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The New Perspective of Adjustable Jeweller's Saw Frame

By

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Abstract

Jeweller's saw frame has been in existence in the jewellery industry for decades. Although initially it was unadjustable, the current form of jeweller's saw frame lacks the adjustment that can take care of large material surfaces being cut or pierced. In its current form, the adjustment is focused only on the blade. The study seeks to analyse, design and produce a different jeweller's saw frame that can to a large extent take into consideration adjustment of the frame with the length and width of the material in mind. Studio-based and descriptive research methods were applied in the study to design and sequentially explore the production of a new jeweller's saw frame as well as evaluation of its use. Purposive sampling technique was used for the study. Participant observation and interview were used in collecting first-hand information from 60 respondents. Books, journals and periodicals were used as a secondary data. The study found out that the use of the existing jeweller's saw frame is time consuming particularly when piercing or cutting a large surface substrate. Piercing becomes expensive due to the breaking of blades when working on substrates with large surfaces. The study recommended that jewellery tools and equipment production industry should study this production and advance their trend of jeweller's saw frame production. Institutions, jewellers, teachers and students of jewellery programmes and subjects should direct attention to using this type of saw frame which can save cost and reduce waste.

Keywords: Blade, Design, Fabrication, Metal Surface, Piercing, Saw Frame, Substrate

1.0 Introduction

There are many important tools used in producing jewellery. One of such tools is jeweller's saw frame. A jeweller's saw frame is a hand-held tool made with metal with mostly wooden handle as seen in Figure 1. It has mainly six parts namely: top set screw and pad, throat that accommodates blade, handle set screw and pad, frame, blade length adjustment and handle (Kathol, 2008). Jewellers' saw frame is a necessity in cutting, piercing and decorating artworks (Maclennan, 2018). According to hobbytools.com.au/prod87.htm cutting patterns and design for jewellery is easily done with the use of jeweller's saw frame. It is an ideal tool for fine detailed artwork. It is specially designed for cutting and piercing of metal, wood, plastic, mica and other substrates. In jewellery and metal design and fabrication, cutting and piercing constitute at least 30% of the processes. Without cutting and piercing almost all jewellery and metal design and fabrication works could not be produced (Koulidou, 2018). Works such as those that decorate our ears as earrings, our fingers as rings, our arms as bracelets, our ankles as anklets, our necks as necklaces and pendants, or our torsos as brooches, toes, nose, and tongues are all made out of cutting and piercing. Also, metal artworks like medals, trophies, wall decorated pieces, frames among others are all cutting and piercing oriented (Silina & Haddadi, 2015). It is also articulated in support of this argument that, the jeweller's saw frame goes beyond piercing of jewellery that is decorating works, figures, letters and many others into functional items to serve a purpose (Koulidou, & Mitchell, 2021).

While jeweller's saw frame proves to be essential, Simard (2019) opines that there are different types of jeweller's saw frames available to the jeweller. Kathol (2008) noted that jeweller's saw can be categorised into adjustable and non-adjustable saw frames. The aforementioned accounts on adjustable and non-adjustable categories of jeweller's saw frame come in varied forms and types. Although there are variations in forms, shapes and types, they are all under the umbrella of adjustable or non-adjustable jeweller's saw frame. Kathol (2008) and Jewellers Academy (2020) stipulate five varied types of jeweller's saw frame but with same or similar functions. These are Basic adjustable jeweller's saw, Eclipse saw frame, Swiss Grobet Saw Frame fixed, Knew Concepts saw frame and Green Lion Saw. Vanaria (2019) and Technology Student (2019) on the other hand argued that the different types of jeweller's saw frame known to the jeweller and the metal design and fabricators are six namely; Basic adjustable jeweller's saw frame, Eclipse saw frame, Swiss Grobet saw frame fixed, Knew Concepts saw frame, Green Lion Saw and Fret saw frame.

The point must be made that Vanaria (2019) asserts "though there are many different variants out there, the most common type of jeweller's saw is the German pattern saw frame. This classic design has stood the test of time and proved over and over again that you do not need to reinvent the wheel". This study has a different opinion to that of Vanaria's argument that, there is no need to reinvent different types of jeweller's saw frame. This cannot be true from the perspective of cutting, piercing and designing larger sheets of metal or substrate. The current jewellers' saw frames as discussed above are blade-focused not material-focused in terms of operation. The available throat depth of jeweller's saw frame ranges from 3 inches to 8inches. A metal surface or substrate that goes beyond the throat range becomes difficult to handle. In cutting a large surface substrate one has to cut to where the throat depth ends and remove the saw frame to cut from a different angle. This process will repeat itself till cutting is complete. Sometimes the process cannot be complete without the use of other tools.

Koulidou (2018) explains that the many purposes which jeweller's saw frame serve starts with fixing of blade before use. In fixing a jeweller's saw blade one first has to loosen the wing nuts at each end of the frame. Then put one end of the blade into the fastening opposite to the handle and tighten the wing nut, securing it in place. Place the piercing saw against a bench and apply pressure, flexing the frame slightly. Fit the opposite end of the blade into the remaining fastening and tighten the wing nut. After, test to check whether the blade is set at the right tension by plucking the blade. A sharp 'ping' sound should be heard, suggesting the blade is correctly tensioned. This prevents breaking or snapping of the blade while using it to cut and shape metal (Technology Student, 2019).

