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Motorized Multipurpose Machine

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Abstract-The aim of our project is to increase the productivity by fabricating a Motorized Multipurpose machine that could perform four machining operation (Drilling, Sawing (Using Hacksaw), Grinding & Sheet Metal Cutting) at a time. The Bevel gear mechanism, Rack & pinion mechanism and CAM mechanisms were used in our project to make the Multi-operations possible with a single input. The need for our project was found out in industries here mass production is carried out. In mass Production each operation is carried out step by step manner in a continuous order by transporting the work piece from one machine to another in a sequence. Thus the transferring of work piece from one machine to another consumed time, human effort as well as power consumption for each and every machine. Thus our project is the fabrication of machine which came with the breakup for time consumed for the shifting of work piece as well as the power consumption leading to high productivity, low production cost as well as the decreased capital cost Since the cost of our multipurpose machine is less than the total cost of all the machine purchased separate.

Keywords: Rack and Pinion, Bevel Gear Mechanism, Multi-Operations

I. INTRODUCTION

Here we are fabricating the multi operation machine which contains four operations in a single machine. The operations are namely drilling, grinding, slotting and cutting. It is a new concept specially meant to reduce the work time and save the cost. Instead of using separate machine for each process, we are combining all the machines together into a single machine reducing the time cost and time.

The power transmission for each and every operation is done through the various methods such as power transmission through belt & pulley, power transmission through shaft & gears. The power transmission are done in such a way that there occurs efficient power transmission with no loss in between. The detailed description of the components used, links present, mechanism followed and process involved will be discussed below

II. PROCESS INVOLVED

A. Drilling

Drilling is cutting process that uses a drill bit to cut a hole of circular cross cross-section in the solid material. The drill bit is usually a rotary cutting tool. The drill bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolution per minute. This forces the cutting edge against the work piece, cutting off the chips from the hole as it is drilled.

Fig 1

B. Sawing

Sawing is a process wherein a narrow slit is cut into the work piece by a tool consisting of a series of narrowly spaced teeth called a saw blade. Sawing is used to separate work parts into two or more piece, or to cut an unwanted section of part.

C. Grinding

Grinding is used to finish the work piece that requires surface quality as well as high accuracy of shape and dimension. As the accuracy in dimensions in grinding is of the order of 0.00025mm,in most application it tends to be a finishing operation and removes comparatively less metal, about 0.25 to 0.50 mm. However there are some roughing applications in which grinding removes high volumes of metal quite rapidly.

Fig 2

D. Sheet Metal Cutting

Sheet Metal Cutting processes are those in which a piece of sheet metal is separated by applying a great enough force to cause the material to fail. The most common cutting processes are performed by applying a shearing force and are therefore sometimes referred to as shearing processes

Fig 4

III. POWER TRANSMISSION METHOD

A. 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 (the same if on parallel shafts), or the belt may be crossed, so that the direction of the driven shaft is reversed (the opposite direction to the driver if on parallel shafts). As a source of motion, a conveyor belt is one application where the belt is adapted to carry a load continuously between two points.

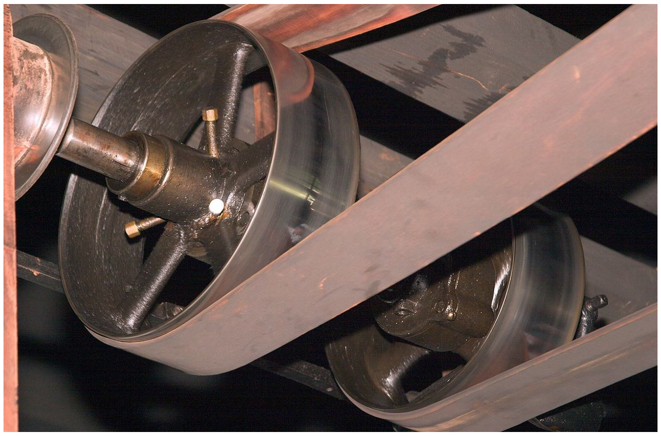

Fig 5

B. Bevel Gear Mechanism

A bevel gear is shaped like a right circular cone with most of its tip cut off. When two bevel gears mesh, their imaginary vertices must occupy the same point. Their shaft axes also intersect at this point, forming an arbitrary non-straight angle between the shafts. The angle between the shafts can be anything except zero or 180 degrees. Bevel gears with equal numbers of teeth and shaft axes at 90 degrees

