Research Paper Engineering

Multi Functioning Machine

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ABSTRACT

Scotch yoke mechanism is used for sawing operation. On the main shaft we have use bevel gear system for power transmission at two locations. Through bevel gear we will give drive to drilling centre and grinding centre. The model facilitate us to get the operation performed This paper presents the concept of Multi-Function Operating Machine mainly carried out for production based industries. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost. We have developed a conceptual model of a machine which would be capable of performing different operation simultaneously, and it should be economically efficient .In this machine we are actually giving drive to the main shaft to which scotch yoke mechanism is directly attached at different working centre simultaneously as it is getting drive from single power source. Objective of this model are conservation of electricity (power supply), reduction in cost associated with power usage, increase in productivity, reduced floor space.

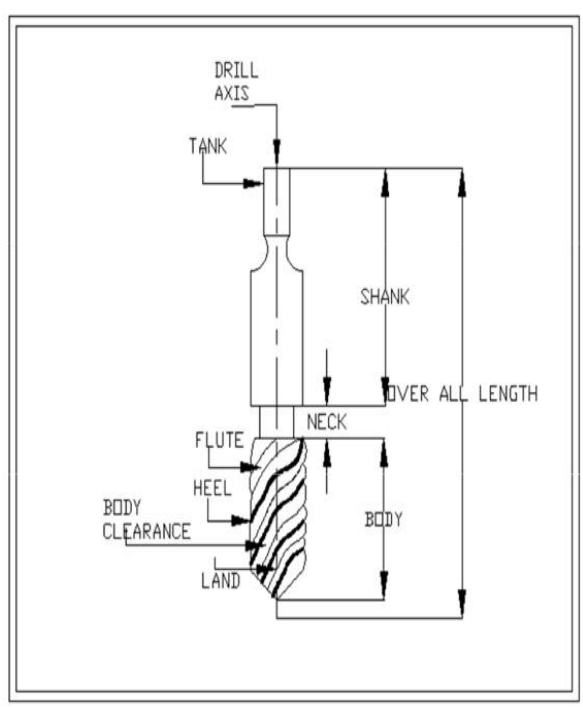
KEYWORDS

1.Introduction

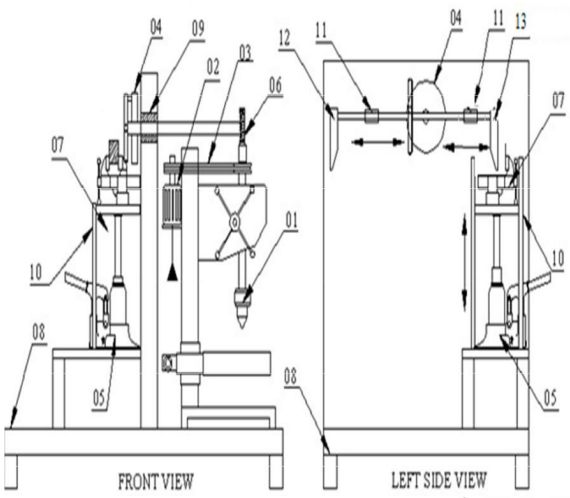
Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost In an industry a considerable portion of investment is being made for machinery installation. So in this paper we have a proposed a machine which can perform operations like drilling, sawing, shaping, some lathe operations at different working centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously. Economics of manufacturing: According to some economists, manufacturing is a wealth-producing sector of an economy, whereas a service sector tends to be wealth-consuming. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in the United States. Manufacturing provides important material support for national infrastructure and for national defense.

2. Main function of our project

1 Drilling :- the use of fasteners. 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 A drill is atool fitted with a cutting tool attachment, usually a drill bit used for does the drilling holes in various materials or fastening various materials together with 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, such as power and capacity



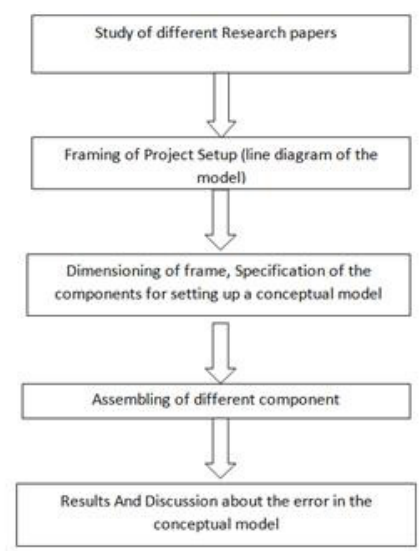
Design of project:-



Machine drawing:-

3. Proposed Methodology

In this project we will generally give the power supply to the shaft on which a bevel gear is mounted on it, and a second bevel gear at a right angle to it has been mounted on a drill shaft to which a drill bit is being attached. At one end of the shaft is connected to power supply , other end is being joined to a circular disc ,through this circular disc scotch yoke mechanism is being performed (rotator y motion is converted to reciprocating motion) . Also in between these two ,a helical gear is mounted which transfer its motion to other helical gear which is mounted on a shaft consist of grinding wheel



