

A Multiple Stamp Device For The Small Scale Batik Industry In Ghana

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Abstract: *This study seeks to produce a multiple stamping device for the small - scale batik industry in Ghana. This is to address the much time spent in using a single stamp during batik production and increase production. The research approach was qualitative and the descriptive and experimental research methods were also employed. Data collection instrument used were mainly interview, participant and non - participant observation as well as secondary data from literature. The scope of the study covered selected small-scale batik producers in the Northern region that consist of a target population of thirty five (35) people and an accessible population of twenty five (25) people. The sample size was twenty (20) people comprising of fifteen(15) Batik Producers and five (5) carpenters. The study also employed the thematic data analyses that normally applies in qualitative research. The findings indicate that the multiple-stamp device can effectively hold three square stamps, each measuring three (3) inches. The stamps can be replaced by unscrewing the bolt that secures them to the device, allowing for flexibility in design and ease of maintenance. The study recommends that the multiple stamp device be used to streamline the stamping process, significantly reducing the time and labour required for batik production in Ghana's small-scale textile industry. By implementing this device, producers can enhance efficiency, minimize manual workload, and increase overall output. Additionally, adopting this tool can contribute to higher precision in design application, ensuring consistent and high-quality batik patterns. Asmah (2014){1} highlighted that batik is widely recognized and practiced across Ghana. Each community, region, or locality has developed its own unique motifs, forms, and names for their batik designs stamps, reflecting cultural heritage and traditional craftsmanship.*

Keywords: *Daboy, batik, stamp, small - scale industry.*

I. INTRODUCTION

BATIK PRODUCTION IN GHANA

Batik from Ghana has earned widespread acclaim on the global stage, particularly in the Western world. Its bold patterns and intricate craftsmanship have captivated the fashion industry and caught the eye of international tastemakers. (Wronska-Friend, 2016){10}. Today, Ghanaian batik is not just a textile, it's a symbol of cultural identity and artistic innovation, increasingly embraced as a standout choice in global fashion circles. Batik is one of the resist dyeing techniques used in Ghana's small-scale textile industry. Most of the stamps used in batik production are made of wood, with

designs skillfully engraved on them. Asmah (2014){1} noted that batik is an ancient technique of printing wax onto fabrics. It involves covering certain areas of a cloth with melted wax while leaving other areas uncovered. After dyeing and removing the wax, the covered areas remain undyed, creating intricate designs. When the waxed cloth is crumpled, fine lines appear, allowing small amounts of dye to seep through, enhancing the beauty of the final piece. These batiks were exclusively worn in royal courts as decreed by the monarchs. Because of this historical significance, certain batik patterns have become household names, and some designs are still reserved solely for royal families.

WOODEN STAMPS FOR BATIK

Typically, batik artisans begin by contemplating artistic concepts that spark strong enthusiasm or persistence Margolin &, Buchanan (1996){11} Once a compelling idea for a batik pattern emerges, they move on to the design phase—executing it either by hand or with the aid of modern technology Aep (2010){12}. Anderberg (2014){3} stated that successful wax transfer onto fabric requires applying adequate pressure during the wax application process. The amount of pressure depends on the level of wax penetration needed and the intended use of the final product. This indicates that transferring wax onto fabrics such as mercerized cotton is achievable; however, the final design on the fabric depends on the type of tool used, the level of expertise applied, and the specific end-use requirements of the material Artistic ideas are the heartbeat of any design prototype—they don't just appear randomly; they are often shaped by a mix of inspiration, cultural context, personal experiences, and sometimes even the materials at hand. When a designer begins crafting a prototype, whether in textiles like batik or in other creative fields, these ideas provide the vision and emotional direction behind the work. Osborn (2017)[71] described batik as a fabric dyeing technique which is applicable to paper where selected areas are covered with wax, glues, or specialized resist materials to prevent dye penetration. He explained that after applying the resist material onto a substrate, the fabric is dyed. Once the wax is removed through dewaxing, the previously waxed areas retain the original fabric colour, while the exposed sections absorb the dye Maloney et al (2004) [131]. The process creates fine cracks in the design, adding aesthetic appeal through intricate color variations. Wooden stamps are normally used in wax application in the small scale textile industry in Ghana. These stamps normally comes as single stamps which makes it very tedious when using different stamps with different designs.