Fig 6

C. Cam Mechanism

A cam and follower is formed by the direct contact of two specially shaped links. The driving link is called Cam and the link that is driven through the direct contact of their surfaces is called the follower. The shape of the contacting surfaces of the cam and the follower determines the movement of the mechanism. In general a cam follower mechanism's energy is transferred from cam to follower. The cam shaft is rotated and according to the cam profile, the follower moves up and down.

D. Rack & Pinion Mechanism

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion.For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope.

For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius (i.e. a toothed straight edge).A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter.

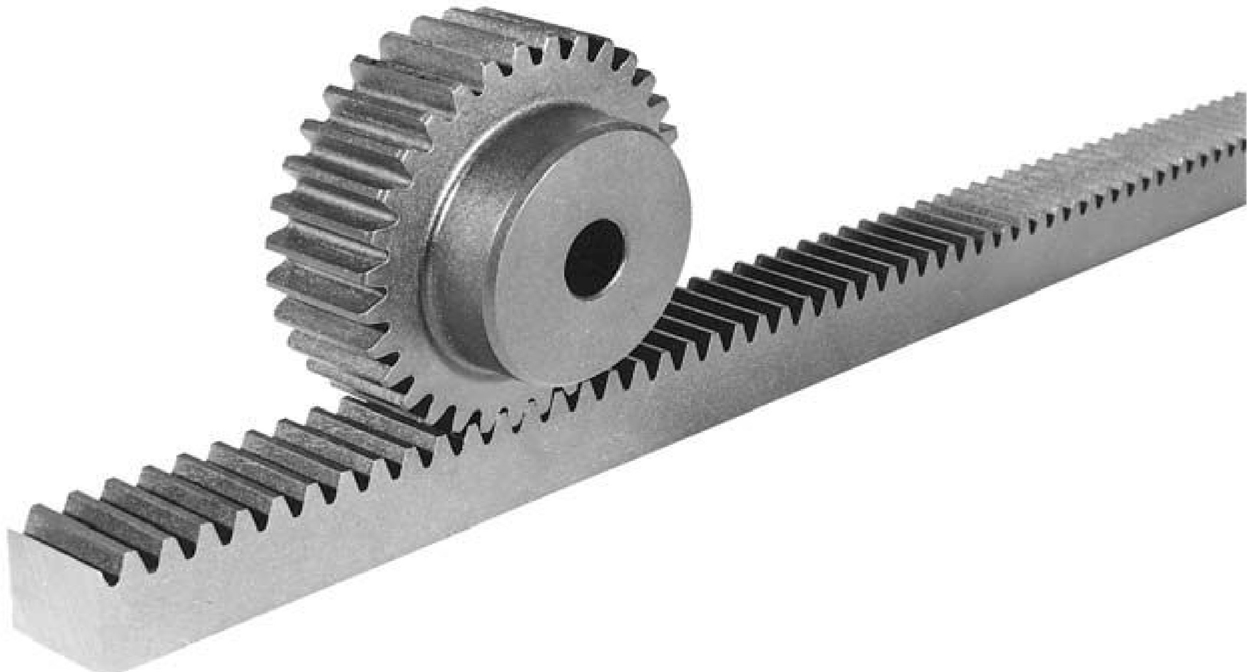

Fig 7

IV. COMMON LINKS

A. The Motor Shaft
B. Pulley and Belts
C. The Common Shaft through which the power is transmitted to all the four processes namely
1) Drilling
2) Sawing
3) Grinding
4) Sheet Metal Cutter

V. WORKING PROCEDURE

A common motor is fixed in the frame which is used to transmit the power for all the processes. This power transmission is carried out through the belt & pulley. The power transmission to the various process is transmitted as follows

A. Drilling

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 multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work piece, cutting off chips from the hole as it is drilled.

