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Design and fabrications of Motorized Multipurpose Machine

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Abstract: Today in this world every task has been made quicker and fast due to technology. In every industry desire to make high productivity rate and maintain the standard of the product at low average cost. This dissertation deals with the design and fabrication of motorized multipurpose machine which perform three operations are namely drilling, cutting, grinding and Slotting. The motorized multi-operation machine contains three operation which is performed under single machine. It can be used in small scale industries and rural workshops to work upon thin metallic and on wood in carpentry shop.

The Multi-Purpose Mechanical Machine is widely used in manufacturing. Industries are primarily designed to provide usable goods and services at a cheap cost of production, low cost of machinery, and low cost of inventory. We are providing drive to the main shaft, which is directly coupled to the bevel gear mechanism; on the main shaft, we have used a bevel gear system for power transfer to three places. Drilling centre, cutting centre, and grinding centre will all be driven by bevel gear. Because it is driven by a single power source, the concept allows us to undertake operations at multiple working centres at the same time. Electricity conservation (power supply), cost savings related with power usage, increased productivity, and reduced floor space are all features of this strategy. The scotch yoke mechanism is used in this machine, which is autonomous and operated by an electric motor. It can be used to work on thin metallic sheets and wood in a carpentry shop in small size industries/workshops.

Index Terms – Multipusrpose Machine, Motorized, Motor.

I. INTRODUCTION

This idea is for the "Multi-purpose Mechanical Machine" to be designed, developed, and manufactured. Multi-purpose mechanical machines are primarily utilised in small-scale companies. The industries are primarily geared on producing valuable goods and services at low production, machine, and inventory costs. Every activity in this world has become faster and faster as are technical growth, but this progress also necessitates significant investments and expenditures. In today's society, all actions have been accelerated due to technology advancement; however this advancement also necessitates significant investments and expenditures. Every industry aspires to achieve a high rate of productivity while maintaining product quality and standard at a low average cost. Machine installation accounts for a significant portion of a sector's investment. So, in this project, a work is proposed in which a machine is created to be capable of simultaneously doing operations such as drilling, cutting, and grinding at multiple work centres, implying that the Industrial will not have to pay a high price for the machine.

The reason to design a multi-operational mechanical machine is that there is no machine which can perform various operations (i.e. drilling, cutting, slotting & grinding) at the same time. This machine is operated by DC motor and uses a single slider mechanism and bevel gears. This model of the multi operation mechanical machine may be used in small scale industries dealing with light materials like wood, cardboard etc. and domestic purpose.

II. Problem Statement

2.1 . Problem Definition-:

There is a High cost for individual machines. Individual machine will take more workshop area and individual machine operations take more time, energy and manpower therefore to reduce cost, required space, time, energy and manpower this motorized multipurpose machine is more efficient.

2.2. Problem Solution-:

Therefore, to overcome all this drawback our aim is to make a multipurpose machine. This machine perform multipurpose operation at same time with required speed and this machine is automatic which is controlled or operated by motor which is run with the help of current. This machine is based on Belt and Pulley mechanism. This model of multi operational machine is can be used in industries and domestic operation which can performed drilling, grinding and cutting of thin metal and wooden surface.

2.3. Objectives of the project-:

1. To make multi-purpose machine.
2. One time four operations should work on same machine.
3. For increase productivity.
4. To reduce the manufacturing cost of four machine to one.
5. To study the transmission and manufacturing process practically.

III. Methodology

1. Finalization of topic.
2. Study on different research papers.
3. Find out Literature view and market survey related to proposed work.
4. Analytical design of setup.
5. Prepare list of raw material requirement and Purchase.
6. Fabrication of parts.
7. Assembly and testing.
8. Report Writing.

IV. Components

1. Drill

A drill is a tool fitted with a cutting tool attachment, usually a drill bit used for drilling holes in various materials. The attachment is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip of the cutting tool does the work of cutting into the target material. Drills are commonly used in woodworking, metalworking and construction. Specially designed drills are also used in medicine, space missions and other applications. Drills are available with a wide variety of performance characteristics.