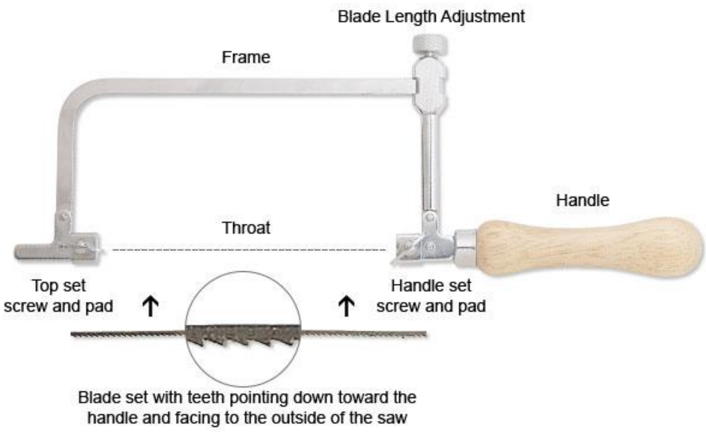


Figure 1: *A labelled Jeweller's saw frame*
Source: http://www.hobbytools.com.au/prod87.htm 2022

In using the jeweller's saw frame to cut, shape, or design, a lot of factors come to play. These are; 1) the size of the sheet metal, 2) size of the jeweller's saw frame and its blade, 3) the type of the jeweller's saw frame (adjustable or non-adjustable) and 4) the design or pattern to cut. The current types of jeweller's saw frame have a lot of issues to deal with, in relation to the first (1) and the fourth point (4). The design or pattern to cut or pierce when it's on a larger surface of sheet metal means one cannot use only jeweller's saw frame to do the piercing (Kennett, 2013). The blades of the jeweller's saw frame come in many sizes, called grades. Its selection is dependent on the metal being cut. Sizes of Jeweller's saw blade according to Simard (2019) and Vanaria (2019) are categorized into; thin metal blade sizes marked as 8/0, 7/0, 6/0, 5/0, 4/0, 3/0, 2/0, 1/0 to 0 and for thicker metal blade sizes marked 1, 2, 3, 4, 5, 6, 7, 8. The thin blade sizes produce fine outcome while the thicker blade sizes give a coarser outcome. The size 8/0 is the smallest blade with the finest teeth and thinnest kerf, while a size 8 is the largest blade with biggest teeth and widest kerf (Vanaria, 2020 & Vanaria, 2019). It is instructive to note that irrespective of the thickness and thinness of the jeweller's saw blade, its length remains closely the same. But in general, one can consider a 2/0 blade as a good and all-rounder for metals and substrates.

Vanaria (2020) further noted that the use of these saw frames is length and width restricted although some are adjustable at only one end. Considerably, this restriction to a large extent affects the sizes of the surface the jewellers, metal design and fabricators and visual artists can cut as well as the ergonomics of using the saw frame. These challenges that jewellers' saw frame poses to the jewellery and metal design industry is worth investigating to profess a solution (Vanaria, 2020). The available jewellers' saw frame is blade-length adjustable and not material surface length adjustable. The cutting of material is limited to the length of the non-adjustable saw frame length and as such the jeweller has no option but to devise another means to cut if the material surface is larger than the existing saw frame. It is for this reason that the study seeks to investigate and find solution to the challenges the existing jeweller's saw frame poses to the jewellery and metalwork industry by exploring with the existing ones to produce a new but improved jewellers' saw frame. This paper is set to identify types of jeweller's saw frames, analyse and discuss the impact of it on the jewellery and metalwork industry. It argues explorative ways to design and produce an advanced jeweller's saw frame with an enhanced effect for use by jewellers and metal design and fabricators and produce a customized one for use.

Tool production is very much linked with the design and the form which the tool will take. In the case of producing a new form of jeweller's saw frame, it is important to recognize the forms of the existing ones to produce an advanced one with additional features, of course, that is the focus of this paper. Most decorative pieces used as jewellery are produced by jewellers, metal product designers or metal design fabricators (Bycroft & Dupré, 2019). The function of these artists depends on many tools but especially jeweller's saw frame. They use this tool in making jewellery from metal or substrate preparation to the finished product. In other instances, this tool is used to only texture, true edges, create design, aid in creating spaces and decorating surfaces of metals or substrates (Volandes, 2019). Most times, performing these functions requires jeweller's saw frame that can be used on large surface metal or substrate. The challenge here has to do with jewellers and metal designers struggling to get other tools to assist them in performing this function; which should not have been the case only if the jeweller's saw frame is enabled to be adjusted either way to contain large surface metal or substrate.

Other recognized group of people who uses jeweller's saw frame are students and apprentices of jewellery making institutions and organizations. In Ghana, institutions such as

Dr. Hilla Limann Technical University, Kwame Nkrumah University of Science and Technology, AsanSka University College of Design and Technology offer jewellery and metal design programmes for students who make use of jeweller's saw frames. Also to note are the over 50 second cycle institutions in Ghana offering jewellery subjects as well as over 400 hundred local jewellery production shops dotted across the country. Students and apprentices of these organizations make use of jeweller's saw frame in one way or the other. Any improved jeweller's saw frame has the potential of lessening the time spent and increasing quality work for all users across the world (Introduction to Jewelry Making and Beading, n.d). Vanaria (2019) indicates that ergonomically there is a need for good and healthy body posture and movement while cutting. Jewellers and metal designers do detailed work that requires them to stay in one position for a long period of time. This puts them at risk of muscle strain (arms, neck and back) and eye strain. A good jeweller's saw frame helps in good health condition of the jeweller. Using a jeweller's saw frame which limits the way of cutting means the jeweller must aid the cutting with the body. This act can lead to posture challenges and inaccurate cutting. It beckons on the jeweller to choose the right jeweller's saw frame whether customized or the type that can aid in achieving a good work without any challenges (Hamilton, Haw, McCarrell, Noriega, Wakeford, & Hayes, 2010).

2.0 Materials and Methods

2.1 The Study Area

This study is generic, it draws its underpinning from the experience of the researcher and students of the Industrial Art Department of Dr. Hilla Limann Technical University in the Upper West region of Ghana. Situated at Kpongu a suburb of Wa as seen in Figure 2, Dr Hilla Limann Technical University (DHLTU) was established in 1999. It introduced the programme Industrial Art in 2013, although the department was established in 2008. One of the courses offered by the department is Metal Design and Fabrication. This course combines jewellery and metal design production as its main content. Suffice to say the course makes great use of jeweller's saw frame and blade not only for jewellery making but for designing and decorating metals for various functions. For more than a decade of using this tool; its limitation though minimal with jewellery production but extreme with designing and decorating metalworks particularly those with large surfaces. Students who have offered and are offering Metal Design and Fabrication in DHLTU as well as other jewellery students often struggle in using the existing jeweller's saw frame. Although the setting of the study is the DHLTU, the tool in question is a basic tool which every jeweller is exposed to. This makes the study very important to the jewellery and metal design industry across the globe.