The drilling tool is present at one end of the machine. The common shaft is rotated by the pulley connected to it which is powered by the belt connected to the motor's pulley. The one end of the common shaft is connected to the bevel gear which converts the horizontal axis rotation of the common shaft into the vertical axis rotation of the drill chuck.

Fig 8

Here the rack and pinion mechanism is used as the method of giving feed for the drilling operation. The rack and pinion mechanism is operated manually (i.e.) the feed is controlled manually by connecting a rod to the pinion. The work piece is placed on the work piece holder at the bottom.

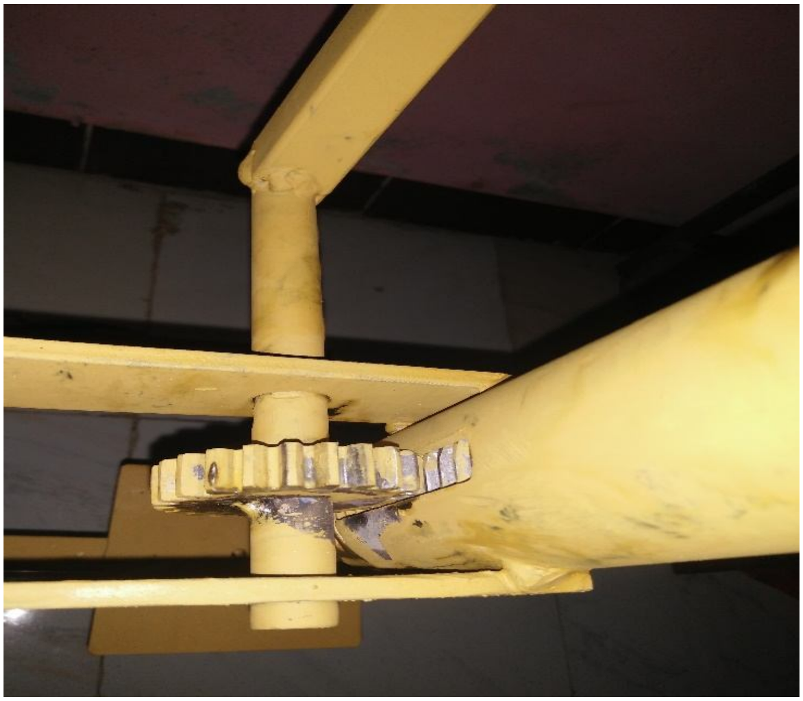

Fig 9

B. Sawing

The sawing operation is done by operating the Hacksaw in To & Fro motion. The To & Fro motion of the Hacksaw is obtained by the use of Cam mechanism. The sawing operation is fitted at one end of the machine. The common shaft is rotated by the pulley connected to it which is powered by the belt connected to the motor's pulley.