DYE APPLICATION IN BATIK PRODUCTION

Batik is a traditional Indonesian textile art that involves applying intricate motifs to fabric before adding color. Recognized for its cultural significance, Indonesian batik was inscribed by UNESCO as an Intangible Cultural Heritage of Humanity on October 2, 2009. (UNESCO, 2009) [16.]. The dyeing stage is one of the important stage of batik production. The beauty of the end product is determined by the colour of the batik fabric. Cotton fabrics are normally used for the batik production. The specific characteristics of the fiber and the properties of the dyes or pigments being applied is considered during dyeing. These choices depend on factors such as the chemical structure and classification of the colorants, their availability on the market, how well they bond with the target material, cost-effectiveness, and other practical considerations Guaratini & Zanoni (2000)[14]. Different colour shemes are used for dyeing batik product depending on the choice of colour of the wearer and the occasion. Afandi, (2014)[15] noted that, the popular features of motifs in batik Lasem are a mythical bird called Hong and plants that are the form of mixed cultures of Javanese and Chinese

A preliminary study conducted in the Tamale metropolis in the Northern region of Ghana on selected batik producers

revealed that using single stamps to apply melted wax onto fabric takes considerable time and slows down production. Additionally, this process requires more labour, as each stamp must be meticulously placed. Again design precision of stamping single stamps at different intervals is also a great challenge. The researcher aim to bridge the gap by developing a multiple-stamping device that reduces time and labour while increasing efficiency in Ghana's small-scale batik industry. This will help improve efficiency, encourage creativity and innovation and enhance production capacity.

The Objectives of the study:

- ✓ To design and produce a multiple stamp device to aid stamping of wax at the small - scale batik industry.

II. SIGNIFICANCE OF THE STUDY

This study presents significant advantages for small-scale batik producers in Ghana. The introduction of a multiple-stamp device will enable batik producers to apply wax more efficiently, reducing the time and labour traditionally required in the stamping process. This innovation will streamline production and improve overall productivity. Moreover, by introducing a new tool into the batik industry, the study encourages creative thinking among producers, potentially inspiring the development of additional tools to overcome other challenges in textile production. By simplifying workflow and accelerating the stamping process, the multiple-stamp device allows producers to generate more textiles in less time, ultimately increasing output, broadening market opportunities, and enhancing income potential.

III. METHODOLOGY

Mason (2002) emphasizes that the flexible nature of qualitative interviews allows respondents to engage in meaningful dialogue with researchers, rather than merely answering a list of predefined questions. This study adopted a qualitative research approach, incorporating both descriptive and experimental research designs to explore and address the research problem comprehensively. The thematic data analysis plan that is normally employed in qualitative research was also employed. According to Creswell (2008), qualitative research embraces an inductive process that prioritizes personal meaning and seeks to capture the richness and complexity of real-life contexts. Using this approach, along with a descriptive design, enabled the researcher to take on an interactive role—observing and engaging with both batik producers and carpenters. These interactions provided deep, insightful information that supported the development of the multiple-stamp device. Leedy and Ormrod (2005) assert that descriptive research involves observing phenomena in their natural state without attempting to manipulate variables. It does not aim to establish cause-and-effect relationships but instead focuses on detailed documentation. In this study, the descriptive design was instrumental in presenting a comprehensive account of the tools, materials, and steps involved in constructing the multiple-stamp device.

Complementing this, the experimental design played a critical role in problem-solving. As Sidhu (2003) notes, experimental research is used to identify observable changes and determine causal relationships. This enabled the researcher to test various types of wood before selecting the most suitable material for constructing the device, ensuring both functionality and durability.

