Modification In Gear Hobbing Machine

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Abstract: *Gear hobbing machine is a machine used for gear cutting, cutting splines, and cutting sprockets, which is a special type of milling machine. The teeth or splines are progressively cut into the work piece by a series of cuts made by a cutting tool called a hob. Compared to other gear forming processes it is relatively inexpensive but still quite accurate, thus it is used for a broad range of parts and quantities.*

It is the most widely used gear-cutting machine for creating spur and helical gears and more gears are cut by hobbing than any other process, as it is relatively quick and inexpensive.

Index Terms **– Casting, Milling, Modification, Gears.**

I. INTRODUCTION

The gear hobbing machine is the main gear processing equipment, which is used to manufacture large volumes and high efficiency production of spur and helical gears. Now question comes when there is need to manufacture variable transmission ratio of gears, at that time we need frequently to produce and replace the driving change gears, which bring inconvenience for the industry. This inconvenience results in decrease in production efficiency, precision, accuracy and processing flexibility. To avoid this major inconvenience we are re- equipping this gear hobbing machine.

Recently every manufacturing industry is very much conscious about improvement in equipment performance and in this techno part computerized Numerical Control Technology is playing most important role. It is not economic for industry to install in machine at a time they have old machine so that retrofitting is useful. Retrofitting refers to the addition of new technology or features to older systems this definition gives an almost all information about the word retrofitting. When we say that retrofitting related to some component that mean we try to upgrade that component and improve their efficacy through a present technology. Rebuilding and remanufacturing typically include a CNC retrofit. The anticipated benefits include a lower cost investment than purchasing a new machine and an improvement in uptime and availability. But there are often other unanticipated benefits to retrofitting including lower energy costs, higher performance and a new level of manufacturing data accessibility.

II. METHODOLOGY

The LORENZ SJV00 universal gear hobbing machine was originally a standard mechanical transmission machine. LORENZ SJV00 machine includes hob spindle, disk regulator, commonplace hob head, work table, modification gears, hydraulic driving and cooling system, electrical system and so on. It drives by one main motor, with all motions of the machine, like rotation of the hob and work table achieved by exploitation mechanical modification gears and corresponding index ratios. The main drive motor is a single speed three phase AC 2.2 kW induction motor. Totally different speeds will be achieved through a pulley- block belt. Index quantitative relation between the worktable and the hob gear modified by using index gears that is settled within the back of the machine. The right constant timed relationship between the revolution of the hob and the worktable maintained with help of index modification gears and feed modification gears. Separate system is employed to affects the rotation of the work gear and correlates the feed motion through a separate modification gear system (known as differential change gears) for getting the right lead. The differential imparts slight supplemental increment or decrement motion of the worktable freelance of index modification gears and feed modification gears. Worktable is mounted on giant bearing surface to enhance the damping against the intermittent cutting action of a hob. A worm wheel of a size larger than maximum size of gear to be hobbed drives the worktable on the machine. The mechanical drive to work table is via one worm-wheel, and suits right and left hobs, achieved by an additional gear within the indexing arrangement: - The arrangement is additionally suitable for each climb cutting and traditional hobbing. Cutter spindle holds the hob arbor and ensures that the hob arbor and cutter assembly run true on its own axis throughout cutting. To reduce the result on the intermittent cutting action of the hobbing method, hob shift arrangement has done including the regulator.

Limit switches get used as a security cut out or primarily as signal switches. An electrical pump provides the coolant oil to the hob head while cutting. The electrical control gear cabinet is mounted on the machine rear and has the whole contactor switch gear and machine control relays. In the front of the machine, a switch panel has settled. Principle behind hobbing i.e. a nonstop generating method, in which the cutter (the hob) rotates continuously in mesh with the gear being hobbed, progressively cutting all the teeth at constant time. because the hob rotates, its multiple cutting edges, that all lie on associate degree enveloping helicoid worm surface, cut move into house the flanks of a virtual generating rack of infinite length that continuously rolls with the gear blank to generate the desired tooth type. Rotation of the hob in mesh with the work piece during this approach, with no different relative motion, would generate conjugate teeth on the gear. Within the method of cutting different teeth of substances or different ratio of substances combine, the gear should be adjusted. Which should be adjusted with the transmission quantitative relation of the created gear couple and therefore the teeth number of created gears. During this complete method modification gears are essential to hob totally different gears since the index ratio depends on the quantity of teeth of the gear and therefore the hob and the variety of gear that must be manufactured. Once the produced gear is modified, the modification gears should be calculated and manufactured. This will increase not solely complexness however additionally the process prices and adjusting time for producing and fixing the modification gears and results inconvenience.

