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DESIGN, CONSTRUCTION AND CHARACTERIZATION OF A MACHINE WORK TABLE

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ABSTRACT
Casting Work Is A Special Part Of Manufacturing World. It Is A Delicate And Interesting Process. Firstly, Involve The Making Of Pattern Usually Of Wood; It Is The Prototype Or Blue Print Of What The Actual Work Will Look, When Completed. Pattern Is Used To Create Or Make Cavity, Where Molten Cast Iron Will Be Poured. Casting Operation Involves The Use Of Following Elements I.E. Carbon, Silicon, Manganese And Nickel Is Added As Additive To Course Hardness Of The Material. While Iron Ore As Main Constituent. The Process Involve Melting It At Furnace At Temperature Range 1147^{0}C To 1197^{0}C, After Which Is Poured In A Hole Made By The Pattern Through The Sprue, Pins, Covered With Casting Sand. It Allowed To Cool At Zero Level To Ensure That The Cast Work Capacity Of Carrying Load And Damping Properties. This Project Is Aimed At Using Casing Operation To Form, Work Table Of Electrical Drilling Machine And Educated The Student On The Use And Maintenance Of Machine Tool (Electrical Drilling Machine) As Applicable To Industries And Curriculum.

INTRODUCTION
A drilling machine comes n many shapes and sizes, from small hand held power drill to bench mounted and finally floor mounted model. But all these have one general principle of operation operations other than, such as countersinking; counter boring, reaming and taping large or small holes.

The focus of this project work, will also cover the type of drill bits, and shop formulas for setting up each operation. As well as maintenance and safety precautions when operating on such equipment.
This work will also cover procedure for setting up the work and proper method of selecting tools and work holding devices to get the job done safety without coursing damage to the equipment, yourself (operator) as somebody nearby.

PERFORMANCE AND USE

A drilling machine, called a drill press, is used to cut holes into or through metals, wood, or other materials. Drilling machine use a drilling tool that has cutting edge of its point. This cutting tool is held in the drill press by a chuck or morse taper and is rotate and fed into the work at variable speeds. Drilling machine may be used to perform other operation as said earlier, they can perform countersinking, boring, counter boring, spot facing, reaming and tapping. Drill press operators must know how to set up the work, set speed and feed, and provide for coolant to get an acceptable finished product.
The size or capacity of drilling machine is usually determine by the largest piece of stock that can be centre drill a 30 inch diameter piece of stock. To Other ways to determine the size of the drill press are by the largest hole that can be drilled, the distance between the spindle and column, and the vertical distance between the world table and spindle and column, and the vertical distance between the work table and spindle.

CHARACTERISTIC

All drilling machine have the following construction characteristics a spindle, sleeve or Quill, column head work table and base

- The spindle holds the drill or cutting tools and revolves in a fixed position in a sleeve. In most drilling machines, the spindle is vertical and the work is supported on horizontal table.
- The sleeve or quill assembly does not revolved but may side in its bearing in a direction parallel to its axis when the sleeve carrying the spindle with a cutting to its axis tool is lowered, the cutting tool is fed into the work, and when it is moved upward, the cutting tool is withdraw from the work. Feed pressure is applied to the sleeve by hand or power

causes. The revolving drill to cut its way into the work a few thousandth of an inch per revolution.

- The column of most drill presses is circular and built rugged and solid, the column support the head and a sleeve or quill assembly.
- The head of the drill press is composed of the sleeve, spindle, electric motor, and feed mechanism. The head is bottled to the column.
- The work table is supported to an arm mounted to the column. The work table can be adjusted vertically to accommodate different height of work, or it may be swung completely out of the way. It may be tilled up to 90^0 in either direction, to allow for long pieces to be end or angle drilled.

