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Spot Facing Machine for Unique Applications

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Abstract

The expansion of the Indian manufacturing industry is heavily reliant on productivity and quality. Productivity is determined by a variety of elements, one of which is the manufacturing efficiency with which the organization's operations and activities are carried out. Productivity may be increased by lowering overall machining time, merging processes, and so on. In the case of mass production, where the diversity of jobs is limited and the number to be produced is large, it is critical to complete the work as quickly as possible. This is not conceivable if we use a general-purpose machine to manufacture. Using a specific-purpose machine is the best approach to optimizing both production rate and quality. Drilling requires human power, drilling depth cannot be accurately calculated, the task may be ruined due to human mistakes, and varied-sized holes cannot be drilled without changing the drill bit. It takes a long time to repeat several tasks. These are the disadvantages.

Keywords: - *drill bit, quality,productivity, CATIA V5, production rate etc.*

INTRODUCTION

Special Purpose Machines (SPM) are not readily accessible. Standard production programmes do not cover it either. They are created and tailored to the individual needs of the consumer. Bespoke machines are another name for them. The application of SPM reduces human mistakes and fatigue in repeated operations, and raises productivity to the required level. It also ensures part quality and interchangeability. It is either a cam-operated machine, one that employs hydraulics and pneumatics as acting elements, or a combination of the

three. To send commands to the actuating elements, a specialized programmable logic controller is frequently employed in conjunction with positional sensors and transducers. As an actuating element, several specific motors, such as stepper motors and servo motors are sometimes employed. Special mechanisms, drives, gears, and so forth may also be employed. After all of this effort, the production is really high. However, in order to reap the benefits of this highly specialized equipment, the input to the automatic machine must be subject to tight quality control.

A spot face, also known as a face, is a machined feature that faces a specific section of the work piece (a spot), producing a smooth, flat, correctly placed surface. This is especially important on cast or forged work pieces, because the smooth, flat, correctly positioned surface of the spot face contrasts with the surrounding surface, whose roughness, flatness, and placement are prone to broader tolerances and hence cannot be secured with machining accuracy. The most common use of spot facing (spot facing) is to face the area around a bolt hole where the bolt's head will sit, which is often done by cutting a shallow counter bore, just deep enough "to clean up," that is, only enough material is removed to get down past any irregularity and thus make the surface flat. Other common applications of spot facing include facing a pad onto a boss, creating planar surfaces in known locations that can orient a casting or forging into position in the assembly, allowing part marking such as stamping or nameplate riveting, and providing machine-finish visual appeal in spots without the need for overall finishing (FAO). In the traditional approach, only one task can be worked on at a time for diverse operations such as drilling, tapping, spot facing, and so on; however, to boost productivity, a special purpose machine that can execute several operations in one cycle is required. Increasing manufacturing quality while decreasing production costs and time are critical variables in obtaining increased productivity. To achieve this aim, present manufacturing processes must be reconsidered, which may require the adoption of new production techniques and more modern technology.

The following studies are carried out in this paper: Component handling (loading and unloading) and hydraulic clamping save time. Increase in both qualitative and quantitative productivity; reduced human involvement; indirect decrease in operator

fatigue; increase in corporate profit A multi-tasking machine includes a special purpose machine. This is a novel technique for increasing organisational productivity. When we compare a regular machine to a special-purpose machine in terms of time, cost, number of processes needed, and so on, the multi-tasking machine is the better option. The most notable characteristic of employing multi-spindle machines is the cycle time; parallel machining reduces overall operating time.

The form and geometry of the valve body vary significantly from those of other sections. The situation of the side and top ribs is multifaceted and difficult to manufacture. The side and top ribs of the valves are difficult to produce on a turning machine. The final operation after the different processes are completed is the back spot surgery on the valve body. The spiral boring machine is the primary option for doing the back spot confronting procedure. There are several perspectives required in the actual operation, but as of now no other alternatives appear, so the method is running on the widespread penetration machine. This is an unusual operation on the radial penetrating machine since the shaft travelling upward indicates inverse gravity. As a result of the mass on the axle, vibrations occur, and the axle runs out. It has an impact on the machine's proficiency. Part clasping is also a difficulty since the time required is significantly more, and if clipping is not done properly, a disaster may occur because the shaft lifts the body above.

