



Redesigning a Fabricated Electric Throwing Wheel with Foot Pedal Controls: A Technical Note

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ABSTRACT

The throwing wheel is a device similar to a turntable, used by ceramists to form various beautiful and functional clay objects. Since they are so expensive to acquire, Inameti, Undie, Elemi, Muze and Ajibade (2021) fabricated 2 high-end throwing wheels that functioned comparatively well. However, while the fabricated wheel functioned well, there was no foot pedal control. Thus, the speed control in that first design was by a knob operated by hand, because the pedal designed with it failed to function as expected. Since it is difficult to throw on a wheel and still control speed with hands, this study sought to improve a previous throwing wheel design with the addition of a foot pedal switch, to enable users control the speed with their feet, while working with both hands. Following the authors' review of the structural and electrical/electronic design of the previous wheel, a new wiring diagram was made to include relays that enable the foot pedals to function. The foot pedal controls worked adequately for speed control, and the torque of the system was constant at all speeds. The results indicated that the redesign of the throwing wheel was very successful.

KEYWORDS: Throwing wheel, 24V DC, foot pedal control, redesign

Introduction

Throwing wheels (also called porter's wheels) are the most fundamental equipment in ceramics and pottery studios. The throwing wheel is a device similar to a turntable, used by ceramists to form various beautiful and functional clay objects. Throwing wheels are very expensive studio equipment because they are imported. For instance, the Gladstone Special Needs Wheel (Fig. 1) costs up to £4,740.00 (Gane 2024). This price translates to about N8,437,200, at the present parallel market exchange rate of N1780 to the Pound Sterling. At this cost, it will be very difficult for a Nigerian university to afford, in the present economic circumstances. This is the reason why art schools in Nigeria find it difficult to own throwing wheels for ceramics studies. This situation clearly provides the incentive to design and fabricate throwing wheels locally, since it has been

suggested that a good fabricated equipment can be built for about half the cost of original products (Pitelka 2007).

The throwing wheel is a complex equipment, because of the functions it performs. Besides the wheel-head needing to spin continuously, as the potter wishes, it needs to spin at a controllable speed, and with a very good torque that is unaffected by the slowing-down of the speed. This design challenge makes it a tasking equipment to build or fabricate. Owing to its unique design challenge, many efforts by designers in Nigeria to fabricate one usually ends in failure. Apart from outright failure of the fabrications, the contraptions that usually come out of such efforts are also far from functional. Many such efforts attempt to produce throwing wheels using discarded junk from automobile workshops, leading to cranky approximated contrap-



Fig. 1: The Gladstone Special Needs Wheel.

tions that do not work. This scenario prompted the researchers to embark on a study to design and fabricate a standard, functional electric throwing wheel comparable to the imported varieties. Thus, in *Fabricating Two Electric Throwing Wheels for the Department of Visual Arts, University of Cross River State, Calabar*, Inameti, Undie, Elemi, Muze and Ajibade (2021), sought to use industrial components to design and fabricate an electric throwing wheel comparative to imported versions. The wheel worked effectively and the speed control did not affect torque, and it was very easy to work with. While the fabricated wheel was a milestone, it had a downside because the foot pedal control did not function as expected and speed control was eventually achieved via a knob controlled by hand. Considering that the two hands of the user are involved in throwing, and that the hands will be damp and sometimes muddy, it became imperative to rethink the design and improve it with the addition of a pedal switch for controlling the speed with the foot. This paper is a technical note detailing the redesigning and fabrication of the throwing wheel to have functional foot pedal switches for controlling speed, while throwing with both hands.

Statement of the Problem

In *Fabricating Two Electric Throwing Wheels for the Department of Visual Arts, University of Cross River State, Calabar* (2021), the authors sought to produce an electric throwing wheel of global standard. However, the wheel's foot pedal for users to use in controlling the speed failed to work as envisaged. Thus, the speed control in that first design was by a knob operated by the hand, because the pedal designed with it failed to function as expected. It is difficult to operate the knob to control speed by hand, while the same hands are busy working on the clay, spinning on the wheel-head. There was then a need to move the research forward,

to evolve a better design that will enable users to control the wheel's speed using their feet instead of hands.