2. Frame

The frame of setup for the Multi-Operational Machine consist of four ends inclined at certain position to transmit power from AC motor connected to shaft at one end having Scotch Yoke Mechanism such that the power to another parallel shaft is transmitted via chain sprocket system (time driving chain) having drill chuck fitted with drill bit at one end and grinding wheel at other end for the other two operations to be performed under single workstation. The frame is made up of mild steel which holds the mainframe of the project such that to minimize the vibrations and oscillations during it working operation ,all the four ends of the frame is clamped at fixed position by means of mechanical clamps

3. Ball Bearings

A bearing is a device to permit constrained relative motion between two parts, typically rotation or linear movement. Bearings may be classified broadly according to the motions they allow and according to their principle of operation. Low friction bearings are often important for efficiency, to reduce wear and to facilitate high speeds. Essentially, a bearing can reduce friction by virtue of its shape, by its material, or by introducing and containing a fluid between surfaces. By shape, gains advantage usually by using spheres or rollers. By material, exploits the nature of the bearing material used. Sliding bearings, usually called bushes journal bearings, sleeve bearings, rifle bearings or plain bearings. Rolling-element bearings such as ball bearings and roller bearings are used for this purpose. In this project roller ball bearing such as bearing no: - (SKF-6294) is used for this purpose.

4. A.C. Motors

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stator having coilssupplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

5. Shaft

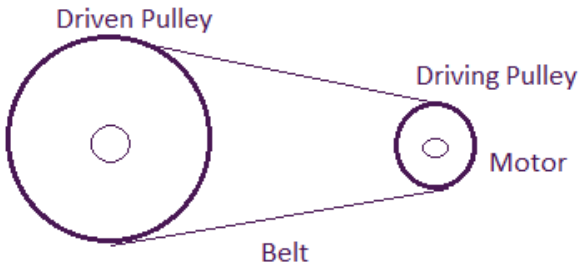
A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulley & belt and bearings are mounted on it. The material used for ordinary shafts is mild steel. When high strength is required, an alloy steel such as nickel, nickel-chromium or chromium-vanadium steel is used. Shafts are generally formed by hot rolling and finished to size by cold drawing or turning and grinding.

6. Gears

Bevel gears are used as the main mechanism for a hand drill. As the handle of the drill is turned in a vertical direction, the bevel gears change the rotation of the chuck to a horizontal ratio. Bevel gears are gears where the axes of the two shafts intersect and the tooth- bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone.

7. Belt and Pulley

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel. In a two-pulley system, the belt can either drive the pulleys normally in one direction, or the belt may be crossed, so that the direction of the driven shaft is reversed As a source of motion, a conveyor belt is one application where the belt is adapted to carry a load continuously between two points. 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 huge, 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.

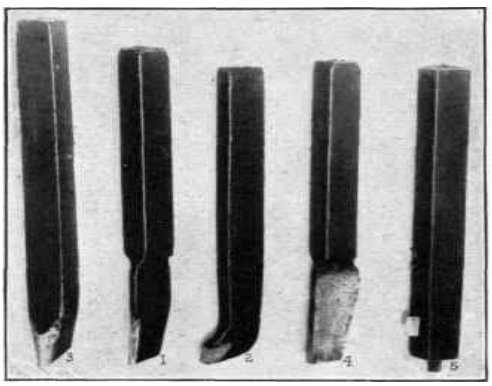


8. Hack saw Blade

Hand hacksaw blades are traditional cutting tool for metal and non-metal materials. Applications can be found in household and craft workshops. Blades are made from carbon steel, high speed steel and bimetal material. From the wide range of products you may choose blade directly for your needs. A hacksaw is a type of hand tool designed specifically for cutting through materials such as plastic, steel, and other metals. They are a variant of the traditional hand saw, typically used for cutting wood, and have become a staple tool for professionals and hobbyists alike.