DATA COLLECTION INSTRUMENT

Ary et al. (2013) define instrumentation as the systematic process by which data is collected throughout a research study. In this investigation, interviews and participant observation were utilized as the primary data collection instruments. To guide this process, a structured interview guide and an observation checklist were carefully designed and implemented. These tools were administered to a diverse group of participants, including craftsmen actively involved in Ghana's small-scale batik industry as well as carpenters who contributed to the design and construction of the multiple-stamp device. The interview guide consisted of open-ended questions that encouraged respondents to share insights about their techniques, challenges, and the tools they use in their daily practice. This helped uncover rich, contextual information essential to understanding current production methods and potential areas for innovation. Also, participant observation allowed the researcher to engage directly with the environment in which batik production takes place—observing workflows, interactions, and the practical application of tools in real time. Non-verbal cues, workspace arrangements, and spontaneous feedback were also documented, offering a fuller picture of the production context. Together, these instruments provided a comprehensive foundation for gathering both verbal and behavioral data, enhancing the reliability and depth of the study's findings.

POPULATION AND SAMPLE SIZE

The population for this study comprised selected small-scale batik producers in the Northern Region of Ghana. The target population included thirty-five (35) individuals, while the accessible population consisted of twenty-five (25) participants who were available and willing to participate during the data collection period. Field (2005) defines a sample as a smaller but representative subset of a population used to draw conclusions about the entire group. Based on this principle, a purposeful sample of twenty (20) participants was selected for the study. This sample included fifteen (15) batik producers and five (5) carpenters. The inclusion of both batik producers and carpenters groups was critical during the study because the batik producers contributed hands-on experience and expert knowledge in traditional fabric design, while the carpenters provided essential technical input in constructing and refining the multiple stamp device. Their collaborative input ensured that the final prototype aligned with practical design needs and functioned effectively under typical production conditions. The batik producers also shared feedback on usability, comfort, and time-saving benefits, which was invaluable in evaluating the tool's impact on workflow efficiency. At the same time, carpenters

experimented with various materials and construction techniques to guarantee durability and user-friendliness.

By involving participants from both design and construction backgrounds, the study adopted a holistic perspective that not only addressed design innovation but also emphasized real world applicability and sustainability within Ghana's small-scale textile sector.

IV. TOOLS AND EQUIPMENTS USED IN CONSTRUCTING THE MULTIPLE STAMP DEVICE

- ✓ *Thick plywood* served as the primary material for constructing the base of the multiple-stamp device, chosen for its strength, stability, and ability to withstand repeated use during wax application.
- ✓ *Nail* were used to securely fasten the various wooden components—such as the handle and support beams—to ensure a sturdy and reliable structure.
- ✓ *A hand saw* was utilized to cut the plywood and other wooden pieces to their required dimensions with precision, laying the groundwork for accurate assembly.
- ✓ *Drilling machine* was employed to create multiple, well-aligned holes in both the plywood base and the wooden stamps. These holes were made to accommodate bolts and nuts, allowing for the secure attachment and easy replacement of stamps during batik production.
- ✓ *Lacquer* was applied as a finishing polish to the completed wooden device. This not only enhanced its visual appeal but also protected the wood from moisture and wear, increasing the tool's durability.
- ✓ *Bolts and nut* were used to tightly fasten the three individual wooden stamps to the base. This adjustable mechanism allows users to swap out stamp designs with ease, promoting flexibility and customization in batik patterns.

V. DESIGN SPECIFICATIONS

Based on the data collected from the batik producers, the design specifications was obtained. This is show in figure 1 below. Figure 1 below shows the design specifications of the multiple stamp device.

