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Developing an Auto Sizing System for Vertical Honing Machine

[1]SOMASHEKHAR P JATTI, [2]Dr. R. G MENCH

[1, 2] BVB College of Engineering, Department Of Industrial and Production Engineering, Hubli, India

Abstract: **Honing is an internal cutting technique that uses abrasives on a rotating tool to produce extremely accurate holes that require a very smooth finish. Similar to lapping where abrasive sticks are mounted in a rotating tool. Auto sizing means inspecting the dimension of work piece while machining itself. It avoids unnecessary time and manpower used in inspection process. It helps in getting high productivity. In this project work, an attempt has been made to build an auto sizing system using pressure cell and microcontroller. An experiment has been conducted by using two stage air compressor, air gauge, ADC, microcontroller, honing head etc., to study the variations of pressure, voltage verses clearance of work piece and depth micrometer.**

Keywords: **Honing head, Pressure cell, 8051 Microcontroller.**

I. INTRODUCTION

Honing is an abrasive machining process that produces a precision surface on a metal workpiece by scrubbing an abrasive stone against it along a controlled path. Honing is primarily used to improve the geometric form of a surface, but may also improve the surface texture. Honing tools Honing uses a special tool, called a honing stone or a hone, to achieve a precision surface. Smaller grain sizes produce a smoother surface on the work piece. The hone is usually turned in the bore while being moved in and out. Special cutting fluids are used to give a smooth cutting action and to remove the material that has been abraded. The flexible honing tool is a relatively inexpensive honing process. These tools produce a controlled surface condition unobtainable by any other method. It involves finish, geometry and metallurgical structure.

II. LITERATURE REVIEW

A research has been done to understand about AUTOSIZING SYSTEM FOR VERTICAL HONING MACHINE, using microcontroller and pressure cell, Background of the invention Honing is a relatively new industrial process. Originally it was developed for finishing or reconditioning of automobile cylinders, liners and also for correcting the shape, size and surface condition of liners. This honing machine is manufactured keeping in view fast, accurate and precision honing at a minimum cost for any variety of jobs. A b Schibisch, Dirk M.; Friedrich, Uwe [1] Honing is an abrasive machining process that produces a precision surface on a metal workpiece by scrubbing an abrasive stone against it along a controlled path. Honing is primarily used to improve the geometric form of a surface, but may also improve the surface texture and King, Robert C.; Hahn, Robert. [2] The hone is usually turned in the bore while being moved in and out. Special cutting fluids are used to give a smooth cutting action and to remove the material that has been abraded. Machines can be portable, simple manual machines, or fully automatic with gauging depending on the application.

By referring above Literature, we come to know how we can autosize the system using pressure cell and microcontroller and I found that invention of Honing is a relatively new industrial process.

III. PROBLEM STATEMENT

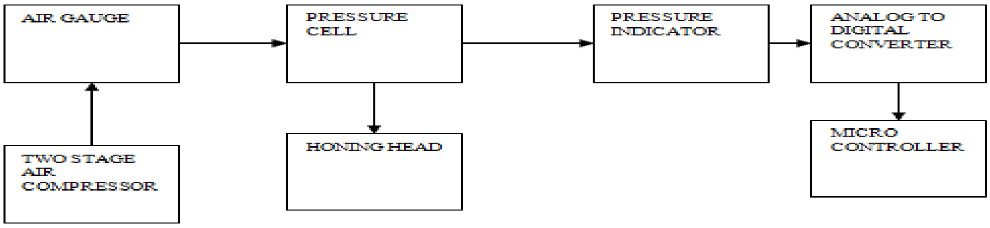
“Developing an autosizing system for vertical honing machine”

1.1 Objectives

1. Increase the productivity
2. Correcting the shape, size and surface condition of liners

IV. EXPERIMENTAL DETAILS

A. Set up



Air under pressure is passed through the tube fitted inside the honing head. When the gap between the nozzle and work piece bore surface increases, air pressure reduces in the line, which is sensed by the pressure cell. When the pressure reduces to predetermined level, the microcontroller/PLC stops the honing.

B. Pressure Sensor

A sensor is a device that produces a measurable response to a change in a physical condition, such as temperature or thermal conductivity, or to a change in chemical concentration. Sensors are particularly useful for making in-situ measurements such as in industrial process control.

