

IMPLEMENTATION OF MULTI PURPOSE MECHANICAL MACHINE

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ABSTRACT: This project deal with design, development and fabrication of “MULTIPURPOSE MECHANICAL MACHINE”. This machine is designed for the purpose of multi operations.

They are as follows:

1. DRILLING,
2. CUTTING,
3. GRINDING &
4. SHAPING.

This machine perform multipurpose operation at same time with required speed & this machine is automatic which is controlled or operated by motor which is run with the help of current. This machine is based on the mechanism of whit worth return and belt drive. This model of the multi operational machine is may be used in industries and domestic operation which can perform mechanical operation like drilling, cutting &shaping of a thin metallic as well as wooden model or body.

Keywords; drilling, cutting, shaping, multipurpose, grinding

I. INTRODUCTION

Introduction:-

The project work subject is one, in which actually we are leaning the theoretical concepts in practical way. Also the practical experience is one of the aims of this subject. For a developing industry these operating performed and the parts or components produced should have its minimum possible production cost, then only the industry runs profitably. There are a number of units having used in industries for various purposes.

Aim and Objective of Work:-

The aim of our project is to design and development of MULTI PURPOSE MECHANICAL MACHINE, a structured which is designed for the purpose of MULTI-OPERATIONS.They are as follows:

1. DRILLING,
2. CUTTING,
3. GRINDING &
4. SHAPING.

Problem Specification

Selection of Material

Several problems were faced during the selection of materials. The materials were bought according to the specifications derived from the designing software.

Availability of the Materials

During the selection and purchasing of the materials several parts and screws were not available according to the design.

To solve this issue the parts were manufactured according to the design.

Loss of material during fabrication

During the fabrication material was removed resulting in the change of the dimensions of the specific part, so redesigning was done considering the machining allowance.

Improper fitting of the parts

Problems were faced during the operation of machine due to the miss-alignment of frame, to solve this issue redesigning of the frame was done keeping the operation area of the used part.

Problems faced in during operation.

Due to the gear speed and torque ratio of the motor, the machine was undergoing heavy load. To solve this speed and torque ratio was re-calculated and the motor was changed according to the new ratio.

II. IMPLEMENTATION,WORKING PRINCIPLE & OPERATION

Reason to Design Machine

The reason to design a multipurpose mechanical machine because there is no machine which perform various operation(i.e. drilling, cutting, shaping & grinding) at same time with required speed & this machine is automatic which is controlled or operated by motor which is run with the help of current. This machine is based on the mechanism of whit worth return and belt drive. This model of the multi operational machine is may be used in industries and domestic operation which can perform mechanical operation like drilling, cutting &shaping of a thin metallic as well as wooden model or body.

Working Principle of Machine

There are only three major principles on which this proposed model generally works.

1. Whitworth’s quick return mechanism
2. Power transmission through belt drive
- 3.Eccentric-and-rod mechanism

Whitworth’s Quick Return Mechanism

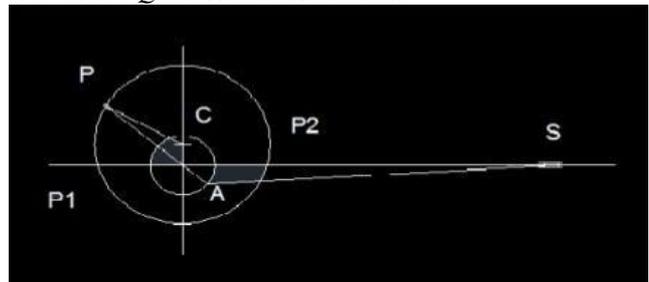


Fig:-3.3.1 Whitworth’s Mechanism

The above diagram shows the mechanism as used on the apparatus. Link 1 on the top diagram is extended to point A. attach to point A is another link with pivot. The other end of this link terminated in a slider. In a machine tool where this mechanism is used the cutting tool is attached to this slider.

The link POA rotates about an O. The mechanism is driven by crank PC which rotates at about C with constant velocity. The slider at P slides along POA as the crank is turned. Its path is shown by the dashed circle, centered on C and through P. Clearly when P is at P1 the slider S is at the outer extremity of its travel .When P is at P2 the slider S is at the inner extremity of its travel.