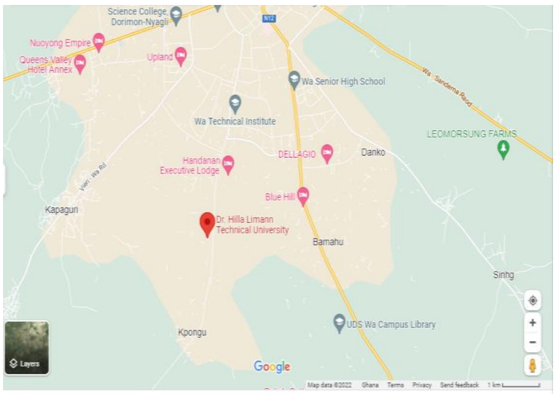


Figure 2: *Location of Dr. Hilla Limann Technical University*
Source: https://www.google.com/maps/place/Dr.+Hilla+Limann+Technical+University/ 2022

This section addresses the resources, materials, tools, equipment and other forms of variables exclusively used to conduct the study. It took into consideration various procedures and techniques used to fabricate the jeweller's saw frame, measure the efficiency of the jeweller's saw frame and analysed its worth. The study was studio-based lead with a combination of descriptive research method used in meeting its objectives. Studio based research method gave room for practical activities on the new jeweller's saw frame to be clearly defined and followed (Given, 2008 & Creswell, 2009). It dealt with the processes and procedures involved in design and production of the finished work (Singh, 2006). On the other hand descriptive research method systematically provided the pictorial, drawings and described all the necessary steps and processes of the study (Creswell & Creswell, 2018).

2.2 Data Collection

Purposive sampling technique was used for the study. Both past and present students of Industrial Art department of DHLTU were interviewed. Focus group interview was conducted using 30 students who are presently in school and 10 past students as respondents. Opinions from 5 jewellery teachers, 5 jewellery lecturers, and 10 jewellery and metal design apprentices were sought. In all a total of 60 respondents were used for the study. The researcher also conducted participant observation alongside interviews in collecting first-hand information. Books, journals and periodicals were used as a secondary data. Data were then gathered, synthesized, themes were deduced, interpretations given and findings were presented.

2.3 Tools, equipment and material

A tool is a device used to perform a task (Bray, 2003). In this study the major tools used to carry out the studio work were ruler, hack saw and blade, hand file, hammer, pair of calipers, 90^{o} angle ruler, plier, tape measure, screw thread tap wrench, spray diffuser, grinding machine, sand paper, hand drill, drill bit, and brush. Equipment according to (McCreight, 2004) is all kinds of machines, appliances either powered or unpowered which assist in performing a task. Equipment used in the study includes bench vice, anvil, welding machine, drill machine and grinding machine. Material is defined as an object or substance which is used to form or make a finished functional item (McCreight, 2004). Materials that constituted the frame were scrap steel metal, bolt and nut, angular bar, wood, white glue, varnish and paint. Other materials used in the study were sawdust and oil. The explanation of these tools, equipment and materials was clearly expressed in the way they were used.

2.4 Procedures Used In Production

The study put together knowing what existed, developed ideas from them, rendered the design in computer and fabricated the new jeweller's saw frame as the procedures in this section.

2.4.1 Existing Jeweller's Saw Frame

The production was initiated by identifying some of the types of jeweller's saw frame with their pictorial features for consideration as seen in Figures 3 to 8.

Figure 3: *Adjustable Saw Frame and Saw Blade Starter Set From Cookson Gold*

Figure 4: *Eclipse Fixed Saw Frame*

Figure 5: *Swiss Grobet Saw Frame Fixed From Cookson Gold*

Figure 6: *Knew Concepts Saw Frame With Quick Release Lever From Cookson Gold*

Figure 7: *Greenlion Jewellers Saw Frame* **Figure 8:** *The Fret Saw Frame*

Figures 3 to 8 in the study were the identified different types of jeweller's saw frame used across the world. This step of identification gave fair ideas on how unique a new jeweller's saw frame should look.

2.4.2 Idea Development

Devising a means to produce a different kind of jeweller's saw frame required the researcher to study the existing ones in order to make room for the new one. This inspired the researcher with ideas to come out with different sketches and drawings with improved features. Views and opinions of teachers, lecturers, students and apprentices were sought on the sketches and drawings and the information recorded and interpreted in the final drawings used for the production. The design that could accommodate features such as easy to adjust and firm to hold was selected for production. Fifteen (15) different drawings were made of which six (6) were selected as seen in Figures 9 to 14. Out of the six, one was used for the production.