III. Flow of Machine

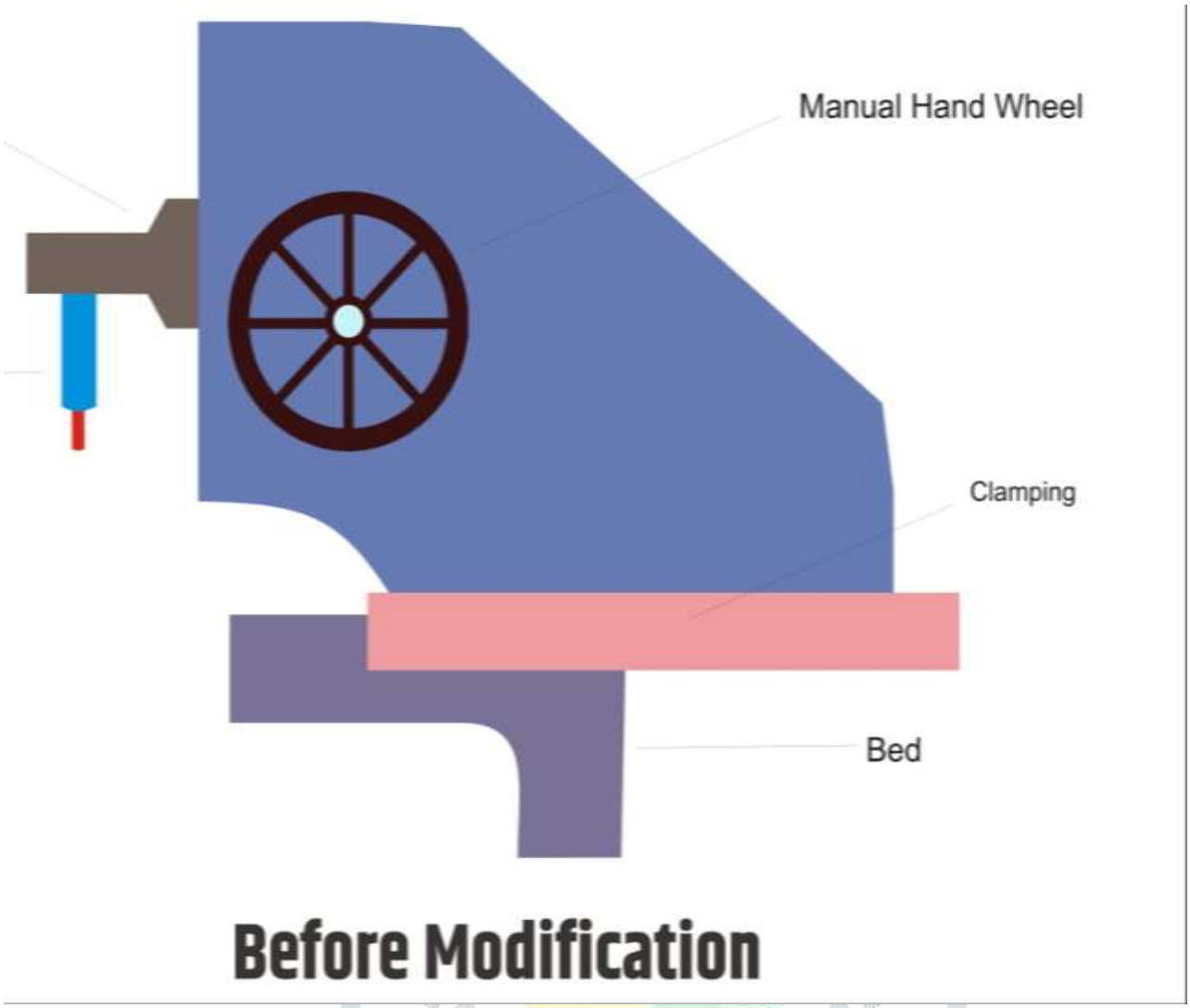
MACHINE DETAILS

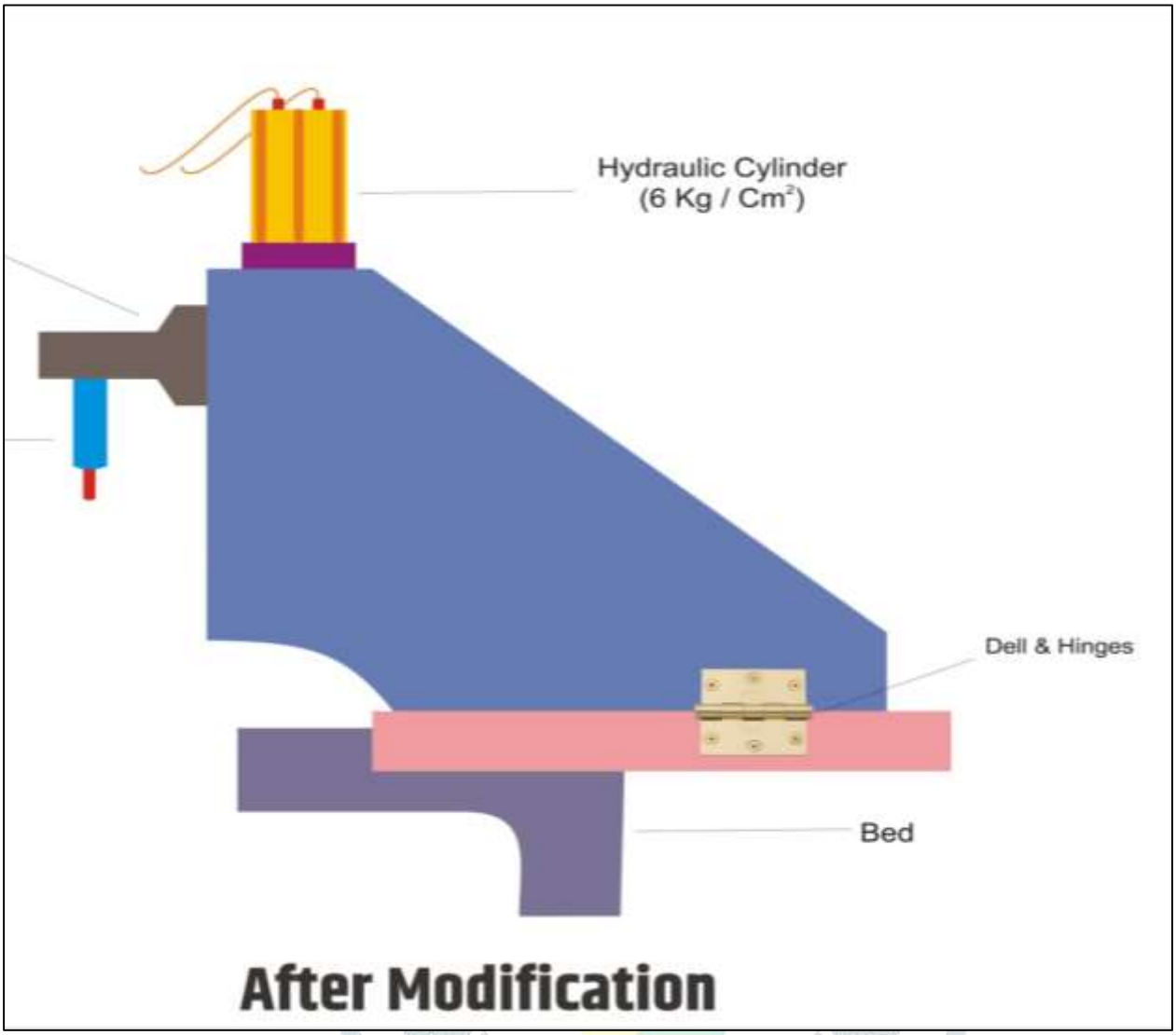
TYPE OF MACHINE	**GEAR SHAPING MACHINE**
MAKE	LORENZ
TYPE	SJV00
TYPE OF CONTROL	KONVENTIONELL

TECHNICAL DETAILS

MAXIMUM WHEEL DIAMETER	180mm
MAXIMUM MODULE	4
MAXIMUM WEIGHT	40Kg
STROKES –INFINITELY VARIABLE	150-1000 Hub/min
NO OF TEETH	12-150

In the previous design the job was assembled and disassembled by sliding the center support in horizontal and vertical (X-Y) direction, which was flexible to its position after fixing the job. Because of the sliding nature of the center support, the flexibility in the job was high and due to which the run out, defect and inaccuracy of the job was high.

