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Modification and Development of Work Holding Device (Steady-Rest)

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***Abstract*—Steady rests are additional median, supports, used in lathe machine for long willowy work to halt it from being bent by the action of the cutting forces. When the length and stiffness of a work piece make it laborious to machine without distorting or deflecting the job, many industrialist turn to the steady rest as a work piece support device. This is mainly veracious for long rod, shafts and homogeneous parts used in industries or heavy equipment demand. Steady rest can be mounted and used to superior advantage on most types of lathes for lengths, face and, centering, internal turning, plunge cutting, boring, and parting off etc. In this paper the effort is being made to modify a Steady Rest to reduce the machining time and setup time in the process. The addition of machining time and setup time gives the total machining time of the process. So, if the set up time will raise, unfortunately total machining time will increase. To make operations fast and accurate there are many attachment used in lathe machines. To reduce the set up time and increase accuracy one of the accessories is generally used which is called as Steady Rest**.

Keywords- *Lathe Machine, Steady Rest, External Element, Pneumatic Cylinder, Control Valve.*

I. INTRODUCTION

Steady rests have been used for many years in association with machining operations. They typically appoint three hydraulically or pneumatically operated roller arms which are adapted to concentrically support a cylindrical job about its outer periphery to provide evenly distributed support for it. The steady rest serves to resist the inclination of the machine tool to throw the job off center during machining process. Few times before, known steady rests have been delineation only for use in contacting the outer periphery of the job.

Consequently, different method must be appointed to support inner surfaces of the job at its free end. When executing machining operations on solid bar stock it is

Possible to use the point of conventional dead centering devices to engross indentations in the end of the job and hold it in place.

With tubular work pieces, however, other techniques must be appoint. The need to support the inner periphery of a tubular job is especially supreme when a lathe is used to make a circumferential cut near the end of the job. One commonly used support technique for tubular work pieces is to appoint a plug to fill the open end of the tube.

Unfortunately, these techniques take additional time thereby decreasing productivity, not to mention the expenditures required for procuring the different support devices. The conventional steady rest assembly appoints a hydraulic or pneumatic cylinder connected to the roller arms. The cylinder must exert heavy pressure on the roller arms during machining operations to prevent the part from going off center. This demand for a constant and large amount of cylinder pressure is difficult to achieve in an economical manner.

Fig-1 Convectional Steady Rest.

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II. RELATED WORK

A. Design and Analysis of Self Centering Steady Rest

Turning is a machining process in which a cutting tool typically a non-rotary tool bit describes a helical tool path by moving more or less linearly while the work piece rotates. This time is termed as "Set up time" while time required to remove material is known as "machining time". Total machining time is summation of both the setup time and machining time. So if the set up time will increase, eventually total machining time will also increase**.**

B. FirtzRehm

A steady rest for the clamping of round shaped work pieces the steady rest including three holding elements including two outer holding elements adapted to be swiveled about a pin mounted in a housing and a middle holding element is adapted to be adjusted axially and in which the coolant or lubricant can be carried away to a work piece by means of ducts in the housing and through the middle holding element of steady rest.

C. Richard J

A true centering steady rest for rotating supporting an elongated cylindrical work piece for a metal working operation on the outer diameter of the work piece, such as a grinding operation. The steady rest includes a housing in which is slid ably mounted a pusher arm carrying a work piece center wear pad. The axis of a rotating work piece may shift in a small distance either horizontally or vertically. My prior patents disclose means for adjusting the wear pad locations for a horizontal change in the work piece axis, without adjusting the steady rest housing. A need exists for independently making either a vertical adjustment or a horizontal adjustment of the wear pads without having to adjust the position of the entire steady rest.

D. Levi D. Tyson

This invention relates to improvements in steady rests for use with lathes and the like for the purpose of supporting long cylindrical work pieces against deflection from the cutting tool pressures. objective of this paper is to provide a steady rest which has greater adjustability for different diameters of work and which is more quickly and easily operated.

E. Welin Berger Guy

A self-centering steady rest with extensive diameter clamping range for centering cylindrical work pieces on machine tools using a constant linear displacement clamping force. The steady rest includes two pivoting levers arranged symmetrically about a linearly displaceable slide with the levers being swing able from their starting position. Providing the ranges within which the diameter of a work piece can lie to obtain an appropriate clamping force .A self-centering steady rest with the extensive diameter clamping range for machine tools.

F. W. F. Liber

This invention is related to a steady rest, which employs a pair of parallel, sliding, linear moving clamping bars for moving wear pads or rollers toward a work piece. A steady rest of the above nature which will be simple in construction, inexpensive to manufacture, easy to install and manipulate, compact in appearance, and very efficient and durable in use.

