Fabrication Of Horizontal Drilling Machine

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Abstract- *Horizontal drilling is a drilling process in which the drill is turned horizontally at work piece. It is used to cut holes into metal, wood, or any other materials which are not possible to move or rotate on the machine. The main objective of horizontal drilling machine is to drill horizontal work piece like railway tracks. Horizontal drilling machine is used for the make a holes at work piece in horizontal direction which are more in immovable nature, heavy, difficult to etc. And it performs multiple tasks like drilling operation, reaming operation and boring operation. By using this horizontal drilling machine we can make holes up to 20 mm diameter. The major applications of the horizontal drilling machine are as follows,*

Railway track, Electric poles, Vertical I-Section drilling, C-Section drilling.

Keywords- Drilling, Reaming, Boring, Horizontal Machine

I. INTRODUCTION

Drilling is a material removing or cutting process in which the tool is uses a drill bit to cut a hole of cross section in solid material. The Horizontal Drilling machine is used to makes a different sizes of circular holes on a work piece in horizontal direction. By using this drilling machine we can makes the different types of drilling operations like drilling, reaming and boring operations. This is the most common machining process; one estimate is that that 75% of all cutting material removed comes from the drilling operations. This chapter contains basic information pertaining to drilling machines. Drilling machine is one of the most important machine tool in a work shop. It was designed to produce a cylindrical hole of required diameter and depth on metal work pieces. Though holes can be made by different machine tools in a work shop, drilling machine is designed specifically to perform the operation of drilling and similar operations. Drilling can be done easily at low cost in a shorter period of time in a drilling machine. Drilling can be called as the operation of producing a cylindrical hole of required diameter and depth by removing metal by the rotating edges of drill. The cutting tool known as drill is fitted into the spindle of the drilling machine. A mark of indentation is made at the required location with a center punch. The rotating drill is pressed at the location and is fed into the work. The hole can be made up to a required depth.

1.2 Different types of drilling operations:

The operations that are commonly performed on drilling machines are,

1. Drilling
2. Reaming
3. Boring

1.2.1 Drilling:

This is the operation of making a circular hole by removing a volume of metal from the work piece by a cutting tool called drill.

1.2.2 Reaming:

This is the operation of sizing and finishing a hole already made by a drill. Reaming is performed by means of a cutting tool called reamer having several cutting edges. Reaming serves to make the hole smoother, straighter and more accurate in diameter. Reamer may be classified as solid reamer and adjustable reamer.

1.2.3 Boring:

This is the operation of enlarging a hole by means of adjustable cutting tools with only one cutting edge. A boring tool is employed for this purpose. It used to finish a hole accurately and to bring it to the required size. In machining, boring is the process of enlarging a hole that has already been drilled (or cast) by means of a single point cutting tool

II. LITERATURE REVIEW

This survey presents a literature review on drilling operation modeling to study the effects of parameters on performance measures. The physical process is defined and the key process parameters that are significant to its modeling are highlighted. In recent years, many of the researchers has investigated the machining operation for identifying the parameter influence on different responses and building of

mathematical model with the assistance of response surface methodology, Fuzzy Logic and Artificial Neural Network, etc. Generally, the modeling of the drilling process can support to achieve the process parameters with less effort and with economic benefits:

1. A.S.Udgave et.al. In this paper author studies and tries to study attachments for the radial drilling machine to make it special purpose machine. This will increase productivity and also reduces time. In this paper work is done on the currently going on job as well as it includes industrial case study. Spindle head is developed to drill two holes simultaneously in one setting only. Two spindles are driven by a single motor with mechanism of changing speed. Different mechanism is given to the table and spindle head to adjust according to work piece. Also this paper gives information about types of multi spindle drilling head.

2. Dnyaneshwar Bharad et.al. Here study of different parameters which is affecting the production capacity and time has been discussed. In the study author states that machining time required is main or one of the main parameter which will affect the efficiency of machine. Author also discusses about advantages of using two drilling heads over conventional drilling machine such as achieving two holes at the same time, less space required than any conventional drilling machine, only one driving motor required, etc.

3. Manish N Kale et.al. In this author studies two different processes which can be achieved on single machine i.e. drilling and riveting on a single special purpose machine. Earlier drilling is done on a drilling machine after that for riveting operation component is setup on a orbital riveting spindle which is very time consuming process and apparently it will affect the productivity of the machining system. This problem is focused and solution is given to this problem. Along with this analysis of the machine parts has been done by using different computer software's. Concluding all this things, time saved per job is 24.7 sec.

4. Prof P.R. Sawant et.al.have conducted case study on multi drilling and tapping machine. Here they have compared different parameters of the special purpose machine for drilling and tapping with the radial drilling machine. They have considered 7 holes of same diameter, 1 hole of larger diameter, 1 linear tapping operation, 1 angular tapping operation. By performing this operation on both machine they made the conclusion. What to do increase productivity and to enhance machining system. Advantages of automatic work handling and control system over the manual system also has been studied.