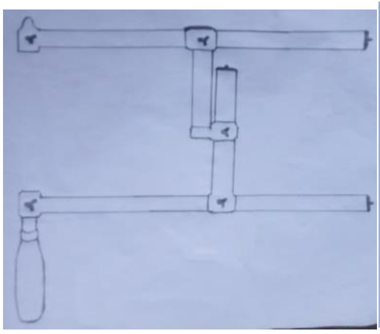


Figure 9: *Drawn Jeweller's saw frame 1*

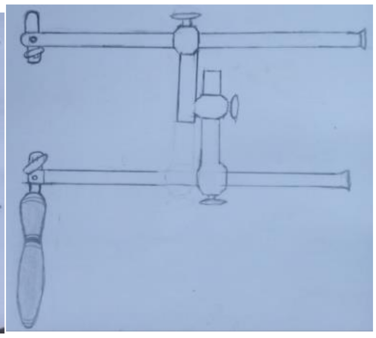


Figure 10: *Drawn Jeweller's saw frame 2*

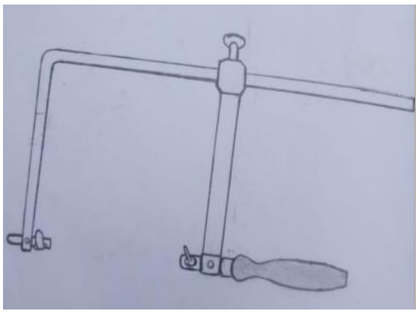


Figure 11: *Drawn Jeweller's saw frame 3*

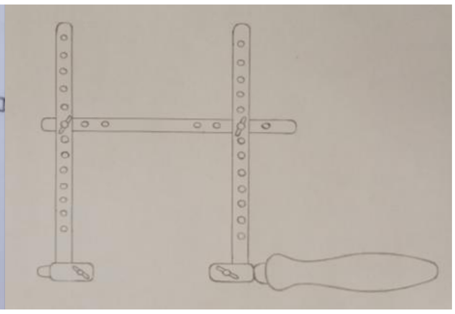


Figure 12: *Drawn Jeweller's saw frame 4*

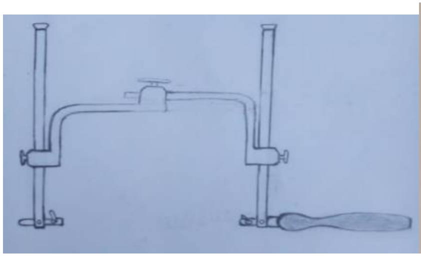


Figure 13: *Drawn Jeweller's saw frame 5*

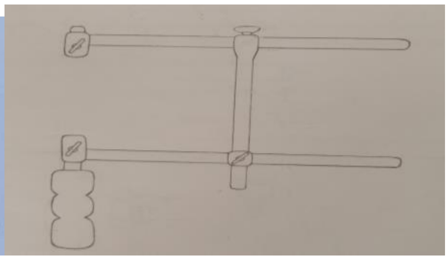


Figure 14: *Drawn Jeweller's saw frame 6*

Source: *Researcher's studio 2022.*

2.4.3 Computer Aided Design Of Selected Drawing

The researcher converted the selected drawing into computer-aided design with dimensions. The components of the jeweller's saw frame were clearly elaborated as seen in Figures 15 and 16.

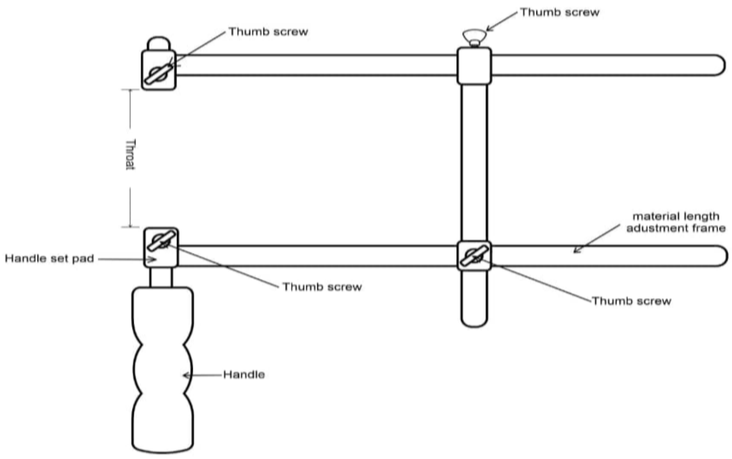


Figure 15: *Computer rendition of the selected design*

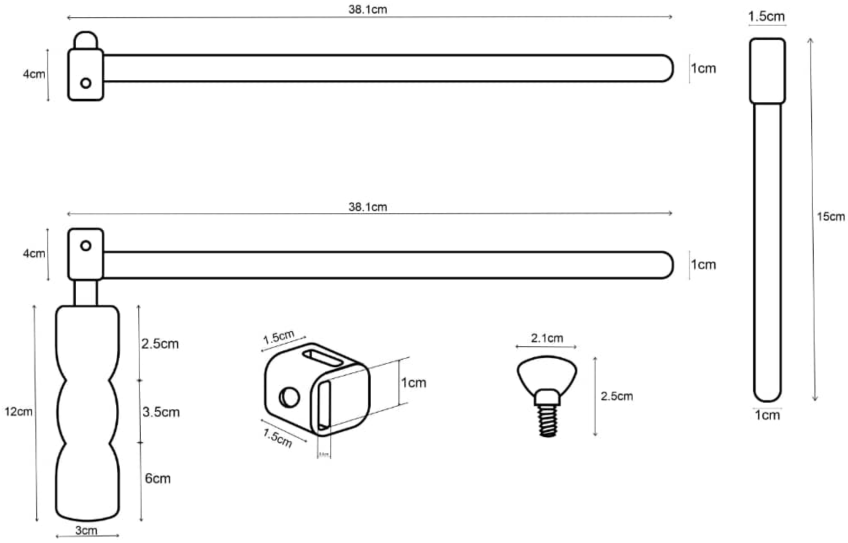


Figure 16: *Components of the selected design with dimensions*
Source: *Researcher's studio 2022.*

2.4.4 Model Of Selected Designed Jeweller's Saw Frame

The design after being rendered in computer software was modelled to examine the possibility of producing the actual work in metal with wooden handle. The model was constructed using aluco board and screw bolts and nuts as seen in Figures 17 to 20.

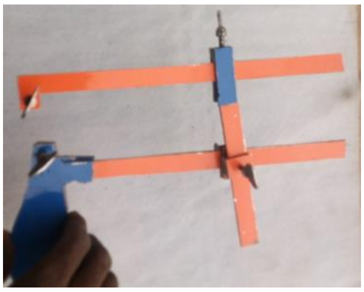


Figure 17: *Right-Side View Of Saw Frame Model*

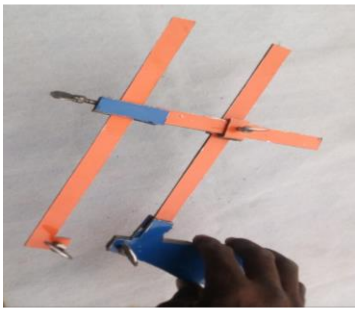


Figure 18: *Left-Side View Of Saw Frame Model*

Figure 19: *Slanted View Of Saw Frame Model*

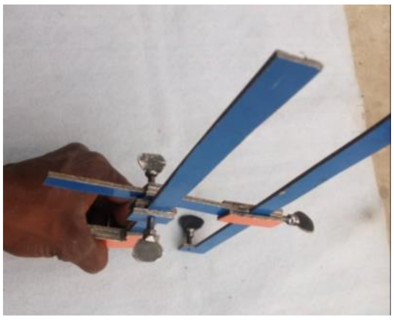


Figure 20: *Three-Quarter View Of Saw Frame Model*
Source: *Researcher's Studio 2022.*

2.4.5 Tools Used

Tools used in the production were ruler, tape measure, pair of calipers, hack saw and blade, hand file, plier, 90^{o} angle ruler, screw thread tap wrench, hammer, spray diffuser, grinding machine, sandpaper, hand drill, drill bit and brush. The application of these tools was described in the caption given as shown in Figures 21 to 30.