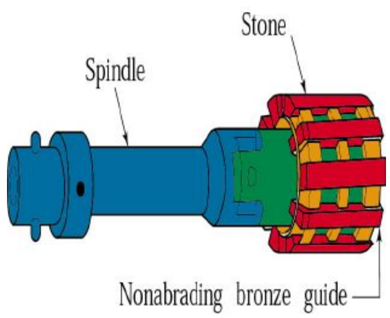
C. Pressure Indicator

Description

Digital pressure indicator is a 3½ digits five channel instrument. These channels are manually selected by means of a rotary switch. Buffered DC output of 200 mili volts for full scale indication of 1999 is provided with each channel.

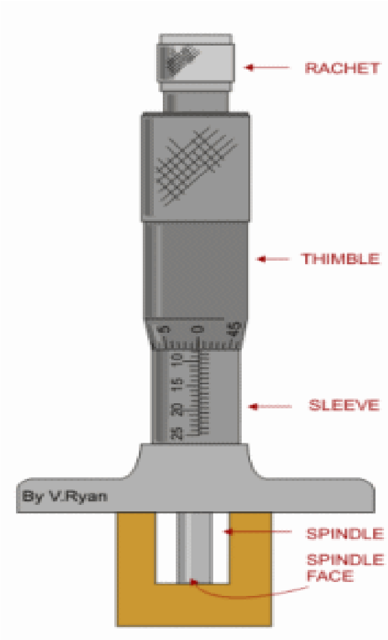
The instrument comprises of a precision high stability excitation source for exciting the sensors, multiturn helical potentiometers for initial tarring, and a high stability instrumentation amplifier and calibration circuitry. Output for recording is provided after adequate buffering.

D. Honing Head



A honing head comprises a holder having a plurality of radial guide slots angularly spaced from each other and an axial hole, a rough-finishing cone shaft and a finishing cone shaft or a single cone shaft axially slidably received in the hole, and a plurality of rough-finishing and finishing honing stone supports alternately disposed in the guide slots for radial movement therein.

E. Depth Micrometer



The depth gauge micrometer is a precision measuring instrument, used by engineers to measure depths. Each revolution of the rachet moves the spindle face 0.5mm towards the bottom of the blind hole. The diagram above shows how the depth gauge is used. The ratchet is turned clockwise until the spindle face touches the bottom of the blind hole. The scales are read in exactly the same way as the scales of a normal micrometer.

V. MICROCONTROLLERS

A highly integrated chip that contains all the components comprising a controller. Typically this includes a CPU, RAM, some form of ROM, I/O ports, and timers. Unlike a general-purpose computer, which also includes all of these components, a microcontroller is designed for a very specific task -- to control a particular system. As a result, the parts can be simplified and reduced, which cuts down on production costs.