Drilling is the most well-known machining procedure, with the operation in business creating round apertures in metallic and non-metallic materials. The drilling process accounts for about 75% of all metal-cutting methods. Drills often have a high length-to-diameter ratio, making them suitable for drilling large holes; nevertheless, due to their flexibility, crucial safety precautions must be taken to maintain precision and protect the drill from breaking. Drilled holes can be both optically and physically blind. A through hole is formed when a drill exits the reversed side of the work piece, whereas a blind hole is formed when the drill does not leave the work piece. Chips that form inside the work piece must leave via the flutes to the exterior of the device throughout the process. Friction will be created as the chip is generated and withdrawn towards the surface. When the drill bit makes contact with the work piece during the hole-making process, friction and heat are generated. As a result, chip transfer and cutting fluids are among the

most important components to consider throughout this technique. Drilled holes are frequently larger than the drill diameter, and depending on the application, the drilled holes will have been treated to various procedures, such as reaming or sharpening, to improve surface completeness and dimensional accuracy.

OBJECTIVES

1. To increase production rate
2. To reduce the operator fatigue
3. Any unskilled operator can do the operation with ease
4. To reduced cost of production
5. To reduce the cycle time
6. To reduce the set up time.

METHODOLOGY

A. Existing Machine

1. The work is now fastened to the fixture, which is a hefty fixture weighing roughly 9 kg.
2. The operator must raise the fixture and place it on the machine's table before performing the spot facing operation. Once the operation is completed, the fixture must be rotated again to unclamp the component.
3. Because the two holes are faced one by one, it takes time.

B. New concept for low cost automation

1. We are designing 3 gears.
2. Gearbox which consists of sun gear at center and 2 planetary gears are meshing.
3. The sun gear with rotate the other 2 gears.
4. MT2 taper shank drill is used which is a standard drill.
5. By all this attachment at a time 2 holes of the component will be spot faced which will increase the production rate and productivity.

THEORY

In this topic, some important points have been discussed which are useful in the special purpose spot facing machine

A. Existing Spot Facing Machine

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2. The operator must raise the fixture and place it on the machine's table before performing the spot facing operation. After completing the operation, the fixture must be rotated again to unclamp the component.
3. Because the two holes are confronted one by one, it takes time.

Fig.1 Existing Spot Facing Machine.

B. Material Properties

Material properties that are used in a spot facing machine are listed below.

1. Yield Strength

It is the maximum stress that can be developed in a material without causing a permanent deformation.

Here, yield strength of gear is 328.6Mpa.

2.Tensile Strength

It is a material's capacity to resist breaking or tearing under strain. The tensile strength of the gear is 800-1100 MPa, depending on the diameter.

3. Hardness

It is a material's capacity to resist deformation, indentation, and penetration caused by abrasion, drilling, impact, and scratching. The maximum hardness here is 200 BHN.

CATIA MODELLING

The catiav5 programme is used to design the real spot-facing machine based on a spot-facing machine as the study subject. The primary goal of this research is to improve the failing structure.

1. Gear

Gears are spherical mechanical components with teeth around their circumference. These teeth interlock with the teeth of the second gear, transferring power and motion between them. Gears increase torque while decreasing speed.

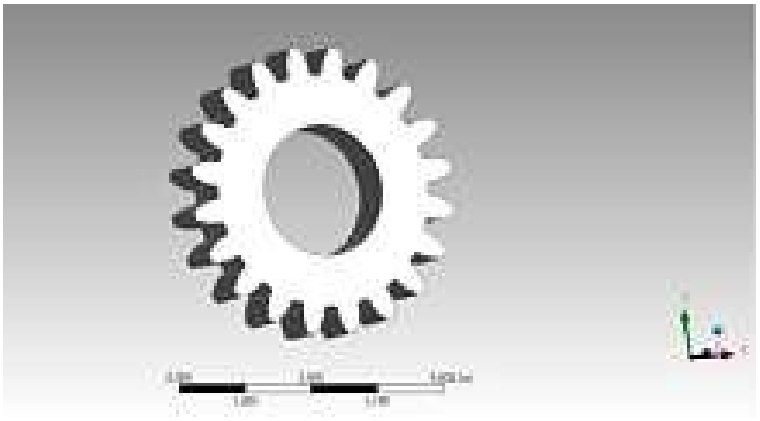


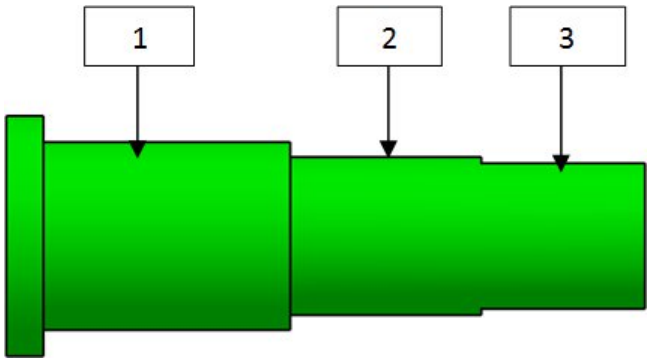
Fig.2 CAD model of gear

Specification

Table.1 Specification of Gears

Specification	Formula	Values(mm)
Addendum	M	1.046
Dedendum	1.25*m	1.3075
Clearance	0.25*m	0.2615
Working depth	2m	2.092
Whole depth	2.25m	2.3535
Total Thickness	1.5708m	1.6430