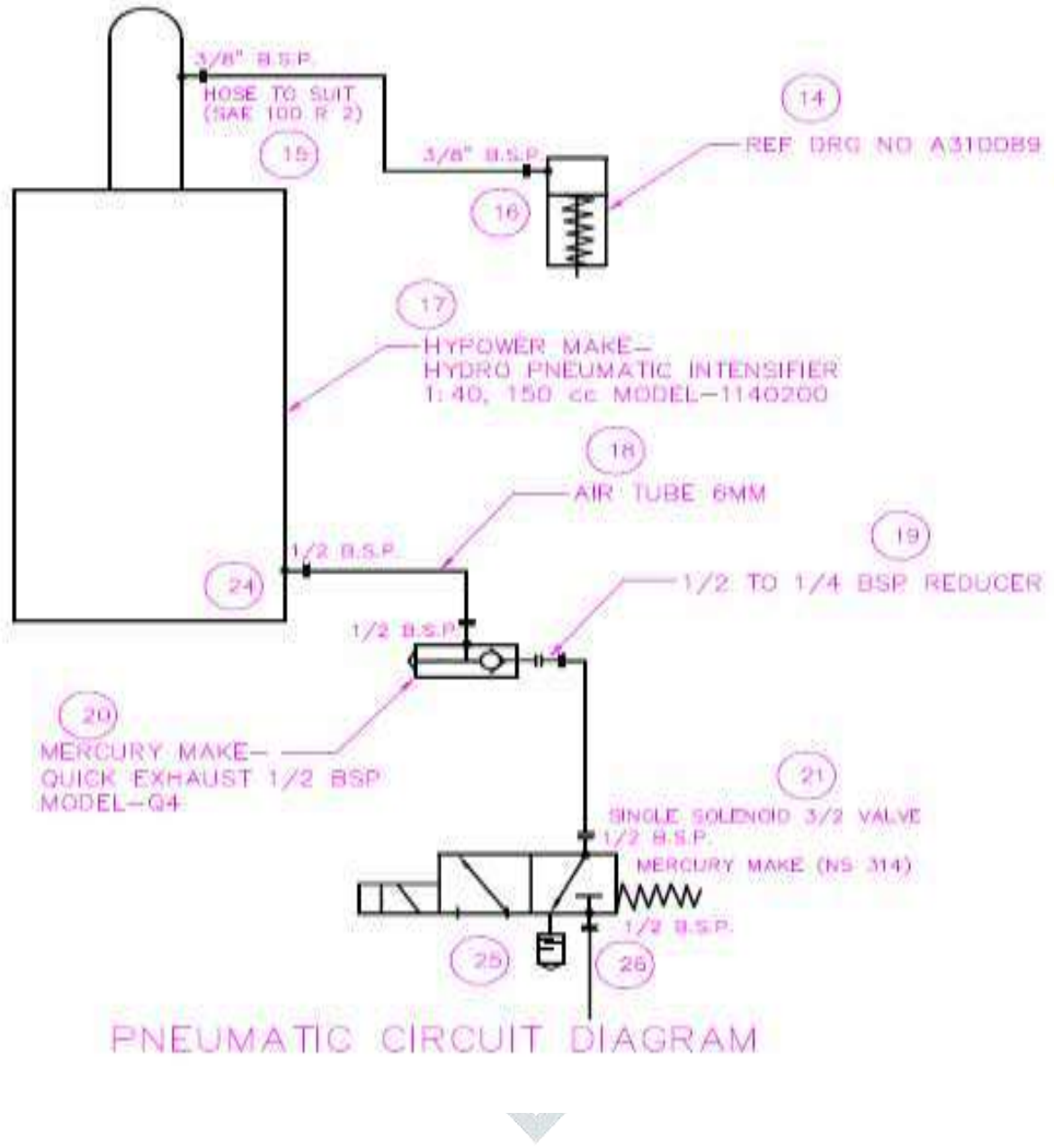

Manual Hand Wheel
Clamping
Bed
Before Modification



So, to increase the accuracy of the job and to decrease the cost and time, we fixed positional variation in the horizontal directional movement of the center by welding and screwing it, which reduced the vibration and flexibility of the position of the job and increased the accuracy and quality of the job and also eliminated the time to slide the center support which results in decreasing the error, run out, time of assembling and disassembling the job.

By fixing the horizontal position of center, we found that it was difficult to load the component on the fixture. So, we changed the center support and designed a new center support and fixed it one step ahead on the vertical direction.