TYPES OF DRILLING MACHINES

There are two types of drilling machines used by maintenance personnel for repairing and lubricating needed parts: powered feed or hand feed. other types of drilling machines such as radial drill press, numerically controlled drilling machine, multiple spindle drilling machine, gang drilling machine and turret drill press, are all variation of the basic brand and power feed drill machines. They are designed for high speed production and industrial shop.

a) **Power feed:** the power feed drilling machines are usually larger and heavier than the hand feed. They are equipped with the ability to feed the cutting tool into the work automatically, at a preset depth of cut per revolution of the spindle, usually in thousandths of an inch per revolution. These machines are used in maintenance shops for medium duty work or work that uses large drill that required power feeds. The power feed capacity is needed for drills or cutting tool that are over $^1/_2$ inch in diameter, because they require more force to cut that which can be provided by using hand pressure. The speeds available on power feed machine can vary 50 **RPM**, the slower speed allow for special operations, such as reaming counter boring and boring counter sinking. The size of these machines generally ranges from 17 inch to 22 inch centre drilling capacity, and arc usually floor mounted. They can handle drills up to 2 inches in diameter, which mount into tapered Morse sockets. Larger work pieces are usually damped directly to the table or base using bolt stop mechanism is located on the head, near the spindle, to aid in drilling to a precise depth.

b) **HAND FEED:** this work is mainly concentrate on the hand feed drilling machines are the simplest and most common type of drilling machines in use today. These are light duty machines that are hand-fed by the operator using a feed handle, so that the operator is able to "feel" the action of the cutting tool as it cuts through the work piece. These drilling machines can be bench or floor mounted. They are driven by an electric motor that turns a drive belt on a motor pulley that is connected to the spindle pulley. Hand feed machines are essentially high speed machines and are use on small work piece that require holes $\mathbf{^1/_2}$ inch or smaller. Normally, the head can be moved up and down on the column by loosening the locking bolts, which allow the drilling machine to drill different height of work.

c) **The drilling operations**

After a work piece is laid out and properly mounted, the drilling process can begin. The drilling process, or complete operation, involves selecting the proper twist drill or cutter for the job, properly installing the drill into the machine spindle, setting the speed and feed, starting the hole on centre, and drilling the hole to specification within prescribe tolerance. Tolerance is the allowable deviation from standard size. The drilling process must have some provisions for tolerance because of the over sizing that naturally occurs in drilling. Drilled hole are always slightly larger than the diameter of the drill's original designation. For instance a $^1/_4$ inch twist drill will produce a hole that may be severally thousandth an inch larger by the machine operator.

Selecting the Drill

Since there are three basic type of drill ie

a. Twist Drill: used for drilling holes from sizes from 1mm to 14mm

b. Forstner Bit: used for larger diameter holes. It is drilled very slowly so that bit does not jam in the wood.

c. Hole Saw: for large diameter a "hole saw" can be used,.

The advantage of this type of drill bit is that the blade can be changed to give different sizes of diameter.

Selecting the proper twist drill means getting the right tool for the job.

The material to be drilled, the size of that material, and the size of the drilled hole must all be considered when selecting the drill. Also, the drill must have the proper lip angle and lip clearance for the job. The drill must be clean and free of any burs or chips. The shank of the drill must also be clean and free of burs to fit into the check. Most drill wear on the outer edges and on the chisel point, so these areas must be checked and reshapedned if needed, before drilling can being. If the twist drill appears to be excessively worn, replace it.

Installing the Drill:

Before installing the drill into drilling machine spindle clean the spindle socket and drill shank of all dirt, chips and burrs. A small tile inside the socket to remove any tough burrs. Slip the tong of the drill or geared drill chuck into sleeve and align he tong into the keyay slot.

Tap the end of the drill lightly with a soft hammer to seat firmly. Another method used to seat the drill into sleeve is to pace a block of wood on the machine table and place the drill down unto the block.

Selecting Drill Speed:

Speed refers to the revolution per minutes (RPM) of the drilling machine spindle. For drilling, the spindle should rotate at a set machine spindle. For drilling, the spindle should rotate at a set speed that is selected for material being drilled; correct speed is essentially for satisfactory drilling. The speed at which a drill turns and cuts is the peripheral speed. Peripheral speed is the speed of a drill at its circumference expressed in surface feet per minutes (**SFPM**). This speed is related to the distance a drill would travel, if rolled on its side. For example a peripheral speed of 30 feet1minutes if rolled on its side.