2. Shaft



A shaft is a mechanical device component that transmits rotational motion and power. Other mechanical parts, such as gears, cams, sprockets, and so on, are attached to the shaft at the appropriate positions. Shaft CAD model, as seen in the image above.

Specification

Table.2 Specification of Shaft

Specification	Values
Length	83.5mm
Diameter(1)	25mm
Diameter(2)	21mm
Diameter(3)	20mm

2. Key

A key is a machine element used in mechanical engineering to link a spinning machine element to a shaft. The key prevents the two elements from rotating relative to one another and may allow torque transmission. A shaft key always necessitates a key seat on both the shaft and the mechanical device. A typical key is depicted here, along with the key seat in both the shaft and the mechanical transmission part.

Fig.4 CAD model of key.

Specification

Table.3 Specification of Key

Specification	Values
Width	5mm
Height	4mm
Length	20.5mm

3. Top housing

It is the top portion of the gearbox. The housing is a sealed chamber filled with special purpose grease. It can resist high temperatures and maintain its lubricating properties. The CAD model of the top housing is depicted in the image below.

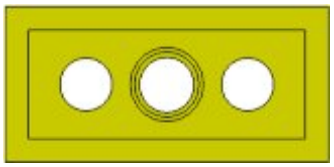


Fig.5 CAD Model of Top Housing

Specification

Table.4 top housing

Specification	Value
Length	141mm
Height	12mm

4. Thrust Bearing For Driving Gear

Bearings are used to support shafts. Thrust bearings are capable of withstanding axial loads but not radial ones. As a result, ball bearings will be employed for radial loads.

The CAD model of a thrust bearing for a drive gear is seen in the image below.

Fig.6. CAD Model of Thrust Bearing For Driving Gear

Specification

Table.5 Specification of Thrust Bearing For Driven Gear

Specification	Value
Inner diameter	25mm
Outer diameter	47mm
Width	15mm

5. Thrust Bearing For Driven Gear

Thrust bearings for driven gear are used to support axial loads. The CAD model of a thrust bearing for a driven gear is illustrated in the image below.

Fig.7 CAD Model of Thrust Bearing For Driven Gear

Specification

Table.6 Specification of Thrust Bearing For Driven Gear

Specification	Value
Inner diameter	25mm
Outer diameter	37mm
Width	7mm

7. BOTTOM HOUSING

It is located at the bottom of the gearbox. This is a sealed chamber containing special purpose grease. All components, such as gears and shafts, It contains a key, bearings, and other components. The bottom housing CAD model is seen in the image below.

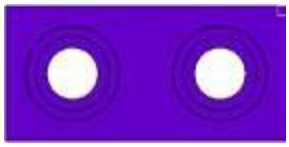


Fig.8 CAD model of bottom housing.

Specification

Table.7 bottom housing

Specification	Value
Length	141mm
Height	67mm

8. CIRCLIP

A circle is a type of fastener or retaining ring that consists of a semi-flexible metal ring with open ends that can be snapped into place on a dowel pin or other item to allow rotation but prohibit lateral movement. The two basic groups are internal and external. It is a common component. The shaft is fitted with an external retention ring to prevent it from moving past the ring's point.

Fig.9 CAD Model of Circlip.

Experimental Set Up of Spot Facing Machine

1. We are designing 3 gears.
2. Gearbox which consists of sun gear at Centre and 2 planetary gears are meshing.
3. The sun gear with rotate the other 2 gears.
4. MT2 taper shank drill is used which is a standard drill.
5. By all this attachment at a time 2 holes of the component will be spot faced which will increase the production rate and productivity.

Fig.10 Experimental Setup of Special Purpose Spot Facing Machine

C.Comparison Between old Machine and New Machine.