5. Yaman Patel et.al studies different problems that are restricting mass production rate and develop a new drilling machine in which the main purpose is to minimize time required for drilling holes on different PCD and also paper deals with the improvement of cycle time.

III. FABRICATION OF HORIZONTAL DRILLING MACHINE

3. 1: Major Components:

1. Motor 2. Gear Box 3. Drill chucks 4.Spindle 5. Chain Drive 6. Feed mechanism 7. Bearings 8. Clamping screws 9. Drill bit 10. Job holder

3. 1.1 MOTOR:

A single phase induction motor is an AC were electrical energy is converted into mechanical energy to perform a drilling operation. This induction motor requires only one power phase for their proper operation. They are commonly used in low power applications, in domestic and industrial use. Simple construction, cheap cost, better reliability, eases to repair and better maintenance are some of its markable advantages.In a drilling machine we are using a single phase ac motor. Which can run at rpm of 2600 may be more for high duty drilling machines.

Fig.3.1 AC induction motor

Motor specifications:

No of Phase: Single phase
Rated power: 0.25 HP
Voltage: 220 V
Material: Cast iron
Frequency: 50HZ
Rated speed: 2600 rpm

3.1.2 GEAR BOX:

The gear box which is also known as the transmission system .Gear is used to transmit power and also for getting different speed. In a drilling machine, we use bevel gear to transmit power. Gear box is a mechanical device used for

torque increase/decrease via speed reduction/increase. It Consist of two or more gears with one of the gears driven by the motor. It is used for purpose of reducing the speed of the motor from 2600rpm to the spindle speed of 173 rpm. The output speed of the gear box will be inversely proportional to gear ratio. A gear is a kind of machine element in which teeth are cut around cylindrical or cone shaped surfaces with equal spacing. By meshing a pair of these elements, they are used to transmit rotations and forces from the driving shaft to the driven shaft. Gears can be classified by shape as in volute, cycloidal and trochoidal gears. Also, they can be classified by shaft positions as parallel shaft gears, intersecting shaft gears, and non-parallel and non-intersecting shaft gears. The history of gears is old and the use of gears already appears in ancient Greece in B.C. in the writing of Archimedes.

Fig. 3.2: Gear box

3. 1.3 Drill chuck :

The drill chuck is mounted on the lower end of the spindle, it holds the drill bit. Here also a key hole is provided to change the drill jigs. Drill chucks are generally self centering. In a drill machine, we use three jaw chucks. And is made of special alloy steel. A drill chuck is a specialized type of clamp used to hold an object with radial symmetry, especially a cylinder. In drills and mills it holds the rotating tool whereas in lathes it holds the rotating work piece. Many chucks have jaws, (sometimes called dogs) that are arranged in a radically symmetrical pattern like the points of a star. The jaws are tightened up to hold the tool or work piece. Often the jaws will be tightened or loosened with the help of a chuck key, which is a wrench -like tool made for the purpose. Many jawed chucks, however, are of the keyless variety, and their tightening and loosening is by hand force alone. Keyless designs offer the convenience of quicker and easier chucking and un chucking, but have a lower gripping force to hold the tool or work piece, which is potentially more of a problem with cylindrical than hexagonal shanks. Collect chucks, rather than having jaws, have collects, which are flexible collars or sleeves that fit closely around the tool or work piece and grip it when squeezed. Chucks on some lathes have jaws that move independently, allowing them to hold irregularly shaped objects. A few chuck designs are even more complex, involving specially shaped jaws, higher numbers of jaws, quick-release mechanisms, or other special features. Magnetic and vacuum chucks are also made, with typically flat surfaces against which work pieces or tools are firmly held by the pressure of their respective force. To chuck a tool or work piece is to hold it with a chuck, in which case it has been chucked. Chucking individual slugs or blanks on a lathe is often called chucking work. In bar work or bar feed work the stock protrudes from the chuck, is worked upon, then parted off (cut off) rather than sawn. Automatic lathes that specialize in chucking work are often called checkers. Types of Drill Chucks: Drill chucks are the part of a drill in which the drill bit is encased and held in place. They are essentially revolving cylinders that are placed on the end of the drill. They usually consist of three sides, or jaws, which move in concert when the outer sleeve of the chuck is turned. Two major types of drill chucks exist, keyed and keyless drill chucks, but within these two major divisions are many sub-types, intended for a wide variety of functions

a. Keyed Chucks

Keyed chucks require a key to be inserted in the side of the before it can be adjusted. They can turn either clockwise or counter-clockwise.

Fig: Keyed chuck.