Objectives of the Study

This research sought to improve a previous throwing wheel design with the redesign of the electrical and electronics system to add a foot pedal switch, to enable users control the speed with their feet, while working with both hands.

Reviewing the Throwing Wheel Designed and Fabricated by Inameti, Undie, Elemi, Muze and Ajibade (2021)

In terms of methodology, the authors employed an experimental approach, using industrial-grade components and locally purchased parts to design and fabricate 2 working electric throwing wheels. In the design, the authors used a DC 24V worm gear electric motor to drive the shaft. Gear shaft speed was 18-360rpm and output torque was 2-25Nm to drive the throwing wheel. The authors used a simple two-way switch to drive the motor forward and reverse. The Wheel's body work was done, and spray-painted with quality auto base Paint. They added an upholstered seat to the wheel to provide a comfort for the user.

The research was successful, because the researchers successfully designed and fabricated two high-end electric throwing wheels for use in the Department of Visual Arts and Technology, University of Cross River State. In particular, the two throwing wheels were made at less than half the cost of an imported version, which was a desirable outcome. Also, owing to the design's unique 24V DC platform, it eliminates incidents of deadly electric shocks, making both students and staff users comfortable to use it. From the works made with the fabricated throwing wheels and the feedback from various users, the equipment was in not inferior to the imported versions. Again, in contrast with previous experimental wheels produced with automobile junks (which never work), Inameti, Undie, Elemi, Muze and Ajibade (2021) produced standard, high-end throwing wheels that were comparable to any of the imported wheels.

In that laudable research, the authors recorded a number of successes, chief among which are as follows:

- 1) The wheel was based on 24V DC, against the 220V AC that other throwing wheels use.
- 2) A standard aluminium wheel head was fabricated
- 3) The speed of the system was stable and adjustable.
- 4) The torque was very good and did not reduce with the reduction in speed.
- 5) The bowl was well made to contain the wheel-head..
- 6) The size was adequate and portable.
- 7) The visual design was aesthetically pleasing.

8) Ceramists were able to effectively throw on it.

While these milestones were laudable achievements, the fabricated wheel had a downside, which was that there was no foot pedal for the user to use in controlling the speed, while working with both hands. This is what motivated the present study, to redesign the wheel and modify its electronic system and install working pedal switches that can enable users control speed, while throwing with both hands.

Method

The authors reviewed the structural and electrical/electronic design of the previous wheel to find gaps that can be modified. While the structural design was

found to be good, and the electrical/electronic design was adequate for the hand knob to control speed, there was a need to redesign the electronics and wiring, to enable a pedal switch to be added. To do this, 24V 20A relays were included, along with a 24 VDC 20A pedal switch (Fig. 2). Thus, for each throwing wheel, 2 relays and one pedal switch was added to the design (see wiring diagram in Fig 3). Using this new wiring diagram, the throwing wheels were dismantled and rewired (Fig 4), with the new components. There after, the wheels were reassembled (Fig 5), rigorously tested and found to work adequately.

Results

The redesigned wheels were then tested by the re-



Fig. 2: Generic pedal switch (DC24v, 20A)