4. Experimental Set-Up

In this conceptual model we have involved the gear arrangement for power transmission at different working centers , basically gear or cogwheel is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part in order to transmit torque, in most cases with teeth on the one gear being of identical shape, and often also with that shape on the other gear. Two or more gears working in tandem are called a transmission and can produce a mechanical advantage through a gear ratio and thus may be considered a simplemachine. Geared devices can change the speed, torque, and direction of a power source. The most common situation is for a gear to mesh with another gear; however, a gear can also mesh with a non-rotating toothed part, called a rack, thereby producing translation instead of rotation.

Component used:-

1. Transformer
2. Gear
3. Dc gear motor
4. Convenor belt
5. Capacitor
6. Diode
7. Led
8. Cast iron rod
9. Pully
10. Electromagnetic clutch

5.1 Properties :- The material selected must possess the necessary properties for the proposed application. The various requirements to be satisfied that Can be weight, surfacefinish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc.

The following four types of principle properties of materials decisively affect their selection

Physical
Mechanical
From manufacturing point of view
Chemical

The various physical properties concerned are melting point, thermal Conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, magnetic purposes etc. The various Mechanical properties Concerned are strength in tensile, Compressive shear, bending, torsional and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties.

The various properties concerned from the manufacturing point of view are,

Cast ability
Weld ability
Forge ability
Surface properties
Shrinkage
Deep drawing etc.

5.2 Manufacturing case

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

5.3 Quality Required

This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go casting of a less number of components which can be fabricated much more economically by welding or hand forging the steel.

5.4 Availability of Material

Some materials may be scarce or in short supply it then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed. The delivery of materials and the delivery date of product should also be kept in mind.

5.5 Space consideration

Sometimes high strength materials have to be selected because the forces involved are high and space limitations are there.

5.6 Cost

As in any other problem, in selection of material the cost of material plays an important part and should not be ignored. Sometimes factors like scrap utilization, appearance and

non-maintenance of the designed part are involved in the selection of proper materials.

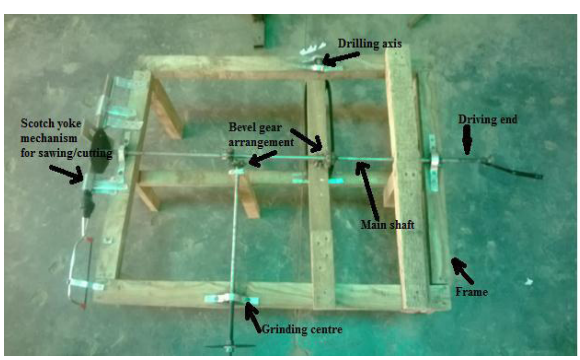
5.7 Merits
Easy to operate.
Reduces time and increases production rate.
Low maintenance.
Easy to implement

6. Working Principle:
Scotch Yoke Mechanism
The Scotch yoke is a mechanism for converting the linear motion of a slider into rotational motion or vice-versa. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part. The shape of the motion of the piston is a pure sine wave over time given a constant rotational speed.

Power Transmission Through Gears
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 a gear is the imaginary toothless surface that you would have by averaging out the peaks and valleys of the individual teeth. The pitch surface of an ordinary gear is the shape of a cylinder. The pitch angle of a gear is the angle between the face of the pitch surface and the axis.

Working of the Model:
In the conceptual model of "Multi-Functional operating machine" we are giving supply to the main shaft (refer fig.13), as we move along the axis of shaft we have mounted a pair of bevel gears, through the pinion shaft we are giving drive to drill shaft through belt-pulley arrangement, we have installed the stepped pulley in the arrangement therefore we can made the speed variation. Now again as we move along the axis of main-shaft further we have again used the bevel gear arrangement to give the drive to grinding center.