G. Xue-Song Wang, Yu-Hu Cheng, Guang-Zheng Peng

This paper presents a dynamic model and a design method for an accurate self-tuning pressure regulator for pneumatic-pressure–load systems that have some special characteristics such as being nonlinear and time-varying. A mathematical model is derived, which consists of a chamber continuity equation, an orifice flow equation and a force balance equation of the spool. Based on a theoretical analysis of the system dynamics, a three-order controlled auto-regressive moving average model is used to describe the practical pressure–load systems. Then a linear quadratic Gaussian self-tuning pressure regulator is designed to realize an adaptive control of pressure in the chamber. Because the system parameters are time-varying and the system states are difficult to detect, the recursive forgetting factor least-squares algorithm and the Kalman filtering method are adopted to estimate the system parameters and the system states. Experimental results show that the proposed self-tuning pressure regulator can be adapted to parameters which vary with such factors as the volume of the chamber and the setting pressure and that better dynamic and static performances can be obtained.

H. Richard J

A steady rest having separate adjusting screws for adjusting the clamping positions of three work piece engaging rollers either horizontally or vertically. A steady rests is employed to support a cylindrical workpiece for precision machining or grinding. More specifically it is related to a multi-point true centering steady rest having internal cams for adjusting the center position of a supported rotating work piece in both horizontally and vertical.

III. STUDIES AND FINDINGS

A. pneumatic system:

A pneumatic system is a composition that utilizations packed air to transmit and control vitality. Pneumatic compositions are exploit as a part of controlling train entryways, programmed generation lines, mechanical cinches, and so forth. Pneumatic composition exploit broadly as a part of industry are usually fueled by compacted air or packed idle gasses. A halfway found and electrically fueled compressor

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powers chambers, air engines, and other pneumatic gadgets. A pneumatic framework controlled through manual or programmed solenoid valves is chosen when it gives a lower cost, more adaptable, or more secure contrasting option to electric and actuators

Main Pneumatic Components: Pneumatic components can be split into two categories:

- Components that induce and transport compressed air.
- Components that absorb compressed air.

All main pneumatic components can be shown by simple pneumatic symbols. Each symbol shows only the purpose of the component it represents but not its structure. Pneumatic symbols can be combined to form pneumatic illustrations. A pneumatic diagram narrates the relations between each pneumatic component, that is, the design of the system. Pneumatic Components: There may exist apart in appearance and sizes of pneumatic components produced by different manufacturers. However, the functions and operating methods among these components are similar. The following are the image and cross section diagrams of the pneumatic components made by another manufacturer for your reference. Pneumatic components for the production and transportation of compressed air are a) Compressor, b) Pressure regulating component. And other component is Connecting pipe.

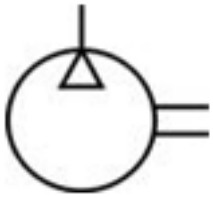

Fig-1 Compressor *Pneumatic symbol*

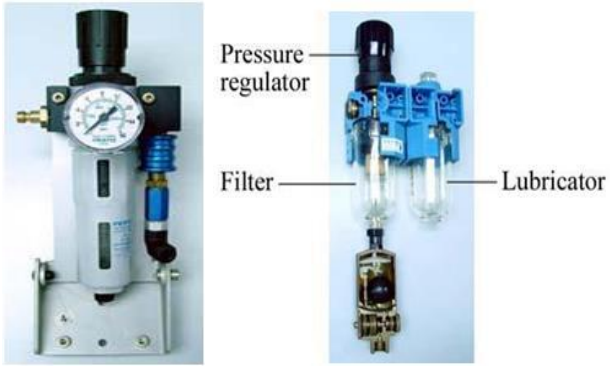

Fig-2 Pressure Regulating component

Fig-3 Double acting cylinder

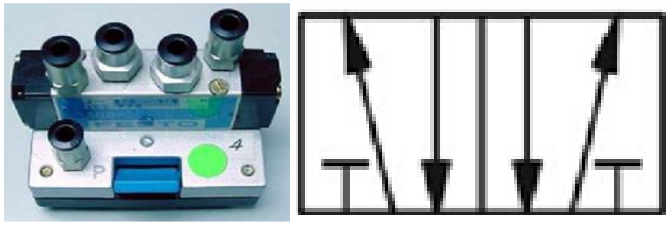

Fig-4 Directional control valve *Cross Section*

B. The Prone of Pneumatic Systems:

Pneumatic control frameworks are broadly utilized as a part of our general public, particularly in the mechanical segments for the driving of programmed machines. Pneumatic frameworks have a ton of points of interest.

C. High Effectiveness:

Numerous plants have furnished their generation lines with compacted air supplies and versatile compressors. There is a boundless supply of air in our climate to deliver packed air. Also, the utilization of packed air is not confined by separation, as it can undoubtedly be transported through funnels. After use, compacted air can be discharged straightforwardly into the air without the need of handling.

D. High Durability and Reliability:

Pneumatic segments are to a great degree strong and can't be harmed effortlessly. Contrasted with electromotive parts, pneumatic segments are more strong and solid.

E. Basic Design:

The outlines of pneumatic segments are moderately straightforward. They are in this manner more reasonable for use in basic programmed control frameworks.