It has been determined through experience and experiment that various metal machine beat at certain speeds; this best speed for any give metal is what is known as its cutting speed (**CS**). If the cutting speed of a material is known then a simple formula can be used to find the recommended RPM of the twist drill.

The slower of the two recommended speed is used for the following formula due to the varying condition that may exist such as the rigidity of the setup, the size of the drilling machine and the quality of finish.

RPM = Cs X 4/D

Where RPM = Recommended cutting speed in surface per minutes
D = the diameter of the drill itself
For example, if a $^1/_2$ – inch (0.500) – inch) twist drill is to cut aluminum, the formula would be set up as follows
RPM = 200 x 4/500 = 800/500 = 1600RPM
Thus the drilling machine would be set up to drill as close to **1, 600 RPM** as possible. It is best to use the machine speed that is closest to the recommended RPM. When using the metric system of measurement, a different must be used to find **RPM**
RPM = cs (m) x 320/D (mm)
Where RPM = drill speed in revolution per minutes
Cs = Recommended cutting speed in surface meter per minutes
320 = A constant for all metric **RPM** calculation
D = Diameter of the twist drill in millimeters
For example, if a 15 mm twist drill is to cut medium carbon steel, with a recommended cutting speed of 21.4 meter per minutes, the formula would set up as follows.
RPM = 21.4 X 320/15 = 6848/15
RPM = 21.4 X 320/15 = 6848/15 = 456.533. RPM or 457
RPM
The RPM is round up or down to the nearest machine speed and the speed can be adjusted, i.e. lower or higher if condition permit.

Special operations Drilling Machine
Counter Sinking: is the tapering or beveling of the end of a hole with a conical cutter called a machine countersinking often a hole is slightly counter sank to guild pin which are to be driven into work piece. But more commonly counter sinking is used to form recesses for flat head screws.

a) **Counter boring:** is the process of using a counter bore to enlarge the upper end of a hole a per determined depth and machine a square shoulder at that depth.
b) **Spot facing:** is the smoothing off and squaring of a rough or curved surface around a hole to permit level seating of washes, nut or boltheads.
c) **Tapping:** is cutting a thread in a drilled hole. is accomplished on the drilling machines chuck to hold and align the top, while it is turned by

hand since the drilling machines is not a tapping machines is not a tapping machines, so it should not be used to power top.

d) **Reaming:** Reaming drilled hole is another operation that can be performed on a drilling machine. It is difficult, if not impossible, to drill hole to an exact standard diameter. When great accuracy is required, the hole are first drilled slightly undersized and then reamed to size.

e) **Boring:** occasionally a straight and smooth hole is needed which is too large or odd size for drill or reamers; a boring tool can be inserted into the drilling machine and bore any size hole which the tool holder will fit. Boring bar with a tool bit installed is used for boring on the larger drilling machines.

DESIGN AND CONSTRUCTION

PATTERN MAKING:-

A special part of manufacturing/engineering world is casting or foundry work as it is property called. This usually involves casting molten iron. Before any casting can be place, a pattern is made usually of wood. This is called pattern is made usually of wood. This is called pattern making and industry this is a very skin full job. Pattern can be said to be a proto-type or blue print of what the actual job will look like when completed. Any inaccuracy of this stage will result in the final cast being wrong or even falling. The pattern can be made from pop (Plastic of Paris) ceramics material and etc. but is usually made from; wood and its sides are given a draft (an angle) so that it can be removed easily from the sand.

Material Composition

There are different types of casting operation white cast iron ductile cast iron ladler cast, grey cast iron leadler cast iron, grey cast iron and etc. but the most suitable for this work is grey cast iron, because it has a most capacity of carrying load and has a damping properties. Which is a good characteristic of a work bench table of a drilling machine?

In grey cast iron, the following element is involved, carbon, silicon, manganese and nickel in the following percentage carbon 4.2%, silicon 3.1 %, manganese 0.4% and 2% of nickel is additive to improve the hardness, while iron ore as

main constitute. It is heated to temperature range of 1147^0c to 1997^0c in a blast furnace and it must be allowed to cool at zero level ie: 24 hours natural cooling.

