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A Review Paper on Design and Development of Multi-Purpose Machine

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Abstract: ***We are presenting paper "Multipurpose Mechanical Machine" which finds application in much modern equipment and system work on the various operations like grinding finishing cutting, drilling etc. As the prices of drilling, cutting, grinding machine are so high and some are not portable, so we can try to made the multipurpose mechanical machine which are portable. The machine motor not required high power voltage it work on single phase, and power transmitted efficiently by the help of V-belt pulleys. 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. 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 Operation, Grinding, Scotch Yoke Mechanism, Multi-Purpose.

I. INTRODUCTION

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 a considerable portion of investment is being made for machinery installation. So in this paper work is proposed where a machine is designed cutting, drilling, grinding, polishing & shaping, some lathe operations at different working centers simultaneously which implies that industrialist will not have 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.
The project focuses on fabrication of machine which can be used to perform different operations required in small fabrication shops in a single machine. This would not only cut down the cost of operations of three machines but also the cost of setting up a fabrication shop. The primary focus of this research work is to reduce the cost as well as the floor space required by these machines.

II. PROBLEM STATEMENT

- Multiple operations need to be carried out for the manufacturing of certain parts and that too on regular basis.
- This requires the use of different kinds of single purpose machine for the manufacturing.
- Those machines are costlier and consume a lot of space within the workshop.
- Also the single unit of machine is capable of performing single task at a particular time.
- While switching to different machines during the operation change, lot of time gest wasted in handling of parts.

Thus to eliminate the above issues we have introduced a small scale concept named as Multi-Purpose Machine which will be lesser in weight, compact in size, as well as very much capable of performing these operations at single time.

III. OBJEVTIVES

1. The objective of this experiment is to investigate the performance of a whitworth quick turn motion and to verify that the motion does have a quick return stroke and a slow cutting or forward stroke.
2. To reduce size of model.
3. To perform all three operations simultaneously on same machine.
4. Multi operations are performed at one time.
5. We can perform multipurpose operations on thin metallic as well as wooden model.

6. Operation of any complicated components can be done with this machine.

Future Scope

1. We can perform various operations like cutting, drilling, or grinding individually by introducing coupling(engagement & disengagement) between them.
2. We can perform grinding operation by introducing a grinding tool at the main shaft.
3. We can perform boring operation by introducing a boring tool by replacing drilling tool.
4. We can change the speed of motor by regulator.

Methodology

In this mechanism, we will provide the power supply to the shaft with the help of motor and belt drive. On one end of the shaft a bevel gear will get mounted, and a second bevel gear at a right angle to it will be mounted on another shaft to which a drill bit is being attached. At the center of the shaft pulley is mounted with a fixed joint which is connected to power supply to gain the rotatory movement. Further, the other end of the shaft is being joined to the grinding wheel for the grinding operation. Thus these two operations (grinding and drilling) will get performed at the same time.

This shaft will also comprise of several sprockets and thus it will be commonly used for drilling, grinding as well as motion transmission unit for other tools too.

One sprocket of the shaft will be connected to a circular disc with a chain drive. Through this circular disc, scotch yoke mechanism is being performed (rotatory motion is converted to reciprocating motion) and will be used for operating the hacksaw. Thus we will have the 3rd operation named as cutting.

The another sprocket of the shaft will be connected to the other disk with the chain drive. The disc will consist of a sander paper for the performing of cleaning of parts from the outer surface without using any of the manual effort.

IV. COMPONENTS OF MACHINE

1. Bevel Gear

A bevel gear is a type of mechanical gear. These gears where the axes of the two shafts intersect and the tooth beating 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 d cone.

Fig. 01: Bevel Gear

2. Belt Drive

A belt and pulley system is characterized by two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across axles. If the pulleys are of differing diameters, a mechanical advantage is realized.