Now as PC rotates with constant velocity the time taken to go from P1 to P2 is less than that taken to go from P2 to P1. However during both those time intervals the slider as moving the same distance. Therefore the speed of S is different during the different parts of cycle. During the shorter time intervals P1 to P2 the slider as has the greater speed and during the interval P2 to P1 it has slower speed. Thus P1 to P2 is quick return and P2 to P1.

When applied to metal cutting machine the other advantage is variable power distribution during the cycle .When S is on the return stroke the slider at P is nearer to O and simple moment's shows that the torque applied is low. Hence, the return stroke uses less power as $P=T \cdot w$. During the cutting stroke the slider at P is at greater radius from O and thus more power is available to perform useful work in cutting metal.

Thus the overall performance is to provide high power forward cutting stroke with a low power and higher speed quick returning preparation for the next cut.

Power Transmission through belts

Belts are the cheapest utility for power transmission between shafts that may not be axially aligned. Power transmission is achieved by specially designed belts and pulleys. The demands on a belt-drive transmission system are large, and this has led to many variations on the theme.

They run smoothly and with little noise, and cushion motor and bearings against load changes, albeit with less strength than gears or chains. However, improvements in belt engineering allow use of belts in systems that only formerly allowed chains or gears.

Types of Bely Drive

1. Flat Belt
2. V Belts
3. Timing Belt
4. Round Belt

Flat Belt Drive

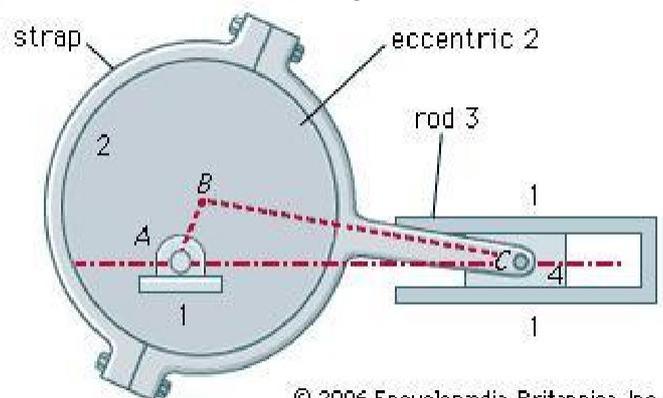
Flat belts were widely used in the 19th and early 20th centuries in line shafting to transmit power in factories. They were also used in countless farming, mining, and logging applications, such as bucksaws, sawmills, threshers, water pumps (for wells, mines.), and electrical generators. Flat belts are still used today, although not nearly as much as in the line-shaft era. The flat belt is a simple system of power transmission that was well suited for its day. Flat belts were traditionally made of leather or fabric.

Today most are made of rubber or synthetic polymers. Grip of leather belts is often better if they are assembled with the hair side (outer side) of the leather against the pulley, although some belts are instead given a half-twist before joining the ends, so that wear can be evenly distributed on both sides of the belt. Belts ends are joined by lacing the ends together with leather thonging (the oldest of the methods), steel comb fasteners and/or lacing, or by gluing or welding (in the case of polyurethane or polyester). Flat belts were traditionally jointed, and still usually are, but they can also be made with endless construction.



Fig:-3.2.1.1 Flat Belt Drive Eccentric-and-rod Mechanism

Eccentric-and-rod mechanism, arrangement of mechanical parts used to obtain a reciprocating straight-line motion from a rotating shaft; it serves the same purpose as a slider-crank mechanism and is particularly useful when the required stroke of the reciprocating motion is small in comparison with the dimensions of the driving shaft.



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Fig:-3.3.1 Eccentric-and-rod mechanism

In the figure, the eccentric disk 2 is fixed off centre to the rotating shaft at A and has an eccentricity AB. The strap and rod 3 consist of two pieces clamped together in a sliding fit in a groove on the periphery of the disk. The rod is connected to the piston 4 within a housing 1. As the eccentric rotates with the shaft, it slides inside the strap, and the piston 4 moves on a straight path of length 2AB. AB is equivalent to the crankshaft and BC is equivalent to the connecting rod of a slider-crank mechanism.