Table.8 Comparison between Old Machine and New Machine

Sr.No	Parameters	Old Machine	New Machine
1	QUANTITY	Quantity to be produced 300 components per 8 hr shift.	Quantity to be produced 1200 components per 8 hr shift.
2	MOUNTING OF FIXTURE	Fixture is manually operated.	Fixture is permanently mounted.
3	CYCLE TIME	60 second.	Cycle time reduced to 20.4 second.
4	FATIGUE TO OPERATOR	More.	Less.
5	MAINTENANCE COST	More.	Less.
6	NO OF SHIFT	No of shifts required=100/8=12.5shift.	No of shift required=40/8=5shift.

D.Result Graph on Production Vs Time.

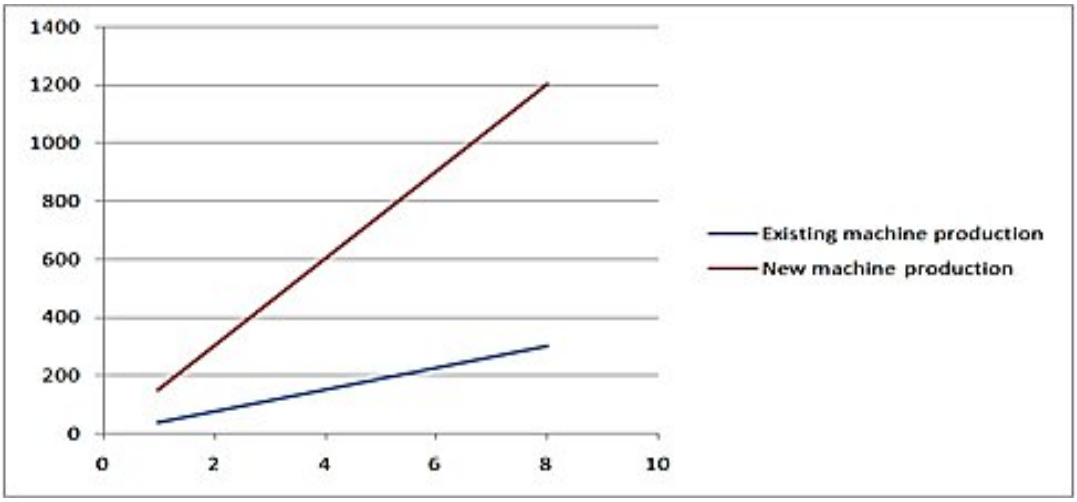


Fig.11 Result between New Machine and old Machine with Production Vs Time(Hr).

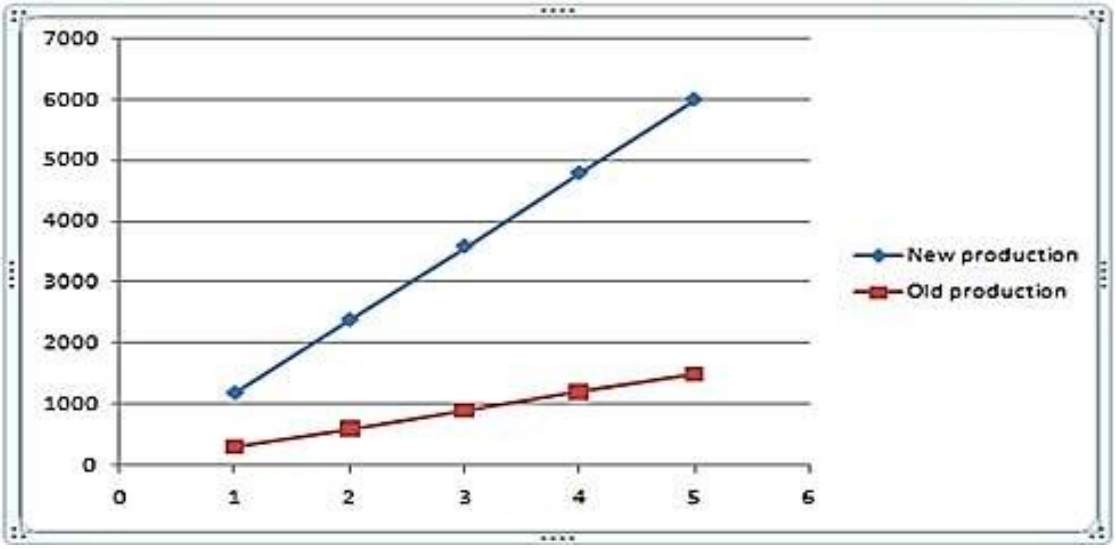


Fig.12 Result between New Machine and Old Machine with Production Vs Number of Shifts

CONCLUSION

The conclusion of this research includes performance enhancement by catia, productivity improvement, cost reduction of spot-facing operations, fatigue reduction for the operator, optimization, and design change.

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