Figure 21: *Hacksaw With Blade Used For Cutting*

Figure 22: *Drill Bit Used For Creating Hole*

Figure 23: *Electrical Hand Drill Machine Used For Creating Hole*

Figure 24: *Tape Measure Used For Measuring*

Figure 25: *Thread Tap Wrench for Creating Thread Slot*

Figure 26: *Screw Thread Tap Wrench For Creating Thread Slot*

Figure 27: *90^{o} angle ruler was used in checking straightness of the work through the angles*

Figure 28: *Sand paper was used in smoothening the surface of the metal and wood*

Figure 29: *Emery paper was used in sanding the work to feel more smooth*

Figure 30: *Hammer Was Used In Shaping And Forming*
Source: *Researcher's Studio 2022.*

2.4.6 Materials Used

In this study, the materials that constituted the frame were scrap steel metal, bolt and nut, angular bar, wood, white glue, varnish, paint, sawdust and oil. The application of these materials was described in the caption given as seen in Figures 31 to 37.

Figure 31: *Scrap Strip Metal Used For The Saw Frame*

Figure 32: *Angular Bar Was Used For Adjustable Mechanism*

Figure 33: *Vanish Was Used To Finish The Surface Of The Wooden Handle*

Figure 34: *Bolt And Nut Used For Thumb Screw*

Figure 35: *Wood Was Carved To Form The Handle Of The Saw Frame*

Figure 36: *PVA White Glue Was Used With Saw Dust To Hold Firm The Handle Of The Saw Frame*

Figure 37: *Silver Colour Paint Used For Coating The Surface Of The Saw Frame*
Source: *Researcher's Studio 2022.*

2.4.7 Equipment

Equipment such as bench vice, anvil, welding machine, drill machine and grinding machine were used in the study. Application of these equipment was described in the caption given as seen in Figures 38 to 42.

Figure 38: *Electric Drill Machine Was Used To Drilling Hole*

Figure 39: *Cutting Machine Was Used For Slitting And Cutting Metal*

Figure 40: *Bench Vice Was Used For Hold Firm Metal*

Figure 41: *Arc Welding Machine For Joining*

Figure 42: *Grinding Machine For Smoothen Surface And Edges Of Metal Used For Frame*
Source: *Researcher's Studio 2022.*

2.4.8 Fabrication Of Jeweller's Saw Frame

The production of the Jeweller's saw frame followed a process which this section spelt out. It dealt with decisions and sizing of the Jewellers Saw Frame, forming of the Jewellers Saw Frame and finishing the Jewellers Saw Frame. Fabrication process started by way of selection of design and pattern. The production used scrap steel metal, angular bar, bolt and nut and wood. Scientific processes which include forming, forging, drilling, threading, arc welding, carving, sanding and coating (Palmer, 2007) were technically applied in the production process to achieve the objective of the study.

1. Forming of The Jeweller's Saw Frame

Decisions and Sizing of Jewellers Saw Frame: Tape measure was used to measure existing jewellers saw frame. The measurement of the existing jeweller's saw frame ranges from 15.5cm x 13.5cm to 31cm x 13.5cm. The study led to comprehensive consideration of suitable and durable all-round adjustable type that can accommodate both blade and metal length adjustment beyond the range of the existing ones for the jewellery and metalsmiths industry.

Sizing: The size of the anticipated jeweller's saw frame was 38.1cm x 15cm excluding the dimension of the handle. Aluco board and bolts and nuts were used to produce a model of the jeweller's saw frame to be produced taking into recognition all the features ascertained from the data collected. Model was severally rearranged and adjusted to fit into the required dimension of the study. The model was evaluated in connection to balance, weight, adjustment and portability.

Measurement: Scrap steel metal used for the jeweller's saw frame was measured using tape measure. Nail was used to mark the areas to cut off. Measurement span 38.1cm x 15cm without the handle. The handle which was wood-made measured 12cm x 3cm. Pictures of measurement of scrap steel metal strips can be seen in Figures 43 and 44.

A B

Figure 43: *Measuring of metal for frame fabrication using tape measure (AB)*

C D

Figure 44: *Measuring of metal for slot fabrication using angle ruler and pair of caliper (CD)*
Source: *Researcher's Studio 2022.*

Cutting: Bench vice was used to hold the scrap steel metal in place for cutting. A hack saw and electrical cutting machine were used to cut the measured scrap steel metal into the required sizes as seen in figures 45 and 46. Cutting was applied in the shaping of the frame, forming of slots, thumb screw and fabrication of handle. With the help of a drilling machine and drill bit, a hole was drilled in the piece where there was a pivot.

A B

Figure 45: *Cutting of metal into required sizes for frame using cutting machine (AB)*

C D

Figure 46: *Cutting of sheet metal to sizes to form slots to accommodate adjustment using hacksaw (CD) Source: Researcher's Studio 2022.*

Shaping: Areas such as the top and bottom corners of the frame under fabrication were shaped amidst filing for accuracy and conformity to the selected design. Welding and hammering were employed to straighten observed bent parts. This was to allow the overlap adjustment of the frame to fall in place smoothly for ergonomic acceptance. The shaping process is pictorially defined in Figures 47 to 52.