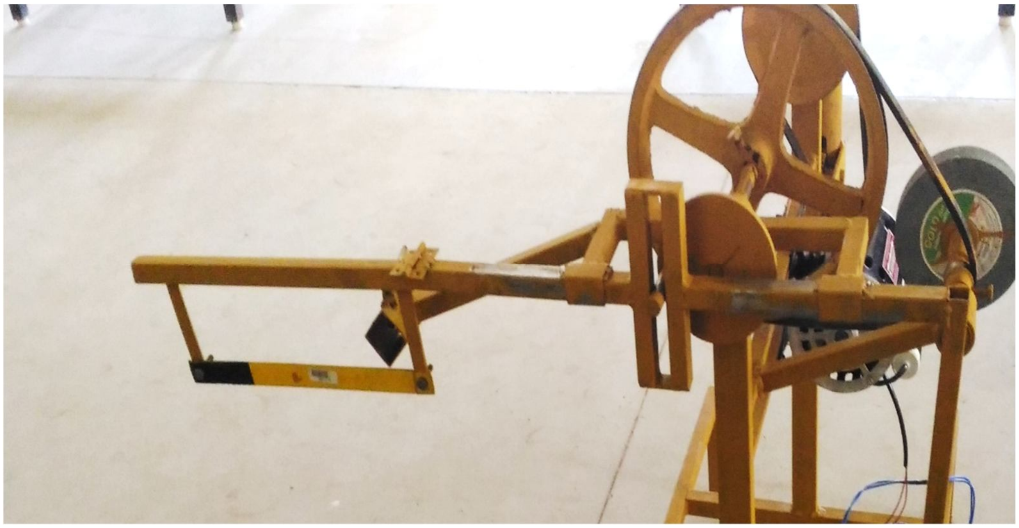

Fig 10

The work piece holder is attached to the frame that is used to hold the work piece for cutting using the hacksaw. The hacksaw is fitted into the tool holder using the tightener so that the hacksaw could be replaced after its life time.

C. Grinding

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.

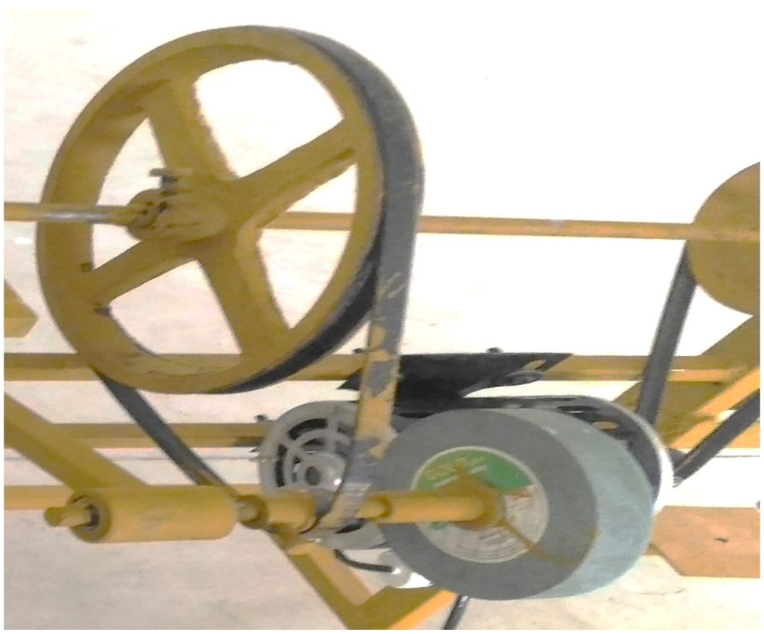

Fig 11

The grinding wheel is fitted in parallel with a small pulley which is powered by the large size pulley connected with the common shaft. The power transmission between the large pulley and small pulley is done using the belt.

D. Sheet Metal Cutting

Sheet metal cutter is placed at bottom of the one end of the machine. The cam mechanism used for the sawing operation is also used for the opening and closing of the sheet metal cutter. Thus the continuous opening and closing of the sheet metal cutter is carried out alternatively. The sheet metal to be cut is placed between the blades for being cut.

Fig 12

VI. CONCLUSION

Thus this project could reduce the external power requirement for machining process and at the same time could increase the productivity. This product could be taken to the next level by making it more automated with the use of microcontrollers which could further increase the accuracy level and reduce the work time.

