



ISSN 2278 – 0211 (Online)

Design and Fabrication of Metal Table Ware for the Council Chamber

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Abstract:

A table ware is a matching set of metal ware or china as a teapot, sugar bowl, creamer, and often plates, cups, and saucers for serving tea and sometimes coffee at table. It covers a variety of objects and tools utilized in serving and eating of meals. Most evidence about the movement of goods in the classical world comes from the finds of pottery, and in demand too were wine, olive oil, and scents that were shipped in pottery, arms and luxurious and splendid metal tableware. Today some metal table wares still hold high personal and social status. KNUST does not have a personal table ware for its council chamber. This publication however, seeks to display a befitting design concept and succeeding production of a metal table ware for the Kwame Nkrumah University of Science and Technology (KNUST) council chamber. Different techniques such as raising, chasing, casting (lost wax and Cold Casting), and forging among others, were incorporated to produce the metal table ware. Descriptive Research and Studio Based Research methods based on the quantitative and qualitative research approaches were employed. The study revealed that huge works can be achieved by casting them in separate parts, and then joining these parts by brazing. It is therefore recommended that brazing should be adopted in joining separate cast parts. Artisans are also encouraged to go in for cold casting since it is easier to cast, lighter in weight and has a low casting defect than be compared to lost wax casting.

Keywords: Metal table ware, Chasing, Planishing, Casting, forging, brazing, KNUST.

1. Introduction

The production and use of metal table ware have been in existence for some time now. However, porcelain and ceramic ware had prevalence in the production of table wares with very little attention to the use of metals. Ellis (2006) intimated that the accepted history of the tea begins in China during the Han Dynasty and tea ware was made of porcelain and consisted of a northern white and a southern light blue porcelain styles. This monotony eventually gave rise to use of metals and colonial America, Boston became the epicenter for silver production and artistry, thus silver and tin tea set began to spread. Metal table ware in the byzantine society was not only an indication of a person's wealth but also of social position and personal status and this reflected in the manner in which he receives guests for dining (Jeffreys et al 2006). They added that precious metals as gold and silver and precious stones used was important to represent a safe investment and maintain their value. According to Kaynak and Fatemi (2014), variety of metals such as aluminium, stainless steel, iron, brass, tin, bronze and silver are used in the metal table ware industry in Thailand, and the most expensive are the intricate skilled handmade pieces. Theis (1999) made mention of some the production techniques such as sheet metal forming, raising and chasing among others, and according to Wang et al (2009), these wares are usually finished with the most dominant surface finishing operations such as electroplating, anodizing and hot dip galvanizing.

Table wares owned by KNUST and other public and private institutions are made of porcelain or ceramic with the school logo and or name printed on them, which only gives it a form of identification in the lineage of monopoly. Metals can however be used in this same manner and when used over time it can be slightly altered and also plated to give it a brand new look. Its durability and longevity is what makes it most desirable. The purpose of this project is to come out with design concepts of table wares that will be fitting for the KNUST council chamber, explore with a number of metal forming techniques and incorporate them in one work and also

document the findings of the research for educational purpose. The metal table ware to be produced is classified as a drink and flat ware under the four main types of table ware (www.wisegeek.com, 2015).

2. Materials and Methods

2.1. Materials and Tools

It was of utmost importance to appraise the materials used for the production of metal table ware. Materials used included non-ferrous metals like copper and brass (sheet, scabs and powder), stainless steel, cow horn, suede cloth, pitch, solder, fiber glass, hardener, and resin. The hardener, fiberglass, resin, silicon and brass powder were specifically used for cold casting. Nitric acid, Sulphuric acid and hydrochloric acid were used to prepare pickle solution and bright dip solution to clean metals. Bees wax was also used to model parts to be cast, with charcoal and clay mixed to serve as a moulds for casting. Tools necessary for the fabrication of the metal table ware included Plaster Of Paris, jewelers saw frame and blades, a set of pliers and files, pencil, scratch brush, carving tools, chasing tools, sledge hammer, clay, modelling tools and punch. Other tools such as calipers, sandbag, rubber mallet, tongs, wooden block, emery, steel wool, hacksaw, knife and shears. Equipment used for production included ingot mould, drilling machine, sanding machine, grinding machine, milling machine, raising stakes and hammer, forge, anvil, micro and blow torches, buffing machine, polishing machine and electroplating machine

2.2. Methodology

Descriptive and Studio based Research method based on the qualitative and quantitative research approaches were employed. The descriptive research method was requisite in order to describe the forms and types of already existing table wares until present times, and then to analyze and document these findings before the designing stage. Moreover, the descriptive method helped to describe the several materials, tools and equipment used for the project. The design and production processes were also described using this method.