A B

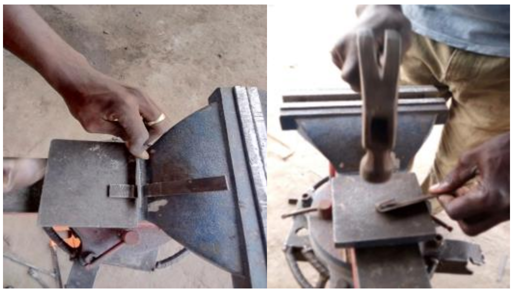
Figure 47: *using of hammer to align metal (AB)*

C D

Figure 48: *creation of hole with hand drilling machine and arc weld (CD)*

Figure 49: *Creation of hole with the use drilling machine*

Figure 50: *Aligning vertical and horizontal metal of the frame*



A B

Figure 51: *Using hammer to bend metal to create stop ends on frame (AB)*

C D

Figure 52: *Stop ends metal being measured with pair of caliper (CD)*
Source: *Researcher's Studio 2022.*

Forming of slot for Frame: The design for this new jeweller's saw frame requires an adjustment mechanism with slot. This was fabricated as seen in Figures 53 to 56 to enable movement of the bottom horizontal metal strip of the frame.

A B

Figure 53: *Closing the end of a shaped metal meant for the slot using plier to hold while welding (AB)*

Figure 54: *Using thread tool to create thread space to accommodate thumb screw on the frame (C)*

A B

Figure 55: *Grinding edges of formed slots with the grinding machine (AB)*

C B

Figure 56: *Finished slot to be fixed on the frame (CB)*
Source: *Researcher's Studio 2022.*

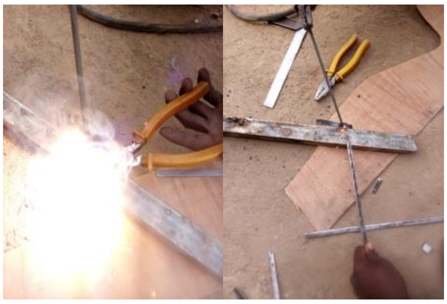
Forming Of Thumb Screw: As part of the fastening mechanism thumb screws was fabricated as shown in figures 57 to 59.

Figure 57: *Welded thumb screw*

Figure 58: *Filing of edges of welded thumb screw with hand file and bench vice*

Figure 59: *Finished thumb screw*
Source: *Researcher's Studio 2022.*

Joining: Arc welding and drilling machine were used in joining the metal where needed to enable firm attachment to each other to acquire the required sizes and shapes as depicted in Figures 60 to 63. A set of thumb screws and pads were created using steel metal at five different points on the frame. Two of the screws are seen at the top of metal strip of the frame adjacent to each other, another one is fixed close to the handle at the bottom of the metal strip of the frame and the remaining two are fixed on the adjustment mechanism slot which is located on the bottom metal strip of the frame.



A B

Figure 60: *Welding Ongoing At The Ends Of Vertical And Horizontal Parts Of The Frame (AB)*

C D

Figure 61: *Assessing Welded Ends (CD)*

A B

Figure 62: *Drilling Hole On The Metal Frame To Allow For Thumb Screw To Be Fixed (AB)*

C

Figure 63: *Assessing The Frame After Drilling(C)Source: Researcher's Studio 2022.*

Assembled Jeweller's Saw Frame: The components of the Jeweller's saw frame were put together as designed and modelled. Figures 64 to 67 gives us clear picture of how the assembling was done.

A B

Figure 64: *Putting Together The Components Of The Frame (AB)*

C D

Figure 65: *Assembled Frame Without Wooden Handle (CD)*

Figure 66: *Birds View of Assembled Frame*

Figure 67: *Assembled Frame Held To See Whether It's Well Assembled*
Source: *Researcher's studio 2022.*

2. Finishing Jeweller's Saw Frame

The work was finished by filing, sanding, polishing, coating and drying. Initially, filing was done to level all the edges and to take away all unwanted parts. Again, it was used to do away with dents and to make the edges of the framework friendly. Emery paper was used to smoothen the surface to make it attractive. Surface finishing was completed by spraying with silver colour. This was done before the handle was carved and fixed using sawdust and white glue. The finished work was finally dried.

Filing and Sanding: The researcher filed the produced jeweller's saw frame to remove rough edges. Both the inside and outside edges were beveled while filing with half-round, rectangular and triangular files. Heavier grit of sandpapers (150 to 600) was used foremost to remove scratches created by hammering, filing and hard surface contacts as seen in Figures 68 and 69. Later, finer grits of 800 to 1200 emery papers were used to complete the process. The researcher cleans the surface of the produced jeweller's saw frame anytime there is a need to change a grit to the next smoother one.

Figure 68: *Filing The Work To Smoothen Edges With Hand File*

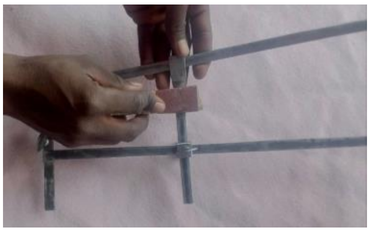


Figure 69: *Sanding The Work To Smoothen Edges With Sand Paper And Emery PaperSource: Researcher's Studio 2022.*

Assessment: The work was assessed to ascertain even smooth surface, all round sand surface and smooth movement on joints as seen in Figure 70 (A, B, C). This process was repeated three times before coating.

A B C

Figure 70: *The researcher examining the saw frame for its ability to move smoothly at its joints as well as checking its surface smoothness (A,B And C)*
Source: *Researcher's studio 2022.*

Surface finishing: According to Cousins Material House (2018), covering the surface of a finished work with protective substance enhances its preference. Silver spray was used to improve upon the appearance of the finished jeweller's saw frame. Reference to this process can be made to Figures 71 and 72.

Figure 71: *Spraying The Components Of Saw Frame With Silver Spray*

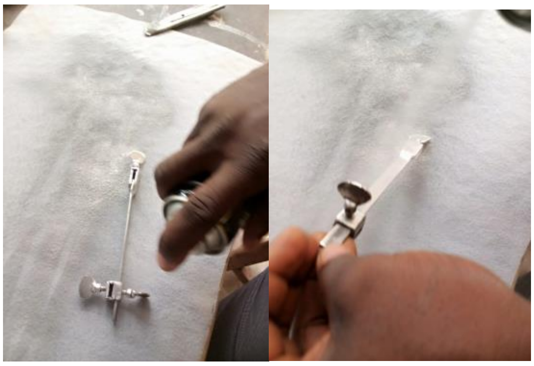


Figure 72: *Spraying The Bottom Part Of The Saw Frame And Its Adjustment Mechanism With Silver Spray*
Source: *Researcher's studio 2022.*

Fixing handle: A wooden handle made out of a mango tree branch was carved and fixed on the jeweller's saw frame. In this process the carved handle was coated with coloured varnish, dried and fixed using glue and sawdust. It was systematically carved to accommodate the frame. See Figures 73 and 74 for pictorial understanding of the process.