3.1.4 SPINDLE:

In machine tools, a spindle is a rotating axis of the machine, which often has a shaft at its heart. The shaft itself is called a spindle, but also, in shop-floor practice, the word often is used metonymically to refer to the entire rotary unit, including not only the shaft itself, but its bearings and anything attached to it. A machine tool may have several spindles, such as the headstock and tailstock spindles on a bench lathe. The main spindle is usually the biggest one. References to "the spindle" without further qualification imply the main spindle. Some machine tools that specialize in high-volume mass production have a group of 4, 6, or even more main spindles. These are called multi spindle machines. For example, gang drills and many screw machines are multi spindle machines. Although a bench lathe has more than one spindle, it is not called a multi spindle machine; it has one main spindle. Spindle shaft is used, which will hold the drill

bit and provide a necessary support for the drill bit. Also a hollow shaft is to be used, so that the weight is reduced and to increase the strength and stop the spindle in least possible time. Hollow shafts are much better to take tensional loads compared to solid shafts. Also has greater strength to Weight ratio.

Fig 3.5: Spindle.

3.1.5 CHAIN DRIVE:

A Chain drive is a mechanical device which is used to rotate the camshaft in internal combustion engines and various gears which are connected through the chain drive. It is also used to transmit mechanical power from one place to another and consists of chain links that are connected in an endless series which mesh with the gear tooth sprockets. Chain drive along with the gear sprockets acts like a flexible gearing system for transmitting power from one movable part to other movable parts of the machine. The use of chain drives is simple yet effective way of transmitting mechanical power to rotate the parts of a machine. The chain has links that are meshed easily with a tooth sprocket that is similar to a pinion gear and this action provides a positive speed ratio between the driving unit and a driven unit in a machine.

Fig 3.6 Chain Drive

3.1.6 FEED MECHANISM:

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-by the operator, using a feed handle. So that operator is able ‘’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 connects to the spindle pulley. Hand-feed machines are essentially high-speed machines and are used on small workplaces that require holes 1/2 inch or smaller. Normally, the head can be moved up and down on the column by loosening the locking bolts. Which allows the drilling machine to drill different heights work? In drilling machines generally both the cutting motion and feed motion are imparted to the drill. Like cutting velocity or speed, the feed rate also needs varying [within a range] depending upon the tool work materials and other conditions and requirements. The drill receives its feed motion from the output shaft of the feed speed gear box through the feed gear box. The cutting motion drilling machines is attained by rotating the drill at different speeds [RPM]. Drilling machine also need to have a reasonably large number of spindle speeds to cover the useful ranges of work material, tool material, drill diameter, machining machine tool conditions. The drill gets its rotary motion from the motor through the speed gear box.

Fig 3.7 Feed Mechanisms

3. 1.7 BEARINGS:

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races. A bearing is a machine element that constraints only the desired motion, and reduces friction between relative motion between moving parts. The design of the bearing may , for example , provide for free linear movement of the moving part or for free rotation around a fixed axis ; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. The bearings are classified broadly according to the type of operation, the motion allowed, or to the directions of the loads [forces] applied to the part There are many types of bearings, each used for different purposes.

Fig: Ball bearing.

3.1.8 CLAMPING SCREWS:

Clamping screws are mechanical elements which use screw thrust for work piece fixing and positioning. Point contact by the full ball securely fixes the work piece. They include several varieties of tip ball shape and material, which can be selected according to the application. As well, hex socket head cap screw type clamping bolts have functions similar to clamping screws.

When fixing the work piece by clamping its inclined surface, the jig body must be machined to match the work piece shape. However, with clamping screws; the jig body just needs screw threading. Jig body shapes can be made simpler. In addition the work piece contact surface wears, just replace the clamping screw. The time and trouble of maintenance is reduced. When fixing the work piece by clamping its inclined surface, the jig body must be machined to match the work piece shape. However, with clamping screws; the jig body just needs screw threading. Jig body shapes can be made simpler. In addition the work piece contact surface wears, just replace the clamping screw. The time and trouble of maintenance is reduced.

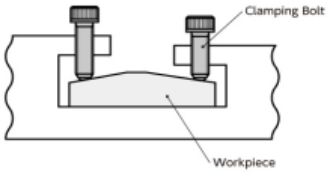

Fig.3.9 Clamping Screws

3. 1.9 DRILL BIT:

Drill bits are cutting tools used to remove material to create holes, almost always of circular cross-section. Drill bits come in many sizes and shapes and can create different kinds of holes in many different materials. In order to create holes drill bits are usually attached to a drill, which powers them to cut through the work piece, typically by rotation. The drill will grasp the upper end of a bit called the shank in the chuck. Drill bits come in standard sizes, described in the drill bit sizes article. A comprehensive drill bit and tap size chart lists metric and imperial size drill Bits alongside the required screw tap sizes. There are also certain specialized drill bits that can create holes with a non-circular cross-section.