Because an eccentric can be attached anywhere along a shaft it is unnecessary to form any part of the shaft into a crank. Eccentrics are seldom used to transmit large forces because friction loss would be high; they are commonly used to drive the valve gears of engines.

Operation of Machine

Operation performs by machine:-

1. DRILLING
2. SHAPING
3. CUTTING
4. GRINDING

Drilling

Drilling is the operation of producing circular hole in the work-piece by using a rotating cutter called DRILL.

- The machine used for drilling is called drilling machine.
- The drilling operation can also be accomplished in lathe, in which the drill is held in tailstock and the work is held by the chuck.
- The most common drill used is the twist drill.

Drilling Machine

- It is the simplest and accurate machine used in production shop.
- The work piece is held stationary i.e. Clamped in position and the drill rotates to make a hole.

Drilling Bit

Drill bits are cutting tools used to create cylindrical holes. Bits are held in a tool called a drill, which rotates them and provides torque and axial force to create the hole. Specialized bits are also available for non-cylindrical-shaped holes. Drill bits come in standard sizes, described in the drill bit sizes article. A comprehensive drill and tap size chart lists metric and imperial sized drills alongside the required screw tap sizes. The term drill can refer to a drilling machine, or can refer to a drill bit for use in a drilling machine.



Fig:- 4.1.3.1 Types of Drilling Bit

Components of Drilling Machine

1. Spindle:-

The spindle holds the drill or cutting tools and revolves in a fixed position in a sleeve.

2. Sleeve:-

The sleeve or quill assembly does not revolve but may slide in its bearing in a direction parallel to its axis. When the sleeve carrying the spindle with a cutting tool is lowered, the cutting tool is fed into the work: and when it's moved upward, the cutting tool is withdrawn from the work. Feed pressure applied to the sleeve by hand or power causes the revolving drill to cut its way into the work a fraction of an mm per revolution.

3. Column:-

The column is cylindrical in shape and built rugged and solid. The column supports the head and the sleeve or quill assembly.

4. Head:-

The head of the drilling machine is composed of the sleeve, a

spindle, an electric motor and feed mechanism. The head is bolted to the column.

5. Worktable:-

The worktable is supported on an arm mounted to the column. The worktables can be adjusted vertically to accommodate different heights of work or it can be swung completely out of the way. It may be tilted up to 90 degree in either direction, to allow long pieces to be end or angle drilled.

6. Base:-

The base of the drilling machine supports the entire machine and when bolted to the floor, provides for vibration-free operation and best machining accuracy. The top of the base is similar to the worktable and may be equipped with t- slot for mounting work too large for the table.

7. Hand Feed:-

The hand- feed drilling machines are the simplest and most common type of drilling machines in use today. These are light duty machine that are operated 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.

8. Power feed:-

The power feed drilling machine are usually larger and heavier than the hand feed ones they are equipped with the ability to feed the cutting tool in to the work automatically. Larger work pieces are usually clamped directly to the table or base using t -bolts and clamps by a small work places are held in a vice. Adept -stop mechanism is located on the head, near the spindle, to aid in drilling to a precise depth.

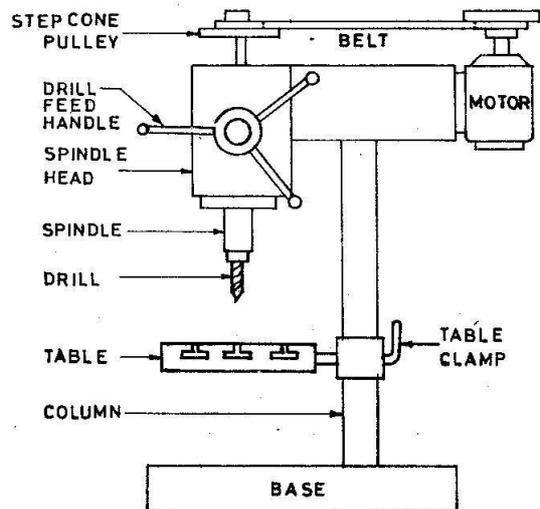


Fig:-4.1.3.1 Bench Drilling Machine

Shaping

The shaping machine is used to machine flat metal surfaces especially where a large amount of metal has to be removed. Other machines such as milling machines are much more expensive and are more suited to removing smaller amounts of metal, very accurately. The reciprocating motion of the mechanism inside the shaping machine can be seen in the