9. Slot Cutters

Slot cutters represent the most frequently used type of end mills. They can be used universally slot cutters are generally used for the production of grooves and slots. Our single or multi-edged slot cutters are made of solid carbide and are widely used due to their reliable machining. Groove or slot milling is an operation in which side and face milling is often preferred to end milling. Slots or grooves can be short or long, closed or open, straight or non-straight, deep or shallow, wide or narrow. Tool selection is normally determined by the width and depth of the groove.



10. Grinding Wheels

A grinding wheel is basically a precision tool composed of abrasive grains held together by a bonding material. The abrasive grains provide the wheel with its cutting ability which helps in finishing the material to the required dimensional accuracy and surface finish. Grinding wheels are abrasive for various cutting and grinding applications. It uses this Grinding wheel for cutting and grinding multiple metal and other workpieces during a workshop. It also uses these wheels to chop and shape complex workpieces.

V. DESIGN CALCULATIONS

We are using motor having speed rating of 1440 rpm but we can not complete all the operations at 1440 rpm so for changing speed we are used pulley belt system.

We are used three shafts on first shaft only cutting, grinding attachment is placed. Cutting and grinding operation require very high speed so we make speed variations by using belt pulley mechanism.

Speed calculations for cutting wheel
Motor pulley have diameter D = 100 mm
Motor speed N = 1440 rpm
Shaft A is first shaft where cutting wheel is attached pulley
mounted on shaft A having diameter d1 = 81mm
We know n1 / N = D / da

Speed of cutter = n1 = D*N / da
=1777 rpm

Speed of cutting / grinding wheel = 1777 RPM
Speed of intermediate shaft :-
Shaft A having speed (na) = 1777 RPM Pulley
On shaft A having diameter (d1) = 81
Pulley diameter on intermediate shaft (d2) : 350 mm speed of
Intermediate shaft = n2 we have to calculate
n1 * d1 = n2 * d2
1777*81 = n2 * 350
N2 = 411 rpm

Speed of intermediate shaft = 411 rpm
Speed calculations for drill and scotch yoke shaft
Scotch yoke mechanism and drilling chuck is mounted on same shaft (shaft C) pulley
Mounted on shaft c having diameter d4 = 304 mm
Pulley mounted on intermediate shaft having diameter d3 = 75 mm speed of
Intermediate shaft n2 = 411 rpm
Speed of shaft C (n3) = n2 * d3 / d4
= (411 * 75) / 304
= 101 rpm
Speed of drill and scotch yoke shaft = 101 rpm

Linear speed of hacksaw and plainer blade
rpm of scotch yoke disc = 101 rpm
that mean 50 times forward and 50 times reverse motion of hacksaw takes place within one minute

Stroke = 100 mm = 0.1m

Linear motion = 0.1 * 101 = 10.1 m / min

VI. Results and Discussion

For designing the structure, motor is kept as a main power source. According to our design all the necessary parts are assessed. Although we have designed the structure with considering the necessary safety factors. These are therotical values that we have collected from the parts from our design dimension. After the actual market research for the availability of the parts of our machine, we are able to process the parts of our desired dimensions. In that case, the standard parts with an approx. Conformance with our calculated values would be preferred and corresponding modification can be done.

- Performing operation on more than one Job at a time.
- Performing multiple operation in one cycle.
- Indexing capability to sequence operation one after another.
- Easy operation and attachments.
- Easy to install and use anywhere.
- Easy to operate.
- Low maintenance cost.
- Simple in construction.

VII. Conclusion

We can see that all the production based industries wanted low production cost and high work rate which is possible through the utilization of multi-function operating machine which will less power as well as less time, since this machine provides working at different centre it really reduced the time consumption up to appreciable limit. In an industry a considerable portion of investment is being made for machinery installation. So in this paper we have proposed a machine which can perform operations like drilling, cutting, grinding at different working centres simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

VIII. Future Scope

1. Other operations can also be incorporated in to the machine.
2. The machine can be made more portable.
3. Cost can also be reduced to some extent by manufacturing it on a mass scale.
4. Regulator can also be incorporated onto the AC motor to regulate the speed of moving motor (varying speed of motor).

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