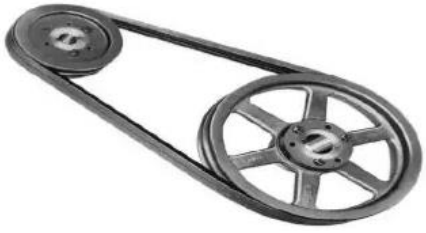

Fig. 02: Belt Drive

3. Scotch Yoke Mechanism

The scotch yoke (also known as slotted link mechanism) is a reciprocating motion mechanism, converting the linear motion of a slider into rotational motion, or vice-versa. The reciprocating part is directly coupled to a sliding yoke with slot that engages a pin on the reciprocating part.

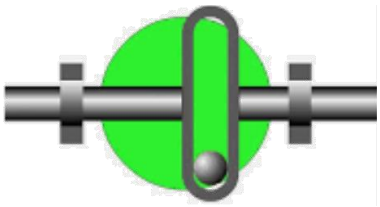

Fig. 03: Scotch Yoke Mechanism

4. Drill Bit

The drill bit is usually a rotary cutting tool, often multi-point. 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**.**

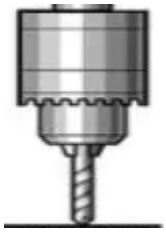

Fig. 04: Drill Bit

5. Grinding Wheel

The grinding wheel is attached at the one end of the shaft. The scotch yoke mechanism is placed at the other end for doing cutting action. For making drilling action, bevel gears are arranged at the middle position of the shaft. All the operations are carried out by giving electrical current to the motor.

Fig. 05: Grinding Wheel

6. Frame

A frame is often a structural system that supports other components of a physical construction and/or steel frame that limits the construction's extent. Frame is the basic part of the machine it supports the assembly of the machine and absorb all the shocks and vibrations during the operations.

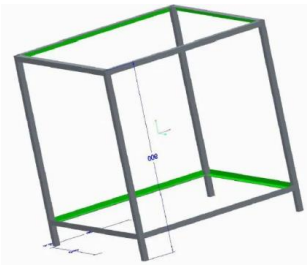

Fig. 06: Frame

7. Bearing

A bearing is a machine element which supports another moving machine element (known as journal). It permits a relative motion between the contact surfaces of the members while carrying the load.

Fig. 07: Bearing

8. Pulley

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt along its circumference. Pulleys are used in variety of ways to lift loads, apply forces & to transmit power.

Fig. 08: Pulley

9. 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.

Fig. 09: Shaft

10. Hacksaw

The hacksaw was manually used for cutting operation and grinding & polishing was done on different motors. The prior technology was using just one mechanism for one operation.

Fig. 10: Hacksaw

11. Nut and Bolt

A nut is a type of fastener with threaded hole. Nuts are almost always used opposite a mating bolt to fasten a stack of parts together.
A bolt is a fastener upon which the nut is fastened.

Fig. 11: Nut and Bolt

12. Sander wheel

A sander is a power tool used to smooth surfaces by abrasion with sandpaper. Sanders have a means to attach the sandpaper and a mechanism to move it rapidly contained a within housing with means to hand-hold it or fix it to a workbench.

Fig. 12: Sander wheel

13. Buffing wheel

Polishing and buffing are finishing processes for smoothing a work piece's surface using an abrasive and a work wheel or a leather strop. Technically polishing refers to processes that use an abrasive that is glued to the work wheel, while buffing uses a loose abrasive applied to the work wheel.

Fig.13: Buffing wheel

14. Motor

Motor here used is as a prime mover to provide drive to the machine.
This is a 220V AC motor. It's main function is to convert electrical energy into mechanical energy for it's further use.

Fig.14: Motor

V. APPLICATIONS

- Can be used in mini workshop.
- New start-ups can go with this as a small initiative.
- Best suited at wooden, plastics as well as metallic workshops.
- Heavy usage at fabrication shop.

VI. WORKING

All the operations are carried out by giving electrical current to the motor. It converts electrical energy into mechanical energy. Then the mechanical energy is transferred to the rotating shaft and split into different operations.
The transmission system used in this machine is pulley system which is driven by V-Belt and chain drive system which is driven by sprockets. A belt and pulley system is characterized by two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across axles.
The arrangement has electrical motors, bevel gears, long shaft, scotch yoke mechanism, drilling, grinding, cutting, sander and a buffing set up.