diagram. As the disc rotates the top of the machine moves forwards and backwards, pushing a cutting tool. The cutting tool removes the metal from work which is carefully bolted down. The shaping machine is a simple and yet extremely effective machine. It is used to remove material, usually metals such as steel or aluminium, to produce a flat surface. However, it can also be used to manufacture gears such as rack and pinion systems and other complex shapes. Inside its shell/casing is a crank and slider mechanism that pushes the cutting tool forward and returns it to its original position. This motion is continuous.

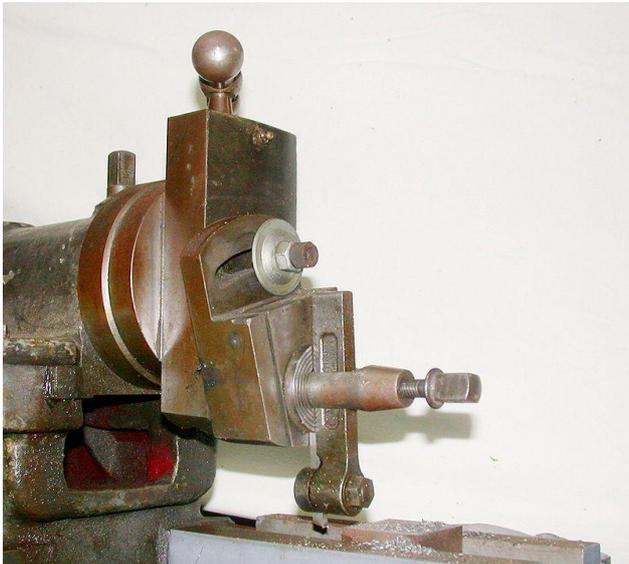


Fig:-4.2.1 Shaping Machine

Types of Shaper

Shapers are mainly classified as standard, draw-cut, horizontal, universal, vertical, geared, crank, hydraulic, contour and traveling head. The horizontal arrangement is the most common. Vertical shapers are generally fitted with a rotary table to enable curved surfaces to be machined (same idea as in helical planning). The vertical shaper is essentially the same thing as a slotter (slotting machine), although technically a distinction can be made if one defines a true vertical shaper as a machine whose slide can be moved from the vertical. A slotter is fixed in the vertical plane.

Cutting

A hacksaw is a fine-tooth saw with a blade held under tension in a frame, used for cutting materials such as metal or plastics. Hand-held hacksaws consist of a metal arch with a handle, usually a pistol grip, with pins for attaching a narrow disposable blade. A screw or other mechanism is used to put the thin blade under tension. The blade can be mounted with the teeth facing toward or away from the handle, resulting in cutting action on either the push or pull stroke. On the push stroke, the arch will flex slightly, decreasing the tension on the blade. Blades are available in standardized lengths, usually 10 or 12 inches for a standard hand hacksaw. "Junior" hacksaws are half this size. Powered hacksaws may use large blades in a range of sizes, or small machines may use the same hand blades.



Fig:-4.3.1 Cutting Operation

Grinding

A grinding wheel is a wheel composed of an abrasive compound and used for various grinding (abrasive cutting) and abrasive machining operations. Such wheels are used in machines. The wheels are generally made from a composite material consisting of coarse-particle aggregate pressed and bonded together by a cementing matrix (called the bond in grinding wheel terminology) to form a solid, circular shape.

Various profiles and cross sections are available depending on the intended usage for the wheel. They may also be made from a solid steel or aluminium's disc with particles bonded to the surface. Today most grinding wheels are artificial composites made with artificial aggregates, but the history of grinding wheels began with natural composite stones, such as those used for millstones.