F. High Adaptability:

Contrasted with the components of different frameworks, compacted air is less influenced by high temperature, dust, erosion, and so forth.

G. Safety:

Pneumatic frameworks are more secure than electromotive frameworks since they can work in inflammable

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environment without bringing about flame or blast. Aside from that, over-burdening in pneumatic framework will just prompt sliding or end of operation. Not at all like electromotive segments, pneumatic segments don't smolder or get overheated when over-burden.

H. Natural Friendly:

The operation of pneumatic frameworks does not create contaminations. The air discharged is additionally handled in unique ways. Subsequently, pneumatic frameworks can work in situations that interest abnormal state of cleanliness. One case is the creation lines of incorporated circuits.

I. Practical:

As pneumatic segments are not costly, the expenses of pneumatic frameworks are very low. Additionally, as pneumatic frameworks are exceptionally tough, the expense of repair is essentially lower than that of different frameworks.

IV. EXISTING SYSTEM

Above study has given idea in the field of design, kinematic and dynamics of existing steady rest system. The steady rest consists of 3 arms assembled in a steel body with rollers at the arms for holding the work piece. The three arms in a circular movement to hold the center of the work piece. This helps to get the repeatability and consistency in getting the centering accuracy. All the three arms are operated by a different operating system that is mechanical operated and hydraulic operated. While studying existing system we found limitation that pneumatic system did not adopt yet on steady rest. Based on the theoretical and analytical result physical model has been developed.

V. OBJECTIVE

From the literature review finally, we decided to adopt pneumatic system and to develop pneumatic operated steady rest for lathe machine. Furthermore, the objective of our project is: -

- Implementation of Pneumatic System on Steady rest.
- Holding Capacity of Work piece.
- Self-Centering of jaws.
- Reduced Set up time and Non-productive time.

VI. CALCULATIONS

TABLE 1 CALCULATION

NO	*Pneumatic Pressure (BAR)*	*Area of Piston (M^2)*	*Force Generated (N)*	*Mass(KG)*
	1psi=0.0689bar	*$A = \pi (d_1^2 - d_2^2) / 4$*	*F= Pressure*Area*	*M=Force/gravity*
1	*6*	*0.0004123*	*247.38*	*25.21*
2	*7*	*0.0004123*	*288.61*	*29.41*
3	*8*	*0.0004123*	*329.84*	*33.62*
4	*9*	*0.0004123*	*371.07*	*37.82*

VII. EXPERIMENTAL SETUP

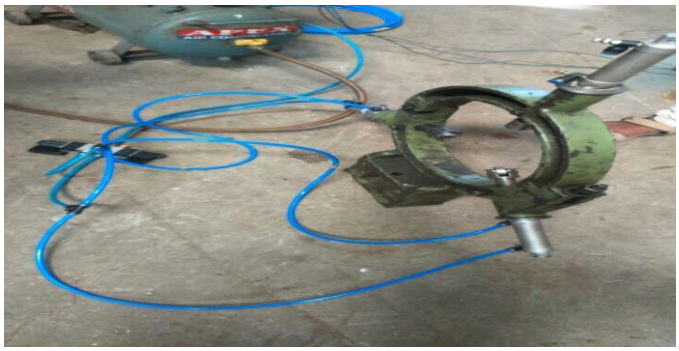

Fig-5 Experimental setup

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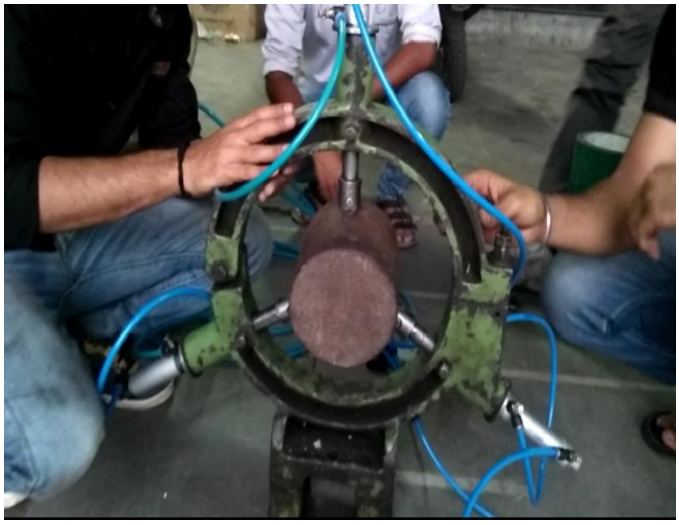

Fig-6 Modified Pneumatic steady Rest

VII. CONCLUSION

Considering design, working and kinematics of steady rest;

- Objective of the steady rest is achieved by pneumatic system.
- All the three arms of steady rest are operating simultaneously hence, self-centering of steady rest is achieved.
- It is concluded that the clamping time because of pneumatic system reduced by 3 to 4 minutes instead of manual adjustment, hence non-productive time is reduced.

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