Flat blade screw driver for electrical applications engineering essay

Introduction

The aim of this project was to construct a flat blade screw driver for electrical applications. This assignment was to be completed in six three hour sessions over a period of nine weeks. Upon completion of this exercise one would have learnt various workshop skills and most importantly awareness in the workshop, due to exposure to a variety of machines and techniques used in the manufacturing process. This is important because as future engineers we need to be all rounded in all applications and though this exercise may not be precisely our field of engineering it is still important to become acquainted with these types of processes.

Work Shop Overview

In order to construct the screwdriver a variety of machines and tools were used to prepare and shape various parts of the screw driver.

Vee BlockListed below are these Machines and their Pictures: -

Bench Vice

Hacksaw

Height GaugeHammer

Band Saw

Wood Chisels

Milling Machine

Outside Calliper

Arbor Press

Metal Turning Lathe

Disc Sander

(Top) Clipping Hammer (Left) Weld Lead (Right) Mild Steel Welding Rod

Drilling Press

Description of Operation and Safety Warnings of Machines

Metal Turning Lathe

Operation

This is used to remove unwanted material from a work piece. This is done by attaching the work piece to a chuck and setting it to a desired R. P. M. drill bits and other cutting tools are used to remove the unwanted material.

Safety

Safety goggles must be worn to protect user's eyes from flying metal during operation.

Loose pieces of clothing must not be worn during operation. Safety jacket must be worn.

Tools and flammable materials must not be stored or placed on or close to machine while it is in use.

Wood Turning Lathe

Operation

This is used to shape and cut wood by rotating the wood to be cut /shaped at a desired R. P. M while the user moves the cutting tool (chisel) along the piece.

Safety

Safety goggles must be worn to protect user's eyes from flying wood chips during operation.

Loose pieces of clothing must not be worn during operation. Safety jacket must be worn.

Tools and flammable materials must not be stored or placed on or close to machine while it is in use.

A dust mask must be worn during operation to protect the user from inhaling finer particles.

Drilling Press

Operation

This is used to drill holes in various materials by means of a rotating drill bit boring into the material.

Safety

Safety goggles must be worn to protect user's eyes during operation.

Loose pieces of clothing must not be worn during operation. Safety jacket must be worn.

Tools and flammable materials must not be stored or placed on or close to machine while it is in use.

Whilst drilling, drill bit must be periodically removed after boring a short distance into material in order to clear bit and hole from filings.

Milling Machine

Operation

This is used to shape and cut solid materials. The work piece is attached to a rotating chuck whilst a rotating cutting device moves over the piece producing desired finish.

Safety

Safety goggles must be worn to protect user's eyes during operation.

Loose pieces of clothing must not be worn during operation. Safety jacket must be worn.

Tools and flammable materials must not be stored or placed on or close to machine while it is in use.

Arbor Press

Operation

This is used for pressing and fitting work pieces together such as riveting. It is a manual machine where force is applied to its handle, which in turn exerts a downward force on the work piece.

Safety

Safety goggles must be worn to protect user's eyes during operation.

Care must be taken to properly align pieces before applying any force.

Disc Sander

Operation

This is used to smooth wood pieces by pressing it against a rotating abrasive disc.

Safety

Safety goggles must be worn to protect user's eyes during operation.

Loose pieces of clothing must not be worn during operation. Safety jacket must be worn.

A dust mask must be worn during operation to protect the user from inhaling finer particles.

Welding Machine

Operation

This is used to weld together two or more pieces of metal. The lead comes into contact with the metal where the high current creates a spark which is called the welding flame.

Safety

A welding mask must be worn to protect eyes.

Welding gloves must also be worn to protect hands from heat and sparks.

The user must clearly say 'eyes' before making contact with the metal.

Safety goggles must be worn when chipping.

No flammable material must be stored near to welding table and safety jacket must be worn.

Process Plan

Several steps were used in the construction of this flat blade screw driver. They are:-

Construction of the blade

Construction of the handle

Construction of the collar

Assembly of components

Installation of pin

Machining of grooves in handle

Polishing of screw driver.

Construction of the blade

A piece of austenitic stainless steel rod was provided, from which a length of 212mm was measured and marked off using a permanent marker. A scriber was then used to mark off precisely the length of 212mm. The rod was then clamped in a bench vice and cut at that length using a hack saw.

The tip of the rod was then forged to obtain the flat blade (see Fig1 &2 in appendix). This was done using an oxy-acetylene blow torch, to heat one end till red hot, after which the tip was hammered to flatten it (see Fig3 in appendix). Upon reaching desired shape the tip was submerged in water at room temperature to cool it.

After cooling the now flattened tip was coloured with a permanent marker and placed onto a vee-block with the flattened side perpendicular to table top. Then the upper and lower height of the screw driver head from the table were measured and recorded using the height gauge. These values were then used to calculate the midpoint of the blade.

Once found, the scribed edge of the height gauge was then used to mark the midpoint on both sides of the screwdriver head, after which all other dimensions were marked onto the blade. Using these lines as reference, a file was then used to file down the excess metal from the head. Care was taken not to pass the scribed lines and to file parallel to the edges of head.

Construction of the Handle

A block of teak wood with dimensions of 4. 5cm x 4. 5cm x 15cm was provided. Diagonals were then drawn using a Miter combination square and pencil, on both of the 4. 5cm x 4. 5cm sides. After which a Tennon saw was used to cut grooves at about 2mm deep into the drawn diagonals.

The block was then locked into the wood turning lathe, and spun at about 1000 R. P. M. The parting chisel was then used to convert the block into a cylinder whilst the outside calliper was used to periodically check diameter of the handle.