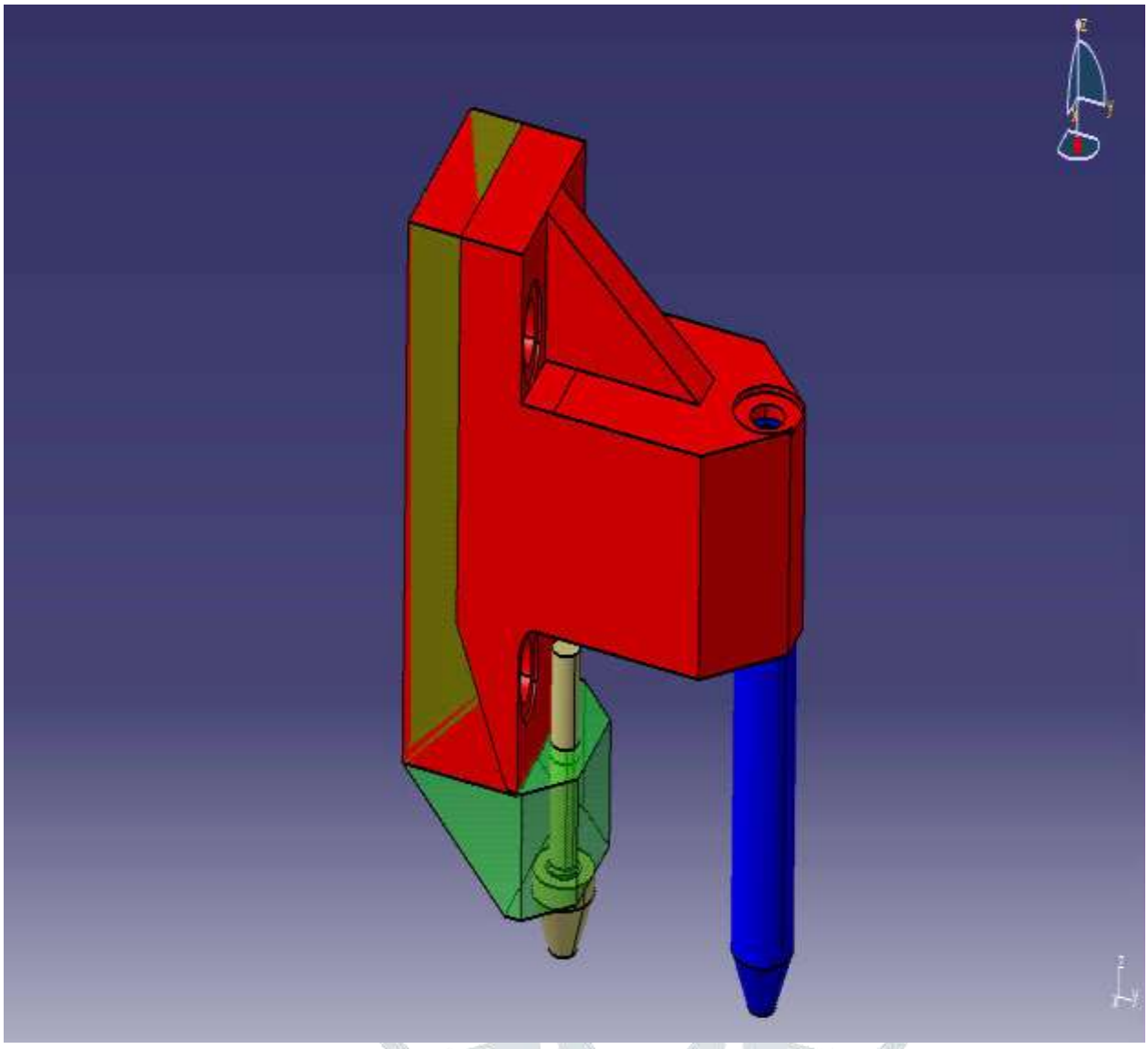
HYDRAULIC AND PHEUMATIC CIRCUIT

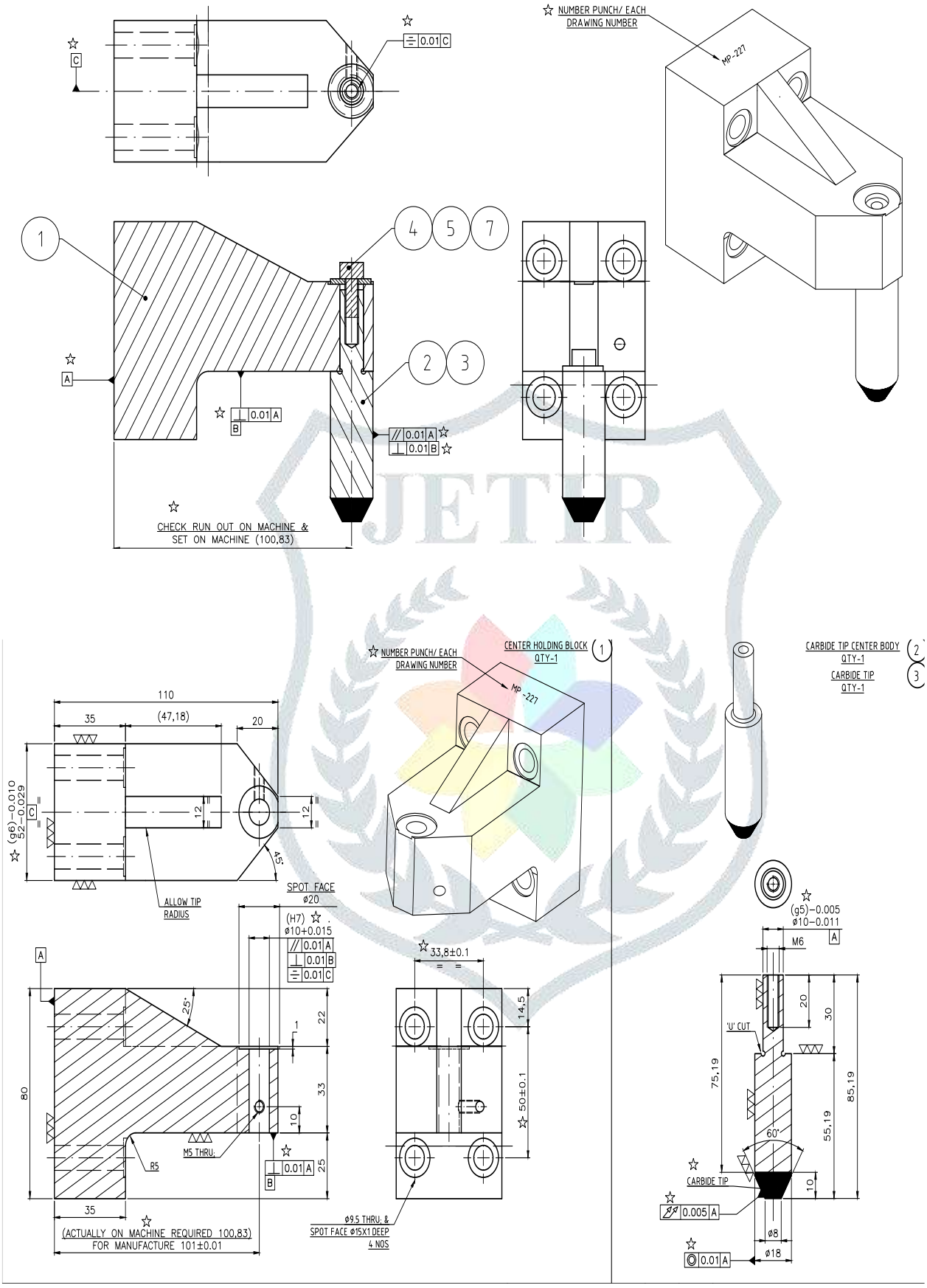


Pneumatic circuit Diagram

The available power supply in the company was Pneumatic supply of 3.5bar which is used for the cleaning of the burr by compressed air gun, this same supply is to be used to actuate the cylinder which in turns de-clamps the job. This pressure isn't enough to de-clamp and also this line is common to all the machines in the plant, there is a possibility of pressure drop as there might be another operator using it. Hence to compensate for this loss and to avoid any interruption in the operation of the fixture mechanism we have used an intensifier in the circuit of ratio 1:40.

DESIGN OF NEW CENTER SUPPORT




NUMBER PUNCH/ EACH DRAWING NUMBER
MP-227
CHECK RUN OUT ON MACHINE & SET ON MACHINE (100,83)
CENTER HOLDING BLOCK QTY-1
CARBIDE TIP CENTER BODY QTY-1
CARBIDE TIP QTY-1
ALLOW TIP RADIUS
SPOT FACE ø20
M5 THRU.
R5
(ACTUALLY ON MACHINE REQUIRED 100,83) FOR MANUFACTURE 101±0.01
ø9.5 THRU. & SPOT FACE ø15X1 DEEP 4 NOS
'U' CUT
M6
CARBIDE TIP

STEPS INVOLVED IN MANUFACTURING THE CENTER SUPPORT

CASTING

The center support is made up of En8 (Carbon steel), and the work piece of the job is made with the use of casting process.

MILLING

Milling process is done on the work piece to achieve required the shape required for center support.