A B

Figure 73: *Creation Of Slot To Accommodate Handle By Using A Drilling Machine And Applying Varnish With Brush To It (AB)*

C D

Figure 74: *Applying Glue And Saw Dust Into The Slot In The Wooden Handle And Putting In The Saw Frame To Complete The Process.*
Source: *Researcher's Studio 2022.*

Drying: After spraying, applying varnish and fixing the handle, the jeweller's saw frame was dried under a shade to get the spray and varnish firmly adhered to the saw frame as shown in Figure 75.

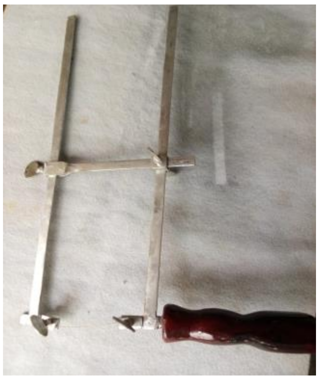


Figure 75: *Drying of saw frame*
Source: *Researcher's studio 2022.*

3. Evaluation Of Jeweller's Saw Frame

The finished jeweller's saw frame was used to pierce simple and intricate designs to ascertain its strength, portability, ergonomics and adjustment efficacy. Figures 76 to 78 give pictorial view of the jeweller's saw been used.

Figure 76: *Fixing Blade Into The Finished Saw Frame*

Figure 77: *Checking For Tension In The Fixed Blade (C,D)*

A B

Figure 78: *Piercing with the new jeweller's saw frame (A, B)*
Source: *Researcher's studio 2022.*

Strength: The finished work was very firm and strong when used. It was able to resist any form of shift or movement to its joints when in use and dropped at a 4feet table height. When pressing from the top to fix the blade, it is accommodating.

Portability: Due to the adjustable nature of the jeweller's saw frame, it makes it possible to dismantle the whole saw frame into four pieces as shown in Figure 79. This makes it easier to carry and handle in one's drawer, cabinet or bag.

Figure 79: *Dismantled jeweller's saw frame*
Source: *Researcher's studio 2022.*

Ergonomics: The usage of the jeweller's saw frame is human and material friendly. The handle is carved in a way that permits firm holding by the right or left hand. Initially, the fear of balance was a serious concern but the finished work proved successful. It is well-balanced when held to pierce designs in metal. It worked effectively when cutting 38.1cm square substrate. One did not have to turn his or herself when using it; rather the turning of the material is enough for good piercing.

Adjustment efficacy: Initially, adjustment was not well aligned but with further planishing and filing it aligned creating an even length which ensures comfortable movement and adjustment of the jeweller's saw frame when using it.

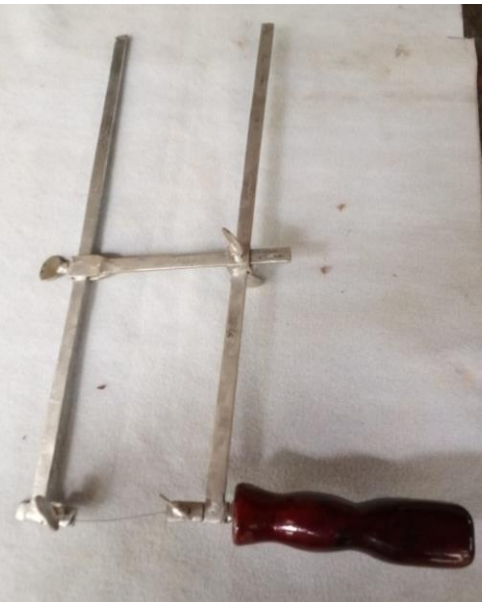


Figure 80: *The finished new adjustable jeweller's saw frame*
Source: *Researcher's studio 2022.*

3.0 Results and Discussion

Results were discussed based on the objectives of the study which were in two folds. The initial one was to identify types of jeweller's saw frames, analyse and discuss the impact of it on the jewellery and metalwork industry. The second one was to design and produce an advanced customized jeweller's saw frame with an enhanced effect for use by jewellers and metal design and fabricators.

The study established six basic jeweller's saw frames known to the jeweller and metal designer. All the adjustable jeweller's saw frame are adjustable to the jeweller's saw blade length. Jewellery produced in Ghana has a lot to do with jeweller's saw frame. The over 400 hundred jewellery manufacturing shops in Ghana are familiar with the use of jeweller's saw frame. In each of the jewellery shops the leading hand tool used in jewellery production is the jeweller's saw frame. Currently on the academic front the tertiary institutions who run jewellery and metal design programmes make use of jeweller's saw frame to train students to acquire skills. Some of the second-cycle institutions use jeweller's saw frame to teach and give hands-on training to those studying jewellery. It must be noted that, metal design and fabricators also make good use of the jeweller's saw frame. They use it for cutting shapes, letters, figures and images in completing a design for decoration and producing functional items. Artisans such as woodwork and basketry experts, billboard designers, blacksmiths among others use the jeweller's saw frame as the main tool for making their profession felt in Ghana. Jeweller's saw frame, not only has it made professions to impact the Ghanaian economy, it has also benefited the individuals with their body adorning, advertising, utensils and tools need and has aided teaching and learning of jewellery programmes in Ghana.