The studio based research method however involved the use of some available tools, materials and equipment to explore some metal forming techniques for the production at the Metal Product Design studio. Data collection instrument of observation enabled the researchers to acquire firsthand information upon a visitation to the council chamber. Wares found were analyzed and evaluated to serve as the groundwork for the design and fabrication of metal table ware for the KNUST council chamber.

2.3. Design and Production Stages

The initial stage of the design began with idea development and preliminary sketches by carefully studying the university's logo. Selected designs out of sample designs developed from the logo have been shown in Figs 1- 6

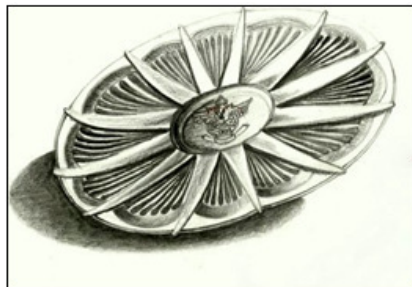


Figure 1: Saucer

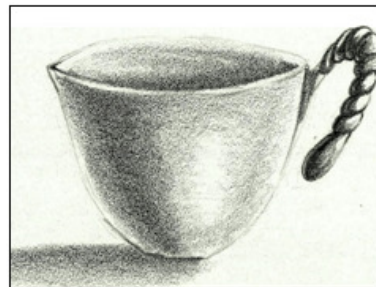


Figure 2: Tea Cup



Figure 3: Cutlery



Figure 4: Cutlery Holder



Figure 5: Tea jar



Figure 6: Condiment set

The production of metal table ware employed different metal forming techniques of raising, chasing and repousse, planishing, milling, lost wax casting, cold casting, and forging, in combination with the use of tools, material and equipment discussed previously.

Raising is the process of creating a seamless form by contraction. A metal disc is hammered progressively against a stake at an angle which narrows it. Chasing and repousse techniques often used together. In chasing malleable metal is shaped on the front while repousse raises a relief from the reverse of the metal. Planishing is a gradual process of removing marks created on a form after raising. This smoothens and hardens the metal. It also polishes the metal in the process and gives it a unique textural effect. Milling is the process by which a metal goes through a roller to flatten or alter into a rod for further use.

Lost wax casting is a method creating a model with bees wax and encasing it in a mould with gates and reservoirs attached as a channel through which molten metal is poured into the mold. Cold casting deals with a mixture of urethane resin with a metal powder and pouring the mixture into a mold to obtain a cast piece. Forging is the process of shaping a metal after it is heated. It usually involves hammer blows as a comprehensive force.

2.4. Tea Cup and Saucer

Two discs with exact dimensions were sawed. They were raised to the appropriate height and shape, and then planished to smooth and harden the metal. The cup was filled with pitch then the design was transferred onto it and chased around. The handle was formed by twisting a copper ingot fixed in a vice. It was bent to shape and soldered as a handle. The saucer was also fixed in a pitch box and the design was achieved by chasing and repousse. The set was filed, polished and gold electroplated (see figures 7, 8, 9 and 10).



Figure 7: Raised Teacup and saucer



Figure 8: Chased cup with twisted handle



Figure 9: Chasing design on saucer



Figure 10: Finished work

2.5. Cutlery

The cutlery design was cut with exact dimension from a stainless steel plate and embossed while red-hot. The handles were cast (lost wax) in brass and finally joined by brazing. Figure 11, and 12 shows brazing and finished work.