DRILLING

Drilling is done to provide hole on the workpiece accord to requirement. Four holes of 9.5mm diameter with depth of 15mm is done and a single hole of 10mm diameter is done.

SURFACE FINISHING

Surface finishing is done to give good surface finish to the center support.

RESULT

1. TIME-SAVING The time measured for setting and handling of the job without fixture was about 11sec and with fixture it is 5sec.

2. ERGONOMICS BRIEF Survey (Baseline Risk Identification of Ergonomics Factors).The BRIEF Survey is intended to find any ergonomic risk factors that may cause any musculoskeletal symptoms to the employee operating the machine. Lower the score of the survey, greater will be the safety and better ergonomics. The BRIEF Survey of the process shows a very significant improvement from 30 to 8 points.

BEFORE MODIFICATION

JOB NO.	RUN OUT BEFORE HOBBING	RUN OUT AFTER HOBBING
1	0.03	0.06
2	0.03	0.04
3	0.02	0.05
4	0.01	0.03
5	0.04	0.06
6	0.02	0.03
7	0.02	0.04

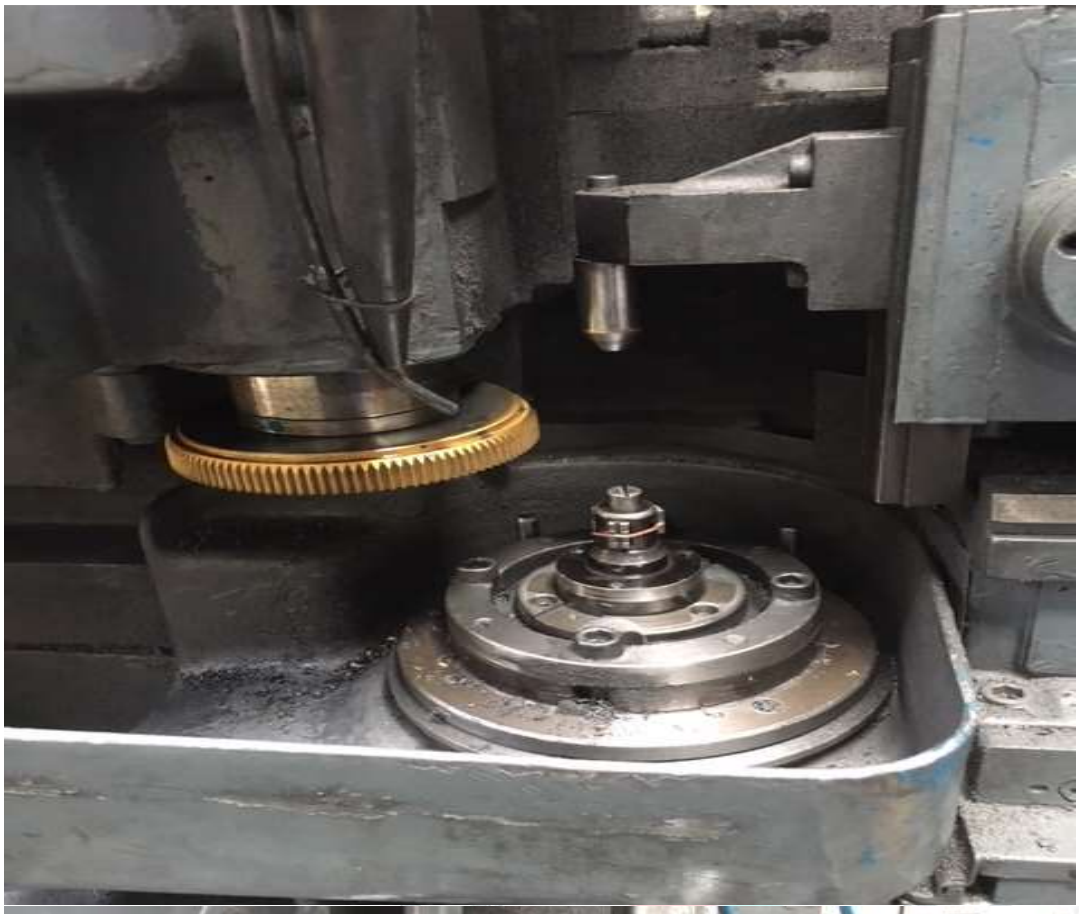
8	0.05	0.06
9	0.01	0.03
10	0.03	0.06

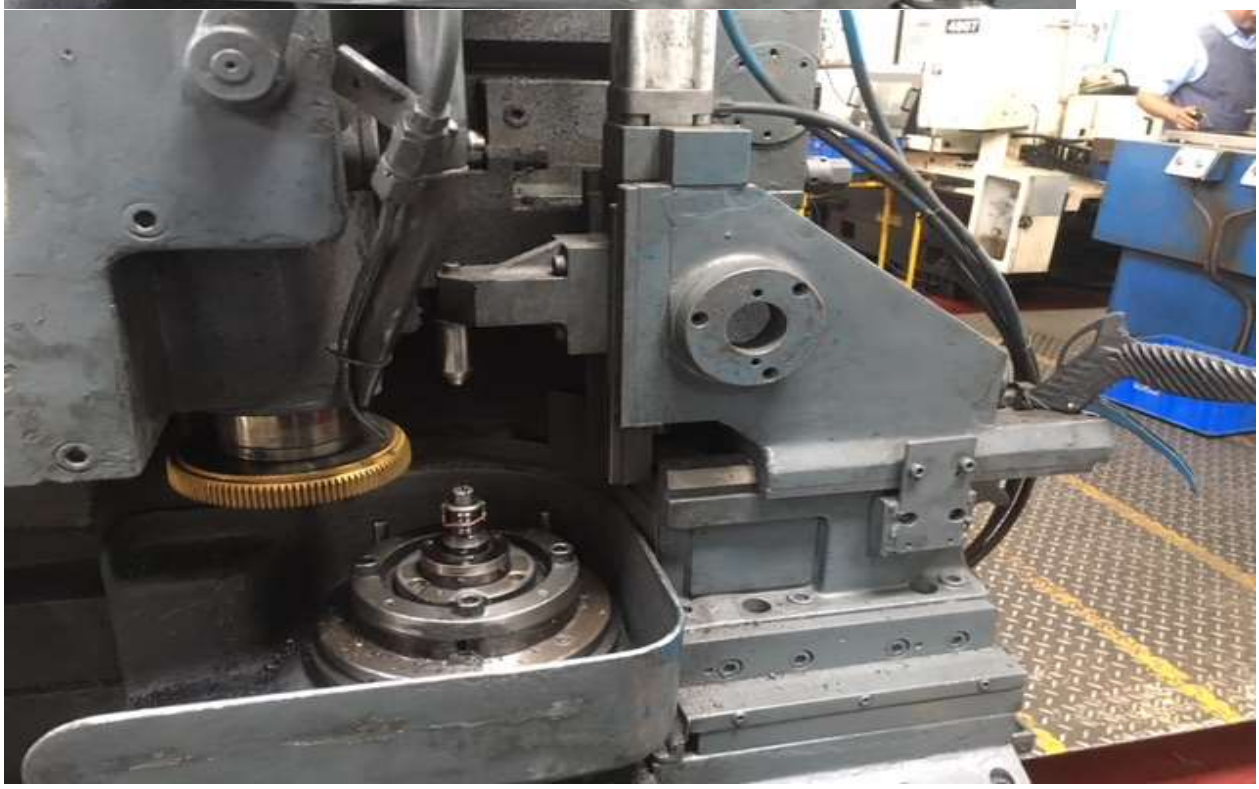
AFTER MODIFICATION

JOB NO.	RUN OUT BEFORE HOBBING	RUN OUT AFTER HOBBING
1	0.03	0.02
2	0.03	0.01
3	0.02	0.01
4	0.01	0.005
5	0.04	0.02
6	0.02	0.01
7	0.02	0.01
8	0.05	0.03
9	0.01	0.01
10	0.03	0.02

3. PRODUCTIVITY: Number of jobs rejected per 100 jobs manufactured, before modification = 8 jobs. Number of jobs rejected per 100 jobs after modification = 1. Therefore, Material Productivity without fixture = 99%

PICTURE AFTER MODIFICATION





CONCLUSION

Retrofitting is nothing but replacement or addition of equipment to existing machine tools to improve not only energy efficiency but extend their lifespan. So, ultimately increase their general output also. Addition of new technology or features to older systems helps improve efficiency and accuracy regarding hardware as well software transformations. Also, computerized numerical innovation simplifies the operations and minimizes the complexity for the operator. So, this retrofitting with

computerized numerical control innovation has been globally recognized and accepted in the gear production industries.

With the ever-increasing demand and pace of production it is necessary to improve the process of production. The proposed clamping mechanism has successfully reduced the ineffective work and the risk factors and eventually results in an over-all increase in the productivity. The mechanism introduced here can be used to develop similar fixtures, which demand clamping of any circular work piece.

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