. We also hope to start testing the new bit if possible.

Acknowledgements

- Project Manager: Dr. Philip Tan
- Research Mentors: Joseph Longenecker, Tony Beers, Brendon Earl
- Consulting Engineers: John Meyer, Dr. Brian Swartz, Dr. Tim Van Dyke, Dr. Donald Pratt
- Project Review Panelists: Doug Flemens, Michael Funck, Mike Guion, J. Scott Heisey, Josh Joyce, Bruce Lindsey, Andrew Parkhurst, Dereck Plante

MESSIAH COLLEGE · DEPARTMENT OF ENGINEERING · the Collaboratory for strategic partnerships and applied research · SIM Serving In Mission