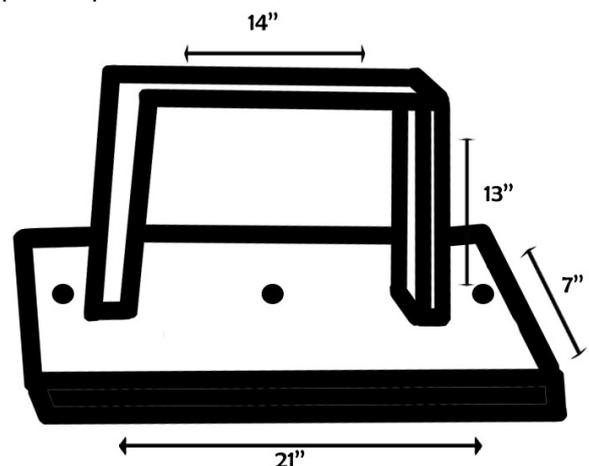


Figure 1: Design specification

VI. METHOD

- ✓ *Cutting the Base:* A thick piece of plywood was measured and cut to dimensions of 7 inches by 13 inches. This rectangular board serves as the main base of the stamping device, providing a sturdy foundation for attaching stamps and supporting structural elements.
- ✓ *Attaching Vertical Support Rails:* Two pieces of 2x2 inch wood, each measuring 13 inches in length, were cut and securely nailed along the left and right edges of the base. These vertical rails offer lateral support and form the structural framework for mounting the handle.
- ✓ *Constructing the Handle Bar:* A third 2x2 inch wood, this time cut to 14 inches, was nailed across the tops of the two side rails. This crossbar forms the handle of the device, enabling users to grip and press the stamp down with better control and even pressure during wax application.
- ✓ *Creating Bolt Holes in the Base:* Using a drilling machine, twelve (12) evenly spaced holes were bored into the plywood base. These holes are specifically designed to accommodate bolts for attaching the wooden stamps, allowing for flexibility in the number and arrangement of stamp blocks during use.
- ✓ *Preparing the Wooden Stamps:* In a similar fashion, holes were drilled into each of the three wooden stamps. These holes align with those on the base, making it easy to secure or remove stamps using bolts and nuts. This feature allows for quick switching between different stamp patterns, contributing to both the tool's versatility and efficiency. Figure 2, 3 and 4 below shows the multiple stamp device, wooden stamps and multiple stamp device fixed with the wooden stamps respectively.



Figure 2: Multiple stamp device Figure 3: Wooden stamps



Figure 4: Final multiple stamp device with stamps fixed

The cotton fabric was tied and dyed with yellow and sea blue colour before the stamping process.

TOOLS AND MATERIAL USED IN THE DYEING PROCESS

- ✓ *Sodium Hydrosulphite:* Used as a *reducing agent*, it converts vat dyes—which are originally insoluble—into a soluble form, making them suitable for fabric dyeing.
- ✓ *Caustic Soda (Sodium Hydroxide):* Plays a key role in activating the dye by *increasing its solubility*, thereby allowing the color to be effectively absorbed into the fabric.
- ✓ *Metallic Bowl:* Serves as a *durable container for heating water*, essential for dissolving dyes and chemicals during the dye preparation process.
- ✓ *Gas Burner:* Provides a consistent *source of heat* used in heating water or dye solutions during the preparation and dyeing phases.
- ✓ *Vat Dye Powder (Yellow, Sea Blue, and Brown):* These are *coloring agents* specifically used in batik due to their vibrant tones and excellent colorfastness. They create long-lasting and vivid patterns on cotton fabrics.
- ✓ *Common Salt (Sodium Chloride):* Added to the dye bath to *enhance dye-fiber bonding*, thereby increasing dye uptake and improving color intensity and evenness.
- ✓ *Plastic Spoons:* Used for the *accurate measurement of chemicals* and for stirring dye mixtures to ensure even consistency and prevent clumping of dye particles.
- ✓ *Plastic Basin:* A multi-purpose container employed for various stages, including *dyeing, washing, and rinsing* of the fabric after wax application and dyeing.
- ✓ *Hand Gloves and Apron (optional but recommended):* Provide *safety and protection* during chemical handling, helping to prevent skin irritation and stains.

VII. THE DYEING PROCESS

The dyeing process was conducted at the Textile Department of Tamale Technical University.

To begin, the researcher heated water by placing a metallic bowl over a gas burner for approximately thirty (30) minutes. Once the water reached the desired temperature, a portion of it was transferred into a small plastic bowl. Into this, one (1) spoonful of yellow vat dye was added and stirred thoroughly using a plastic spoon.