Fig:-4.4.1 Grinding Wheel

Types of Grinding Wheel

1. Cup wheel

A cup wheel as pictured to the right is predominantly used in Tool and Cutter grinders where orientation of the wheel and a slim profile are required. These wheels are used (and dressed) on the side face and have the advantage of producing a truly flat surface on the side of lathe tools. They are used in jig grinders to produce flat surfaces or counter bores.



2. Straight wheel

These are by far the most common style of wheel and can be found on bench or pedestal grinders. They are used on the periphery only and therefore produce a slightly concave surface (hollow ground) on the part. This can be used to advantage on many tools such as chisels.



3. Diamond wheel

Diamond wheels are grinding wheels with industrial diamonds bonded to the periphery. They are used for grinding extremely hard materials such as carbide tips, gemstones or concrete. The saw pictured to the right is a slitting saw and is designed for slicing hard materials, typically gemstones.



III. SUMMARY OF RESULTS

Advantages

- Multi operations are performed at one time.
- All operation is performed by only one motor.
- The return stroke of shaper machine is utilized as cutting operation.
- Time saving.
- Less man power is required.
- Size is compact therefore it requires less space.
- Low manufacturing & maintenance cost.

Disadvantages

- Not fit for heavy production.
- Without human effort it's not operated.
- Limited availability cannot be used for parallel shafts, can become noisy at high speeds.

- Helical gears are expensive and much more difficult to find.

Application

- A drilling machine is a tool used for drilling holes in various types of wood, plastic and metal. The bench drill is bolted down for safe drilling of such materials.
- A grinding machine, often shortened to grinder, is any of various power tools or machine tools used for grinding, which is a type of machining using an abrasive wheel as the cutting tool. Each grain of abrasive on the wheel's surface cuts a small chip from the work piece via shear deformation.
- A shaper is a type of machine tool that uses linear relative motion between the work piece and a single-point cutting tool to machine a linear tool path. Its cut is analogous to that of a lathe, except that it is (archetypally) linear instead of helical.
- A cutting tool or cutter is any tool that is used to remove material from the work piece by means of shear deformation. Cutting may be accomplished by single-point or multipoint tools.

Maintenance

Many bearings require periodic maintenance to prevent premature failure, although some such as fluid or magnetic bearings may require little maintenance. Most bearings in high cycle operations need periodic lubrication and cleaning, and may require adjustment to minimize the effects of wear. Bearing life is often much better when the bearing is kept clean and well-lubricated. However, many applications make good maintenance difficult. For example bearings in the conveyor of a rock crusher are exposed continually to hard abrasive particles. Cleaning is of little use because cleaning is expensive, yet the bearing is contaminated again as soon as the conveyor resumes operation. Thus, a good maintenance program might lubricate the bearings frequently but never clean them.

Lubrication

Some bearings use thick grease for lubrication, which is pushed into the gaps between the bearing surfaces, also known as packing. The grease is held in place by a plastic, leather, or rubber gasket (also called a gland) that covers the inside and outside edges of the bearing race to keep the grease from escaping. Bearings may also be packed with other materials. Historically, the wheels on railroad cars used sleeve bearings packed with waste or loose scraps cotton or wool fiber soaked in oil, than later used solid pads of cotton.

IV. CONCLUSION

Conclusion

After completing the major project on "MULTI PURPOSE MECHANICAL MACHINE" we are much happy and would like to thank our professor, guides and the lectures of the concerned department who have guided us. Multipurpose machine is derived from turning lathe which has been a well-established industrial processes offering attractive

capabilities for handling work piece of various length to be used at micro level. We have presented the development of multipurpose machine in various modes by which it can be actively adopted. We have explained the various parts and components of multipurpose machine using scotch yoke mechanism. Different types of attachments and tools which can be implemented on multi-purpose machine have been discussed. While making this project we have been able to learn a lot and understand the various aspects of “MULTI PURPOSE MECHANICAL MACHINE” we can use our knowledge, which we get during our study.

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