- ❖ The power is transmitted to the long shaft from the electrical motor which is driven by electrical current.
- ❖ The grinding wheel is attached at the one end of the shaft and for making drilling action, bevel gears are arranged at the other end of the shaft.
- ❖ The scotch yoke mechanism is placed on the other shaft for doing cutting action.

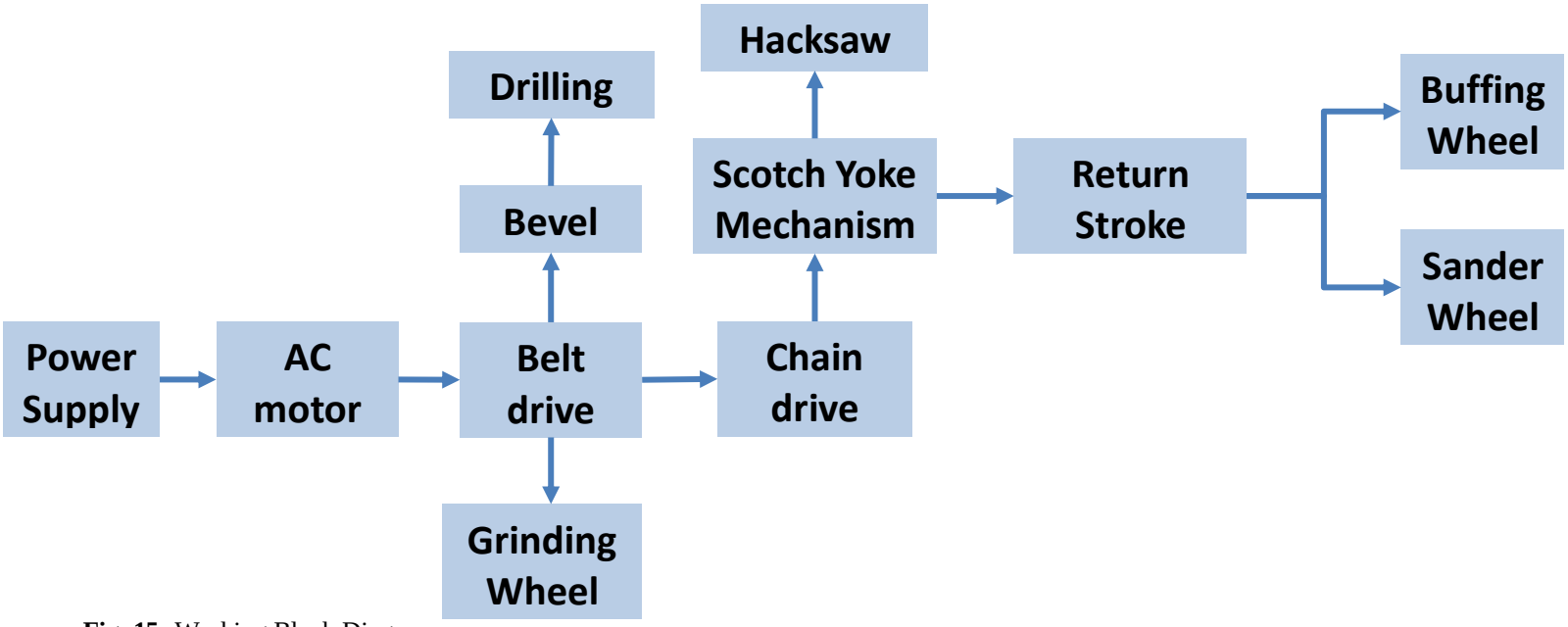

Fig. 15: Working Block Diagram

VII. LITERATURE SURVEY

Rakesh Ambade, Amit Sartabe, Meghraj Arekar, Vaibhav Khachane, Prajakta Gawali [1] This paper presents the concept of Human Powered Multi-Purpose Machine mainly carried out for production based industries. We have developed a conceptual model of a machine which would be capable of performing different operation simultaneously, and it should be economically efficient .This machine can be used in remote places where electricity is irregular or insufficient.