Next, two (2) spoonfuls of caustic soda were added to the dye solution and mixed well. This was followed by the addition of four (4) spoonfuls of sodium hydrosulphite, which was also stirred thoroughly to activate the dye. Finally, a solution of common salt was introduced and stirred into the mixture to enhance dye absorption by the fabric.

Meanwhile, a three-yard cotton fabric, with certain portions tied to resist dye penetration, was soaked in clean water contained in a plastic basin. This pre-treatment helped to eliminate any surface impurities and prepared the fabric for effective dye uptake.

The prepared yellow dye solution was then poured into a larger plastic bowl and diluted with additional water to form

the dye bath. One half of the tied fabric was submerged in the dye bath for thirty (30) minutes, allowing the dye to fully penetrate the exposed areas.

After removal, the fabric was hung in open air to oxidize and dry naturally. The procedure was repeated for the remaining half of the fabric using a sea blue vat dye, resulting in a multi-colored batik fabric. Once dry, the fabric was ready for the wax stamping process.

VIII. TOOLS AND MATERIALS USED IN THE STAMPING/BATIK PROCESS

- ✓ *Gas burner*: Served as the primary source of heat for melting paraffin wax during the stamping process.
- ✓ *Paraffin wax*: Used as the resist agent to create undyed areas on the fabric when applied with stamps.
- ✓ *Metal bowl*: Functioned as the container for melting the wax, placed directly on the gas burner.
- ✓ *Cotton fabric*: Chosen as the main substrate due to its absorbency and suitability for dyeing.
- ✓ *Wooden stamps (three)*: These were the main tools for transferring melted wax onto the fabric in decorative patterns.
- ✓ *Padded table*: Provided a soft, even working surface for laying out the fabric during the stamping phase.
- ✓ *Protective gloves*: Worn to shield hands from exposure to potentially corrosive chemicals and hot wax.
- ✓ *Plastic spoons*: Used for the precise measurement and stirring of dye powders and chemical solutions.
- ✓ *Plastic basin*: A multi-purpose container used for dyeing, washing, and rinsing the treated fabrics.
- ✓ *Aluminium bowl*: Utilized for dewaxing by boiling the waxed fabric, aiding in the removal of residual wax after dyeing.

IX. PRODUCTION PROCESS OF THE BATIK USING THE MULTIPLE STAMP DEVICE

Batik is a centuries-old textile art form practiced worldwide, known for its unique resist-dyeing technique. The process involves applying melted wax to fabric to create patterns that resist dye absorption. When the fabric is later dyed, the wax-covered areas remain untouched, revealing contrasting designs after the wax is removed.

In this study, the researcher carried out the wax application and dyeing procedures at the Textile Department of Tamale Technical University.

To begin, a metallic bowl containing paraffin wax was placed on a gas burner and heated for approximately thirty (30) minutes until the wax was completely melted and ready for use.

For the stamping process, three different stamp designs were selected and mounted onto the multiple-stamp device. This was done by aligning the holes on the stamps with the pre-drilled holes on the device's base and securing them in place using bolts and nuts. This setup ensured that the stamps were tightly fixed and ready for uniform application.

Next, the pre-dyed and tied cotton fabric was laid flat on a padded worktable. The multiple-stamp device, now bearing the three wax stamps, was dipped into the melted paraffin wax and then carefully pressed over the fabric's surface. This step was repeated until the desired pattern covered the entire length of the cloth.

Following stamping, the next phase involved preparing the brown dye bath. Warm water was poured into a small plastic bowl, and the following chemicals were added and thoroughly mixed in sequence: Two (2) spoonfuls of brown vat dye, Three (3) spoonfuls of caustic soda to activate the dye, Four (4) spoonfuls of sodium hydrosulphite to reduce the dye and a solution of common salt, added to enhance dye-fabric affinity.