Fig. 4: The redesigned 24VDC throwing wheel

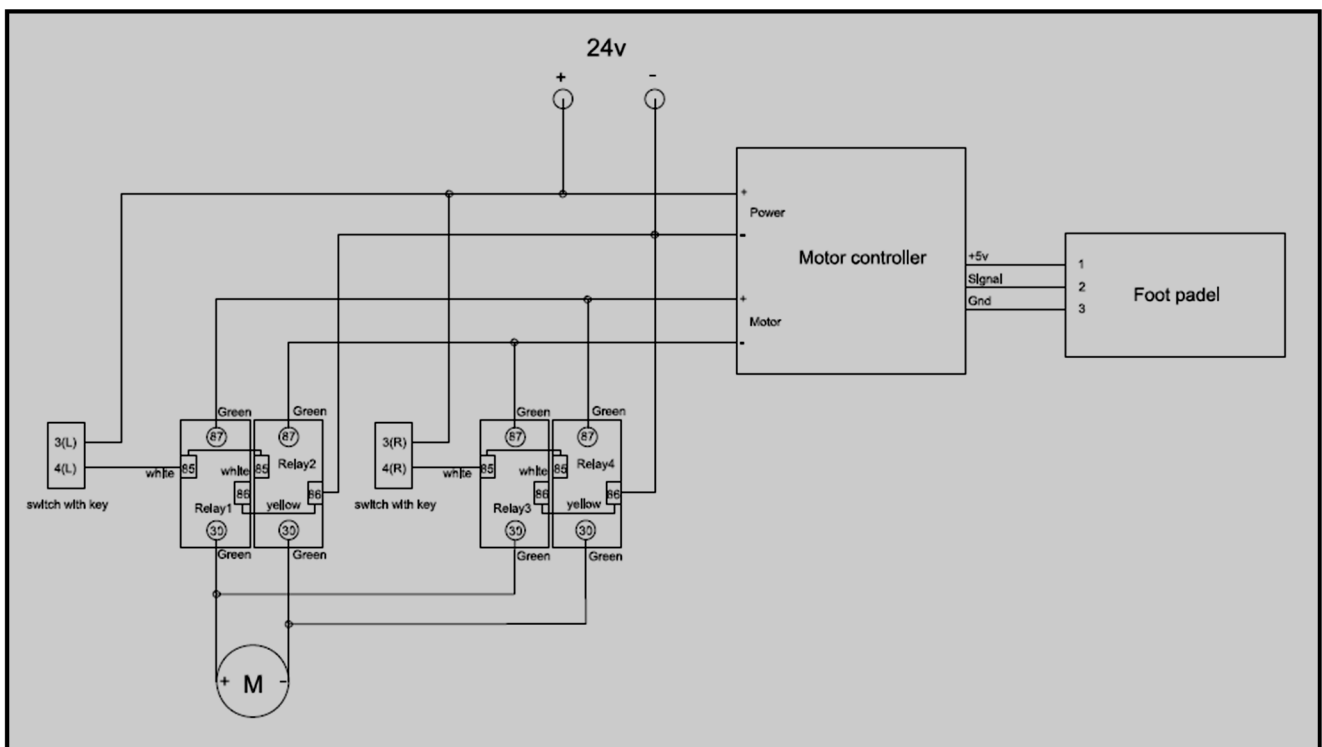


Fig. 3: The wiring diagram of the redesigned wheel, enabling the pedal switch to be added.

searchers, and forms were thrown, using the foot pedals to control the speed. The foot pedal controls worked adequately for speed control, and the torque of the system was constant at all speeds. The results indicated that the redesign of the throwing wheel designed and fabricated by Inameti, Undie, Elemi, Muze and Ajibade (2021) was successful.

Conclusion

This study succeeded in redesigning the Inameti, Undie, Elemi, Muze and Ajibade (2021) throwing wheels to have functional foot pedal controls. What this research has shown is that researches that seem to have failed components do not need to be discarded. Further research on studies that invent technologies and innovations can reveal gaps that make it possible to redo and correct previous limitations. This is what this research has done, to correct the limitation in a previous throwing wheel design, and redesign it to be perfectly functional. By doing this, this study has succeeded in establishing that it is possible to design and fabricate a working throwing wheel, comparable to imported versions, in Nigeria. Furthermore, the results of the wheel's testing during throwing exercises indicate that good quality wheels fabricated in Nigeria can be as good as imported ones, if the right design is made, the right electrical and electronic design is made, and the right components are used.

References

- Gane, Sarah (2024). "9 of the best pottery wheels to buy in 2024". *Gathered*. <<https://www.gathered.how/arts-crafts/art/pottery/pottery-wheels-to-buy>>. Accessed 04.09.2024.
- Inameti, O., P. Undie, N. Elemi, S. Muze and B. Ajibade (2021). "Fabricating Two Electric Throwing Wheels for the Department of Visual Arts, University of Cross River State, Calabar". *Journal of Social and Environmental Sciences* 3(1): 17-22.
- Pitelka, Vince (2007). Building the Harry Davies Single Shaft Vacuum Deairing Pugmill. Online. <<https://www.scribd.com/document/131941430/Building-the-Harry-Davis-Single-Shaft-Vacuum-DeAiring-Pugmill>> Accessed 04.09.2019.
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