S. S. Kulkarni, K.K.Ahire , A.R.Pingale, V.N.Ahire, J.D.Ghodke, R. Shaikh [2] In this machine we are actually giving drive to the main shaft to which scotch yoke mechanism is directly attached, scotch yoke mechanism is used for sawing operation. On the main shaft we have use bevel gear system for power transmission at two locations which drives the other tools of the machine.

Prof. Rahul U. Urunkar, Sushant S. Karanure, Sangram M. Patil, Sudhir S. Patil, Sujay D. Sonawane [3] The numbers of operations are required in manufacturing processes which include but not limited to cutting, Drilling,
Grinding, Welding etc. However the separate equipment is required for performing each and every operation and hence the cost of setup is very high. This project deals with the fabrication of multipurpose mechanical machine which is capable of performing a number of operations in single machine.

Sharad Srivastava & Shivam Srivastava [4] 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 We have developed a conceptual model of a machine which would be capable of performing different operation simultaneously.

M.Prathyusha, P.Mounica, G.Kalyani, G.Prashanthi, Venkata Phani Babu.V [5] This paper presents the concept of Multi-Function Operating Machine mainly carried out for production based industries. They have developed a conceptual model of a machine which would be capable of performing different operations simultaneously and is also economically efficient. In this machine we are actually giving drive to the main shaft to which scotch yoke mechanism is directly attached, scotch yoke mechanism is used for sawing operation. On the main shaft a bevel gear system is used for power transmission at two locations**.**

Amit Kumar, Abhishek Kumar Kushwaha, Faizan Faridi, Aishwary Singh [6] This paper presents the concept of ‘’Multi-Purpose Mechanical Machine’’ mainly carried out for production based industries. So in this project we have a proposed a machine which can perform operations like drilling, cutting, grinding some lathe operations at different working centres simultaneously.

R.Robert Henty, R.Ranjith Kumar, R.Raju, M.Sheik Mohamed Shabir, V.Tamilvanan [7] There are many ways to cut metals, but all these ways take more time our aim isto reduce the cutting time by “DESIGN AND FABRICATION OF A MULTI PURPOSE SCOTCH YOKE MECHANISM” and increasing the number of productivity. By this method six operation can be performing.

Abhilash A.Aher, Prof. Satish D. Shewale, Rajat S. Sonawane, Suraj H. Dheple, Ramesh P. Dinkar [8] In this machine we are actually giving drive to the main shaft using belt pulley arrangement is directly attached, bevel gears are used for drilling operation. On the main shaft we have use bevel gears system for power transmission at three locations. Through bevel gear we will give drive to drilling, grinding as well as polishing centers.

Heinrich Arnold [9] Rather long re-investment cycles of about 15 years have created the notion that innovation in the machine tool industry happens incrementally. But looking at its recent history, the integration of digital controls, technology and computers into

machine tools have hit the industry in three waves of technology shocks. Most companies underestimated the impact of this new technology. This article gives an overview of the history of the machine tool industry since numerical controls were invented and introduced and analysis the disruptive character of this new technology on the market. About 100 Interviews were conducted with decision-makers and industry experts who witnessed the development of the industry over the last forty years. The study establishes a connection between radical technological change, industry structure, and competitive environment. It reveals a number of important occurrences and interrelations that have so far gone unnoticed.

Dr. Toshimichi Moriwaki [10] Recent trends in the machine tool technologies are surveyed from the view points of high speed and high performance machine tools, combined multifunctional machine tools, ultra precision machine tools and advanced and intelligent control technologies.

Frankfurt am Main [11] The crisis is over, but selling machinery remains a tough business. Machine tools nowadays have to be veritable "Jack of all trades", able to handle all kinds of materials, to manage without any process materials as far as possible, and be capable of adapting to new job profiles with maximized flexibility. Two highly respected experts on machining and forming from Dortmund and Chemnitz report on what's in store for machine tool manufacturers and users.

Multi-purpose machines are the declarations of independence. The trend towards the kind of multi-purpose machining centers that are able to cost efficiently handle a broad portfolio of products with small batch sizes accelerated significantly during the crisis. "With a multi- purpose machine, you're less dependent on particular products and sectors", explains Biermann.

VIII. 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.

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