The stamped fabric was then immersed in the brown dye bath for thirty (30) minutes, allowing the exposed areas of the fabric (not covered by wax) to absorb the color. Once removed, the fabric was dried in a shaded, well-ventilated area to preserve color vibrancy and prevent fading.

To complete the process, a metallic pot filled with water was placed on the gas burner and brought to a boil. The dyed fabric was then immersed in the boiling water to melt and remove the wax—a process known as dewaxing. Afterward, the fabric was rinsed thoroughly in cool water to remove any remaining wax residue or chemical traces.

Finally, the completed batik cloth was air-dried and then ironed to enhance its appearance, smooth out wrinkles, and set the design. The result was a vibrant, multi-stamped batik fabric that showcased the efficiency and effectiveness of the newly developed multiple-stamp device. Figure 5, 6,7,8,9 and 10 below shows the fixing of the wooden stamp of device, bolt and nuts, application of wax with the device, dyeing of the waxed fabric, dewaxing of the stamped fabric and the final batik fabric respectively.



Figure 5: Fixing of stamp on device



Figure 6: Bolt and nuts



Figure 7: Application of wax with the multiple stamp device



Figure 8: Dyeing the stamped fabric



Figure 9: Dewaxing the dyed fabric Figure 10: Final batik fabric

X. RESULTS AND DISCUSSIONS

Textiles serve as a vibrant form of non-verbal communication, capturing the rich cultural heritage and traditions of communities worldwide. Among these traditions, *batik* holds a prominent place in Ghanaian textile artistry. This centuries-old technique involves the use of melted paraffin wax to create intricate resist patterns on fabric, which remain undyed during the coloring process. Over time, Ghanaian batik has evolved into a dynamic medium of expression, blending craftsmanship with symbolic design.

This study sought to contribute to the advancement of batik production by designing and constructing a multiple-stamp device. The innovation enables artisans to apply up to three stamps simultaneously, streamlining the wax application process and improving efficiency. Traditionally, batik makers use a single wooden stamp at a time—a method that, while effective, can be time-consuming and labor-intensive. By allowing multiple stamps to function at once, this device significantly reduces production time and encourages the integration of more complex and creative designs.

To ensure practical relevance, the researcher consulted experienced batik producers who regularly use wooden stamps. Their feedback helped determine the necessary dimensions, spacing, and functionality required for the device. The development process also adhered to established *elements and principles of design*, including balance, rhythm, proportion, and unity, ensuring that the final product was both functional and aesthetically coherent.

Construction materials included: Thick plywood for the base, chosen for its durability and flat surface, 2x2 wooden beams for the supporting frame and handle, One-inch nails to securely join the wooden parts, Bolts and nuts for easily attaching and interchanging stamp blocks, Lacquer to polish and protect the wooden structure, enhancing its longevity and presentation

The final device features a rectangular base measuring 7 by 13 inches, capable of holding one to three stamp blocks. The stamps are affixed using a bolt-and-nut system, allowing for quick and easy replacement. The handle, constructed from interconnected 2x2 wooden bars attached to the sides of the base, is designed to provide the user with a firm and balanced grip. This enhances *control, precision, and ease of movement* during the wax stamping process.

The creation of this device not only introduces a tool of practical value but also represents a step toward greater innovation in Ghana's small-scale textile industry. It encourages artisans to experiment with multi-patterned designs, expand their creative capabilities, and improve production output—thereby strengthening both cultural preservation and economic sustainability.

XI. CONCLUSION

This study aimed to design and develop a multiple-stamp device that enables the simultaneous application of several wooden stamps during the wax-printing process. The innovation allows for interchangeable stamp heads, giving artisans the flexibility to vary patterns effortlessly without the need for multiple individual tools. By streamlining the stamping process, the device significantly enhances efficiency, consistency, and productivity in batik design.

The findings of the study recommend the adoption of this multiple-stamp device by small-scale batik producers, particularly within the local textile industry. Its use can foster creative expression through diverse design combinations while reducing production time and labour intensity. This advancement not only empowers batik producers to meet growing market demands but also contributes to preserving and evolving the rich tradition of batik craftsmanship.

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