As we can see that the scotch yoke mechanism is directly fabricated to the main shaft and have same angular velocity as that of main-shaft. Multi-Function Operating Machine: A Conceptual Model



3: Sawing/ cutting end scoteh yoke Machine arrangement

Figure 4: Drilling centre getting drive through bevel gear

7. Result:
Our main aim is to represent our innovative concept, we have taken some useful data from our conceptual model and tried to evaluate the percentage deviation from the standard calculated values which is as follows:-

Since pitch radius of pinion is r_p = 1.4 cm, pitch radius of gear r_g = 2 cm.

By the relation between pitch cone angle and velocity ratio we can find the velocity ratio as we have pitch cone angle for both gear and pinion as 55 deg. and 35 deg.

Percentage Error in power transmission = ——— 100 = 6.51%

Now diameter of circular disc of Scotch yoke mechanism = 7.9 cm

Actual measured effective stroke length of yoke = 7.73 cm

Percentage error in the stroke ——— 2.15%

Similarly many values of rpm at drilling and grinding axis can be measured on changing the input; in this conceptual model feed to the work piece is given through the work table.

Since the model is subjected to friction therefore there is a error of 6.51% and 2.15% during power transmission and transverse motion of sawing blade respectively.

For Drilling and Grinding operation we have used the identical bevel gears therefore both operation will have same velocity ratio.

Table 1: difference in between theoretical power transmission and actual power transmission

S no.	No. of revolution given to main shaft	Theoretical revolution at driven end	Actual revolution at driven end
1	1	1.428	1.335
2	2	2.856	2.67
3	3	4.284	4.22
4	4	5.712	5.65
5	5	7.14	7.075
6	6	8.568	8.503

Table 2: difference in between theoretical effective stroke length of yoke and actual effective stroke length of yoke for different no. of revolution of main shaft

S no.	No. of revolution given to main shaft	Theoretical effective stroke length at driven end	Actual effective stroke length at driven end
1	1	7.9	7.73
2	2	7.9	7.73
3	3	7.9	7.73
4	4	7.9	7.73
5	5	7.9	7.73
6	6	7.9	7.73

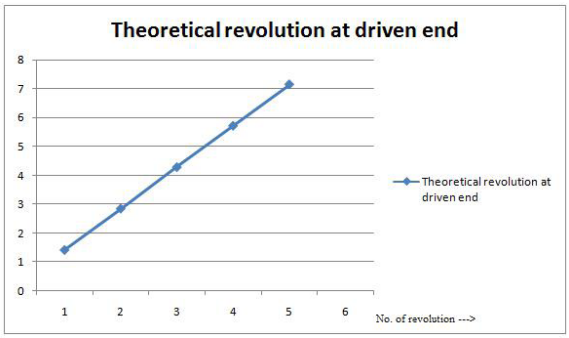
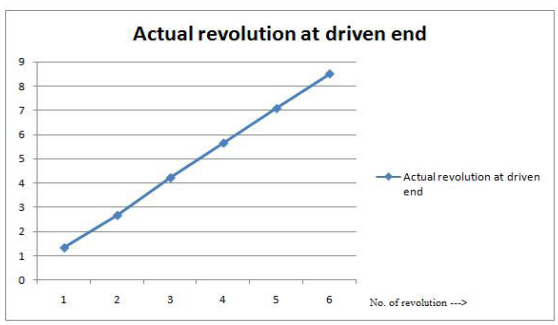


Figure 20: Plot to show theoretical revolution at driven end



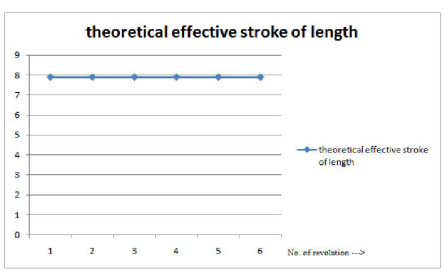
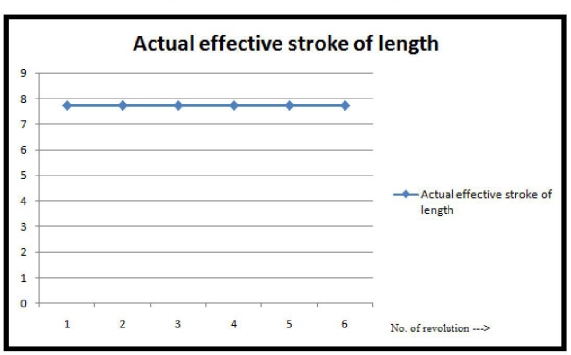


Figure 23: plot to show theoretical effective stroke of length at driven end



Application:-
Used in small scale industries to reduce machine cost.

In such places where frequent change in operation are required

8. 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 center 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, sawing, grinding at different working centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

References:

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