A. MERITS

1) *Reduced Working Time*
2) *Increased Production*
3) *Reduction in Power Consumption*
4) *Less Man Power Requirement*
5) *Less Machining Cost*
6) *Less Capital Cost*

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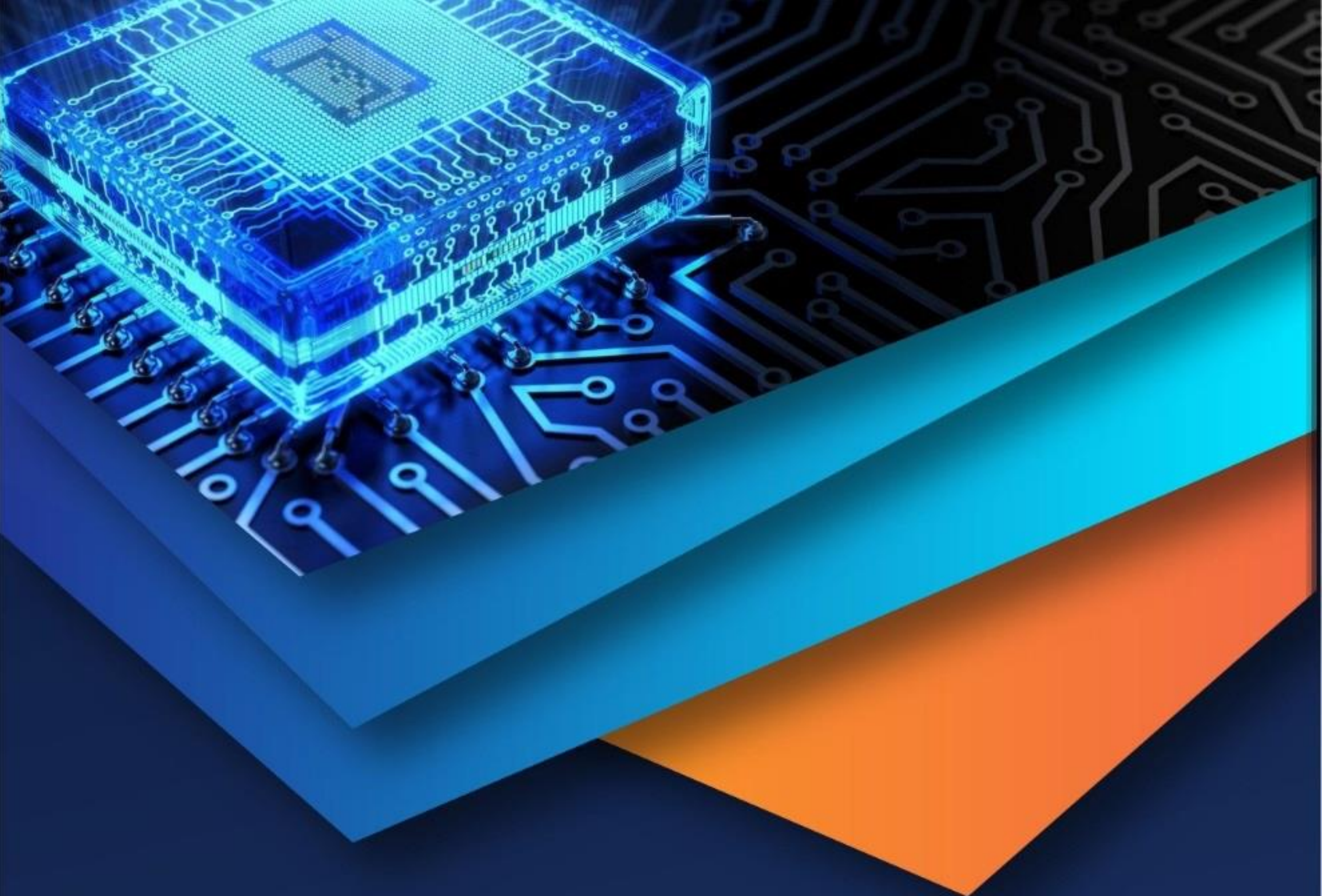

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