The handle was then marked with a pencil along various points using a stencil. After which various chisels (see Fig4 in Appendix) were used to produce the desired shape of the handle to correct dimensions. In finishing a rough 120 grade sandpaper followed by the finer 320 grade sandpaper were used to smoothen handle. Finally excess pieces of wood were cut off from the handle using the Tennon saw after which the grinding disc followed by both grades of sandpaper were used to smoothen and remove any remaining blemishes.

Construction of the Collar

A length of galvanised pipe of diameter 26mm was provided. The pipe was then fitted into a metal turning lathe after which the tailstock was then moved so that the 15/16 inch drill bit was about 0. 5 inches away from the collar.

The lathe was then switched on and the carriage hand wheel was turned clockwise so that the drill bit bored into the pipe a short distance, after which the wheel was turned anti clockwise so that the drill bit could be cleared and PC10 fluid which acts as a coolant and lubricating agent could be applied.

This process was continued until an inner diameter of 24mm and a length of collar of 15mm was produced with an additional section of diameter 25mm on one end. This was to serve as a stopper which would prevent the collar from sliding when assembled.

Assembly of Components

Firstly the collar was pressed into the handle using an Arbor press, after which the blade and handle were mounted onto a metal turning lathe, where the blade was slightly pressed into the handle. This was done in the lathe to ensure that the blade was mounted into the handle horizontally. Finally using the Arbor press, the blade was pushed into the handle to the desired length.

Installation of Pin

A hammer and pin were first used to make a small indent on collar. Using this as a reference the screw driver was placed into a drilling press which had a drilling bit of 1/16 inch. Drilling was done gradually with the bit being removed periodically so as to remove shavings and to apply PC lubricating fluid.

After hole was produced a pin of length 28mm was inserted and both protruding ends were flared with a hammer. In finishing the flared ends were sanded using first a file then emery paper.

Machining of Grooves on Handle

The screwdriver was placed into the chuck of the Elliot Milling Machine which is used to produce horizontal grooves. The chuck consists of sixty equally spaced divisions. Machining was done at every fifteenth division in order to ensure equal spacing of grooves.

A convex shaped single lathe tool bit (fly cutter) was used to cut concave grooves onto handle. The cutter was set to produce grooves of 0. 080 inches in depth. The fly cutter was slowly moved forward along the handle, thus carving the groove. Unwanted vibration was reduced by placing a chuck under handle.

Polishing of Screwdriver

The screwdriver was rotated in a three jaw chuck, where the chuck held the screwdriver by the blade. Emery paper of grade 120 and 220 respectively were used to polish the handle followed by a length of wood. Upon completion, the position of the screwdriver was reversed in the chuck and the process was repeated for the blade, using only the 220 emery paper.

Justification of Materials used.

Several different materials were used during the construction of this screwdriver. Listed below are those materials and the reasons for their choice:-

Teak Wood

Teak wood was used in the construction of the handle for many reasons. Teak wood is strong, dense and durable and can be easily shaped. It would not corrode and would not easily decompose. Wood is also a poor conductor of electricity so it provides some isolation when working in electrical applications

Teak is also resistant to high temperatures; therefore it is suitable for hot electrical applications. Finally wood is a natural renewable resource which would harmlessly decompose in a landfill. Therefore teak wood was an environmentally friendly choice.

Stainless steel

Stainless steel was used in the construction of the blade. This was chosen because stainless steel has high corrosive resistance, also it is easy to machine and work with. It has an excellent strength to weight ratio which means that it can be used in heavy duty electrical environments, at high temperatures. Finally stainless steel is cheap and an overall economic choice.

Galvanised Steel

Galvanised steel is another low cost economic metal with a long life span. The galvanised layer provides protection for the rest of the steel against corrosion, thus making it a good choice for the collar.

Mild steel

Mild steel was used as the pin because it is fairly resistant to corrosion. It also does not have a high tensile strength so it can easily be flared onto the collar when placed into handle.

Discussion

The fabricated screwdriver is fairly suitable for electrical purposes, as it fulfils most of the criteria. Firstly it can remove a screw easily, it provides acceptable electrical insulation and it can perform at high temperatures. Secondly it is easy to construct, economical, environmentally friendly and attractive.

When compared to a Stanley Standard Blade (see Fig5 in appendix) flat head screwdriver, 5/16 x 6 inches, to the fabricated screwdriver in terms of electrical purpose, each tool has its advantage. The Stanley screwdriver has a plastic dielectric handle which offers greater electrical insulation than teak wood. Also the handle of the Stanley is softer than the wooden handle and more ergonomically designed for comfort and grip. The polished wooden handle might slip when untightening screws.

On the other hand the teak handle is more resistant to heat and hence will be more applicable in high temperature conditions. Also plastic is not as strong was wood, the handle of the Stanley is forged onto the blade and hence it more prone to breakage when compared to the wooden handle.

The blade of the Stanley is constructed of nickel alloy steel which is stronger and more corrosive resistant than stainless steel. However it is more expensive and harder to machine than stainless steel. The Stanley blade would have been preferred in electrical applications.

Finally by the process of forging the tip of the fabricated screwdriver was hardened. Hardened tips are needed for slip resistant fits and to prevent mechanical damage to blade. Both the Stanley and the fabricated screw drivers utilized hardened tips.

Conclusion

In conclusion the Fabricated Screwdriver may not be the best electrical screwdriver on the market but in its construction one would have certainly achieved the objectives of this project which was to learn various workshop skills, manufacturing processes, safe machine operation and an overall awareness of the workshop. The Fabricated Screwdriver also satisfied basic standards for use in an electrical environment, such as resistant to high temperatures and an insulated handle. It was also a perfect balance of cost, performance, quality and durability.

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