Materials used to make drill bits:

- Carbon Steel
- High Speed Steel (HSS)
- Cobalt Steel
- Tool Steel w/ Carbide Tips
- Solid Carbide.

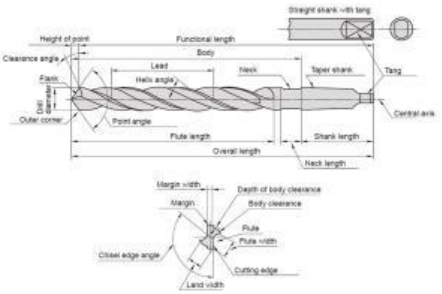

Fig: Drill bit parts

IV. WORKING PROCESS

When we given the power supply to the spindle which is connected with the motor starts to operate. The motor is connected to the drill bit through gear box. The gear box reduces the speed of the motor from 2600 RPM to I73 RPM. Work piece is placed rigidly in the job holder. We can give the suitable feed to the work piece by rotating the hand wheel. We can make the holes on the work piece up to 20mm diameter. The rotating edge of the drill exerts a large force on the piece and the hole is generated. Drilling is a cutting process that uses a drill bit to cut a hole of circular cross section in solid materials. The drill bit is usually a rotary cutting tool, often multi point. The drill bit is pressed against the work piece and rotated at rates from hundreds to thousands of RPM. This forces the cutting edge against the work piece, cutting off chips from the hole as it is drilled Drilling may affect the mechanical properties of the work piece by creating low residual stresses around the hole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface. This causes the work piece to become more susceptible to corrosion and crack propagation at the stressed surface. A finish operation may be done to avoid these detrimental conditions. Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool. Cutting fluid is commonly used to cool the drill bit, increase the tool life, increase the speed and feeds, increase the surface finish, and aid in ejecting chips. Application of these fluids is usually

done by flooding the work piece with coolant and lubricant or by applying a spray mist.

Operations under adverse conditions require special care. If machines are operated under extremely dusty conditions. Operate at slowest speeds to avoid rapid abrasive wear on the moving parts and lubricate the machines more often. Under extreme cold conditions, start the machines at slow speed and allow the parts and lubricants to warm up before increasing the speeds. Lubricant is important because of the heat and the friction generated by the moving parts.Put a light coat of oil on all unpainted surfaces to prevent rust. Operate all machines with care to avoid overworking the electric motor. Cutting tools as per requirement of the job can be fixed into the chuck. Electric motor is used as a prime mover to drive the spindles with the help of a belt and pulley arrangement. now it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

The following are some related processes that often accompany drilling:

Counter boring: This process creates a stepped hole in which a larger diameter follows a smaller diameter partially into a hole.

Countersinking: This process is similar to counter boring but the step in the hole is cone-shaped.

Boring: Boring precisely enlarges an already existing hole using a single point cutter.

Friction drilling: Drilling holes using plastic deformation of the subject (under heat and pressure) instead of cutting it.

Reaming: Reaming is designed to enlarge the size of a hole to leave smooth sides.

Spot facing: This is similar to milling; it is used to provide a flat machine surface on the work piece in a localized area.

Fig.4.1 Horizontal Drilling Machine

5. 1 DISCUSSION:

In this project fabrication of horizontal drilling machine is successfully completed. By using this machine we can make holes up to 20mm diameter. We can make the circular cross section of holes on the different types of materials like wood, iron or any other materials.

5.2 ADVANTAGES:

Mostly drilling machine is used for drilling a variety of holes of different sizes. Also as per requirement of the industry or design of component, different operations can be done such as reaming, countersinking, tapping, etc. just by changing the tool and jig and fixtures designed for the component.

The horizontal drilling machine consists of several advantages. They are,

- Construction is simple.
- Machine can be moved easily to required place.
- Low cost
- Machine occupies less space.
- Easy to operate.
- Highly accurate and more efficient.
- It will save energy consumption.
- No skilled operator is required.

5.3 LIMITATIONS:

- Horizontal drilling machine is used to make holes at work piece in horizontal direction only.
- Only small components can be drilled.
- Loading and unloading of work piece done manually.
- Drilling is done manually.

5.4 APPLICATIONS:

The major applications of the horizontal drilling machine are as follows,

- Railway tracks
- Electric poles
- Vertical I-Section drilling
- C-Section drilling
- Flats and Angular.
- It is used in workshops.

5.5 RESULT:

By using this horizontal drilling machine, holes can be drilled within the range of 5-20mm.

Fig.5.1 Horizontal Drilling Machine

Fig: 5.2After drilling operation on the work piece

VI. CONCLUSION

By using this Horizontal Drilling Machine we can make holes upto 20mm diameter in horizontal direction. And by improving this machine in future we can make a holes up to 30mm diameter also.

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