Figure 11: Brazing



Figure 12: Finished work

2.6. Cutlery holder

The holder was produced using the lost wax method. Wax models for the eagle and the base were made separately. Separate parts of the eagle were assembled after details were made (Fig 13). Three coatings were done. The first consisted of a mixture of charcoal and clay meshed into fine grains in which the work was embedded. It was left to dry under a shed in open air away from the sun, since the heat could melt the wax. The second coating consisted of the same mixture but coarser grains. Finally, a rough mixture of clay, charcoal and palm fiber was used for coating and allowed to dry for days before casting in brass. The two separate moulds were broken to free the cast piece and brushed cleaned. The eagle was brazed unto the base and filed (Fig 14). The piece was patinated and polished, and finally lacquered to preclude tarnishing (Fig 15) (Kallenberg, 1981, Gupta, 1983).



Figure 13: Detailing of body



Figure 14: Filing cast piece



Figure 15: Finished piece

2.7. Tea Jar

This also employed the raising technique. A 12 inches copper disc was raised to a standard height. A portion was truncated to be used as lid. The form was filled with pitch and the design was transferred unto it and chased (Fig 16). The handle was formed by twisting copper ingot and soldering one end to a band, creating a slot to fasten the cow horn. A shaped piece of the horn was set on the lid as knob. A base accessory was made to complement the jar using chasing and repousse technique. The design was sawed out and bent, and soldered unto a disc (Fig 17). A hole (outlet) was drilled on a portion and a spout was formed and soldered directly over it. To preclude the jars contents from being contaminated by reason of the outlet, a cover for the spout was cold cast (Fig 18). The tea jar was finally polished and gold plated. The base accessory was Nickel plated to add contrast to the work. After plating, the gem was set and the handle was fastened in the slot (Fig 19).



Figure 16: Chasing design unto form

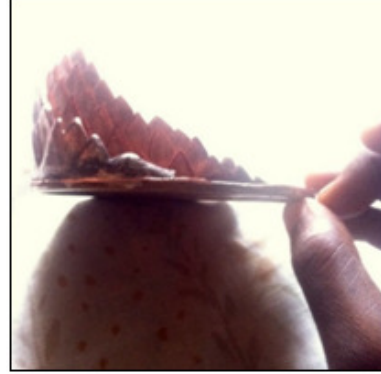


Figure 17: Base accessory



Figure 18: Spout Cover (cold cast)



Figure 19: Finished Work

2.8. Condiment set

Appropriate dimensions for the milk jar was cut with the help of a template, and bent to form a cone. It was filled with pitch and the design was chased around. A disc was cut as lid and a simple mechanism was devised for the lid. A rod was milled, shaped and soldered to the cone for a handle. A groove was cut and a shaped piece was joined for a spout. It was polished and gold plated (Fig 20).



Figure 20: Finished work

The sugar holder was also made by forming a cylinder with the aid of a template. Feather-shaped metal pieces were soldered in a pattern around the form. This had two lids; an inner and an outer lid. A beak was formed and soldered to the outer lid as a whole. An outer lid could be rotated open when both outlets align to free content, and again closed to secure content. The sugar holder was also filed, polished and gold plated (Fig 21 and 22).



Figure 21: Holder with inner lid



Figure 22: Finished work

3. Conclusion

The success of this project would create the avenue for students and metal design artists to explore in this sphere to design and produce varieties of metal table ware for other institutions, as it will foster a higher sense learning and creativity. The study has also established the fact that a number of interesting metal forming techniques can be incorporated in one production. The table ware was produced to corroborate the personal and social prestige of KNUST.

4. Findings and Recommendations

It was revealed that huge works to be cast can be easily achieved by casting them in separate parts, and then joining these parts by brazing. Much difficulty was faced with casting the cutlery holder as a whole due to the base (rocky grounds). However, the base was cast separately and joined (brazed) as one unit. The same method was applied to the cutlery. The handles were brazed after casting. This method should be adopted. Centrifugal force helped to achieve even wall thickness in cold casting for hollow objects. Again, gradual rotation of the mould during and after pouring the mixture (brass powder and resin) helped to achieve even wall thickness. Moreover, it was realized that the weight of the metal plate used contributed to the weight of the tea jar. The use of 1.5mm metal thickness made the jar quite heavy. The weight or thickness of the material used must therefore be considered before production. Cold casting compared to the lost wax casting method has little casting defects, and its products can as well be sandpapered and polished. Products are also light in weight. Artisans should use this method of casting to enjoy the fine qualities.

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