The second objective was to produce a new jeweller's saw frame. In an attempt to meet this objective, the study used scrap steel metals to produce a two-way-adjustable jeweller's saw frame. The study showed a completely new look of jeweller's saw frame which is quite different and extra purposeful. The finished work as seen in Figure 80 is made to have a means of adjusting it to fit the full or less the length of the blade and on the other hand to adjust it to accommodate 38.1cm of all-round surface of substrate materials. The production dealt with four different components. The first focused on the fabrication of the frame length. The second was about fabricating the adjustment mechanism for both blade and material length. The Third centered on fabricating the thumb screw mechanism to hold firm the adjusted areas and the fourth was the construction of the handle to operate the finished work.

Strips of scrap steel metal were dimensional and proportionately cut and shaped to 38.1cm x 1cm in size. In shaping the metal, grinding machine was used to true the edges and the surface of the metal. Angular ruler was used to check the 90° angle of the horizontal metal and to ensure they are parallel to each other. To succeed in this, the vertical metal bar which was 15cm long was to stand at 90° to the two parallel metal. The frame was fixed to look parallel at the top, vertical in the middle and parallel at the bottom. The frame was held in check by adjustment mechanism. The horizontal, vertical and the adjustment mechanism were sanded to give a smooth metal surface that can accommodate silver colour spray. The fabricated frame was sprayed three times to ensure well-coated surface. But this was done before fixing the handle which is discussed in the next three paragraphs.

The adjustment mechanism was the slot which accepted the passage of parallel and vertical metal to enable adjustment on both sides of the jeweller's saw frame. A 1.5 cm x 1.5cm square shape and 1.5cm x 0.9cm rectangle shape of metal with a slot of 1cm x 0.4cm and 1cm respectively were fabricated horizontally and vertically across the parallel and vertical metal frame respectively. The adjustment mechanism was fixed to guide the movement of the metal frame parallel and vertical to each other. It is this mechanism that enables the frame to keep to its shape. The same finishing given to the fabricated frame was repeated for the adjustment mechanism.

The means of holding firm the strip of metal passing through the adjustment mechanism is by the use of the thumb screw. This screw was fabricated by threading the shank and welding the head to form a t shape screw as seen in Figures 57 to 59. It has a dimension of 2.5cm x 2.1cm .it is placed or positioned at the middle hole created in the adjustment mechanism and then screwed through to hold the parallel and vertical metal of the frame.

The finished jeweller's saw frame was completed by producing a handle made of wood. The wood was carved based on 12cm x 3cm dimension in a balanced proportion to enable holding of the saw frame. The handle was carved to be long in length as compared to the other jeweller's saw frame. Aside its length, the width was made broader than the usual. The study used this dimension since it was able to give a balanced and stability in holding and using of the new jeweller's saw frame. The handle is shaped to have three curved shapes. The curved shapes are not same in size. The small size (2.5cm) is shaped on top of the bigger size (3.5cm) and the biggest size (6cm) is shaped to be at the bottom part of the handle. The finished handle was sanded with sandpaper. Varnish was applied before brown polish was used. Upon drying, the handle was lacquered to give a protective surface finish. The finished handle is able to accommodate small and big palms.

The fourth component discussed was assembled, this component has to do with fitting the fabricated finished frame onto the handle using white glue and sawdust. White glue was first applied into a hole created in the handle, the metal saw frame was positioned into the hole and sawdust was used to absorb the white glue as well as making compact the frame to the handle. The finished work was allowed to dry naturally. The new jeweller's saw frame has been in use with the jeweller's saw blade for over a semester and counting.

3.1 Major findings

This study established six outstanding jeweller's saw frames known in the jewellery and metal design industry. Each of them has a peculiar feature which serves specific importance to the jeweller and the metal design and fabricators. The most common feature about all the discovered jeweller's saw frame is the length of blade used in operating them. All of them are capable of accommodating the jeweller's saw blade. This also gave reason for the study to focus mainly on jeweller's saw frame and not the blade. The study established scrap metal of thickness 0.3cm to be durable enough to use as compared to galvanised sheet, aluminum sheet, brass or copper sheet of the same thickness. It was very hard, firm and rigid enough to keep to its shape during fabrication process and when in use (Books, 1981). Exploring the fabrication of the adjustment mechanism revealed the possibility of using bolts and nuts or creating a similar one using iron rod and flat bar metal. The option of the bolts and nuts will require the use of a plier in operating it while the thread iron rod with the wedded flat bar metal will need the bare hand. The latter was used. The new jeweller's saw frame is exceptional from the identified ones according to the study. One is able to dismantle the new jeweller's saw frame into four components for portable carrying of it.

4.0 Conclusions

In jewellery and metal design production among others, jeweller's saw frame plays a major role which cannot be ignored. Its role does not only serve for skill impartation but as a tool for self-employment in the jewellery and metal design and fabrication industry. The tool jeweller's saw frame allows for intricate and well-defined design for metal art and body decoration works. It is good for making suitable works with precision and accuracy. With the immense importance of jeweller's saw frame, the study concludes that its variations identified in the study can be improved upon by advancing its adjustment mechanism to cater for both blade and material to enable large surface work production as such the need for this study and its like. The study recognized ferrous metal as fundamental metal for tool fabrication. Metal for tool fabrication is mostly from the ferrous metal family. This is because ferrous metal is durable in strength and tough to break. Using ferrous metal to fabricate jeweller's saw frame as it is in this study presents the ability of the saw frame to resist wearing off and deforming easily even under frequent handling of it (Books, 1981). This study gives assurance of enormous impact jeweller's saw frame will have on activities of designing, shaping, forming, forging and any other form of fabricating substrates into a finished product. It presents benefit for academic and non-academic institutions in providing more diverse options in imparting knowledge and giving training, skill and competency in jewellery making, metal product designing or fabricating as well as redefining substrates into a functional item.

5.0 Recommendations

The study recommends more write-ups from academia on jeweller's saw frame since pint-size materials and literature can be accounted for on this tool. Mass production of this jeweller's saw frame should be done to assist the jewellery and metal design and fabricator industry with more options of jeweller's saw frame. Academic institutions and informal teaching and learning organisations are encouraged to make good use of this saw frame and study it to produce an advanced one ahead of this current one. The study recommends the use of scrap metal in any further advanced jeweller's saw frame production to help put to use or recycle the use of scrap metal to assist save the environment from waste materials that are degrading it and to make scrap metals very useful in our society.

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