Foundry Work (Casting)

1st Stage. The pattern after final cleaning is placed on a flat board and casting box called a "drag" being placed over (pattern). Special casting sand (usually called green sand) will soon be packed around the pattern, but to ensure that it can be removed easily from the sand, parting powder is sprinkled over and around it. Parting powder is similar to talcum powder. It stops the casting and sticking to the pattern and pulling away with it. When the pattern is finally removed from the sand. Casting sand is then shaken through a sleeve called riddle sand. So that only five particles will be used to fill around the pattern. This is called facing sand and it must be fine so that detail on the pattern shows up on the final casting. Different types of sand are available. The safest is called petro-bond. This is a mixture of quality sand and oil. The cheapest is called green sand and this is mixed with water. Green sand must be mixed with water is added. When molten cast iron is poured into the mould an expansion can result.

2ndStage. The drag is then packed with more casting sand. It is a good idea to sieve all the sand being placed above the pattern and then ram it down firmly using a ramming tool. The tool has two ends, one is cylindrical and its quit point and this can be used for packing sand close up to the pattern. When the drag is packed fully, it is leveled off and is called stickled off using a straight steel bar. The entire drag and it content are then turned over so that base of the pattern can be seen complete u turn. A top box is called a "cope" is then placed on top of the drag and locating pins are put in position so that the casting boxes cannot moved side way and is exactly in line with each other.

3rdStage. Spur pins are positioned one usually on the back of the pattern and the other to the side. These will eventually provide an entrance and exist for the molten cast iron when it is poured into sand the sand is packed/rammed into the cope in the same way as the drag. Parting powder is first applied followed by facing sand. The sprue pin should be father than the box and stand out from the sand when it is leveled with a striking bar small depression are dug into the sand at the top of the two sprue pins. These are useful when the molten cast iron is poured. The depressions are called the poring basin and feeder.

The top box (the cope) is then removed is then removed and if all it is well; the cope with the sand inside should lift of the drag (bottom box) without the sand falling out. A small "gate" is cut below the iron to flow into the cavity left by the mould. Small tools are available or can be made to a dig a variety of shapes in the casting sand. They are similar to small towels.

The pattern is removed using a spike the end of the spike can be threatened and so it can be screwed into softwood pattern. Before removing the pattern from the sand. It ca then be lifted away from the casting box (Drag)

4thstage. The cope (top casting box) is poured back on top of the drag and the locating pins put in position. Before this is done vents can be created using a thin pieces of welding rod, pashing it, through the sand. This allows gases to escape once pashing it through the sand. This allows gases to escape once these are poured. The molten cast iron is poured down the hole left by the spur pin called the runner with great care. As it runs down the runner it flows through the gate cut by the trowel, into the cavity left by the pattern and up the riser, the hole left before removal from the sand to ensure complete solid fraction and to cool to zero level. When removed from the sand the runner and riser are cut away and the cast work is ready for machining (cleaning)

Machining

Can also be called cleaning, since it involve the use of machine tools to smoothen the surface and as well create hole and mill to a desired dimension on already cast work in order to smoothen and polish it mainly it involve the use of machine tools like centre lather machine, drilling machine and finally milling machine. After machining comes packaging.

SUMMARY/ CONCLUSION

This work involves the use of metallurgical casting technique to construct workbench of electrical drilling machine. By a special type o casting know as grey cast iron. Work bench of electrical drilling machine is where object to be work is placed. It involve making the pattern, the pattern is design in a manner to have enforcement in form of ribs to increase it tensile strength .casting work, otherwise known as foundry work is delicate and interesting. Firstly it involve getting the required raw material and choosing the type of casting operation; since there are many type of casting method e.g. white cast iron, grey cast iron and etc.

Grey cast is used for it damping properties, that is; it ability to resist or carry shock. It involve placing the pattern in a box called cope and drag, which is

filled with casting sand, sprue pin and riser for entrance of molten metal and exit of gases. Normally the solidification takes about 25 hours to cool at zero level.

When solidification must have take place a process known as knocking out is used to remove the cast work from the casting sand. Finally the cast work is set for cleaning or surface smoothing otherwise known as machining. It involved using lathe machine power drill and etc. when this is done the rubbed with oil and package or packaged.

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