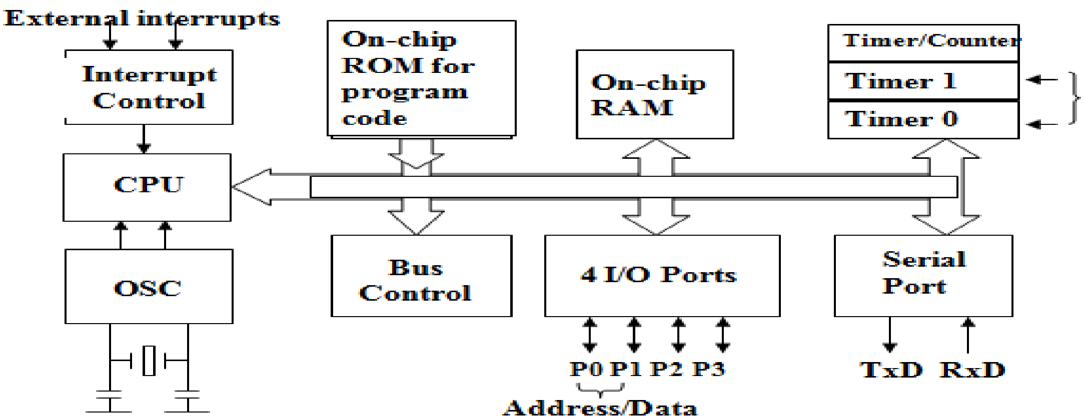


Fig:1 - Block diagram

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5.1 8051 Pin Description

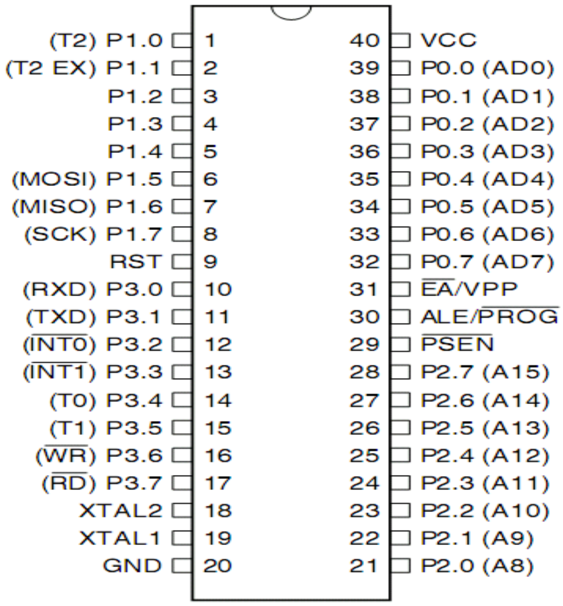
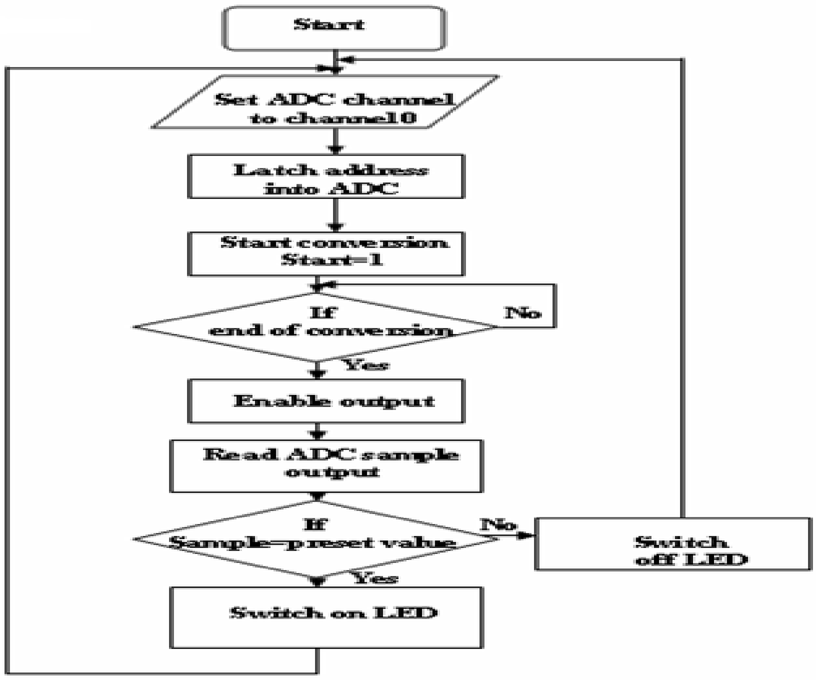


Fig:2 - Pin Configuration

The pin configuration represents as: - VCC: Supply voltage, GND: Ground, PORT 0: Port 0 is an 8-bit open drain bidirectional I/O port. PORT 1: Port 1 is an 8-bit bidirectional I/O port with internal pull-ups, PORT 2: Port 2 is an 8-bit bidirectional I/O Port Pin Alternate Functions: - P1.0 T2 (external count input to Timer/Counter 2), clock-outP1.1 T2EX (Timer/Counter 2 capture/reload trigger and direction control) P1.5 MOSI (used for In-System Programming) P1.6 MISO (used for In-System Programming) P1.7 SCK (used for In-System Programming). PORT 3: Port 3 is an 8-bit bidirectional I/O port with internal pull-ups.RST: Reset input. ALE/PROG: Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during accesses to external memory.

5.2 Flowchart



VI. RESULT AND DISCUSSION

Experiment No. 1: Pressure in = 6 bars

Clearance in mm	Pressure in bar	Voltage in V
0	1.89	42.1
0.01	1.87	41.7
0.02	1.87	41.7
0.03	1.85	41.2
0.04	1.83	40.7
0.05	1.83	40.6
0.06	1.83	40.6
0.07	1.81	40.3
0.08	1.81	40.3
0.09	1.78	39.6
0.1	1.71	37.9
0.11	1.59	35.2
0.12	1.54	35.2
0.13	1.48	34.1
0.14	1.43	32.5
0.15	1.39	31.3
0.16	1.36	30.4
0.17	1.32	29.7
0.18	1.31	28.9
0.19	1.29	28

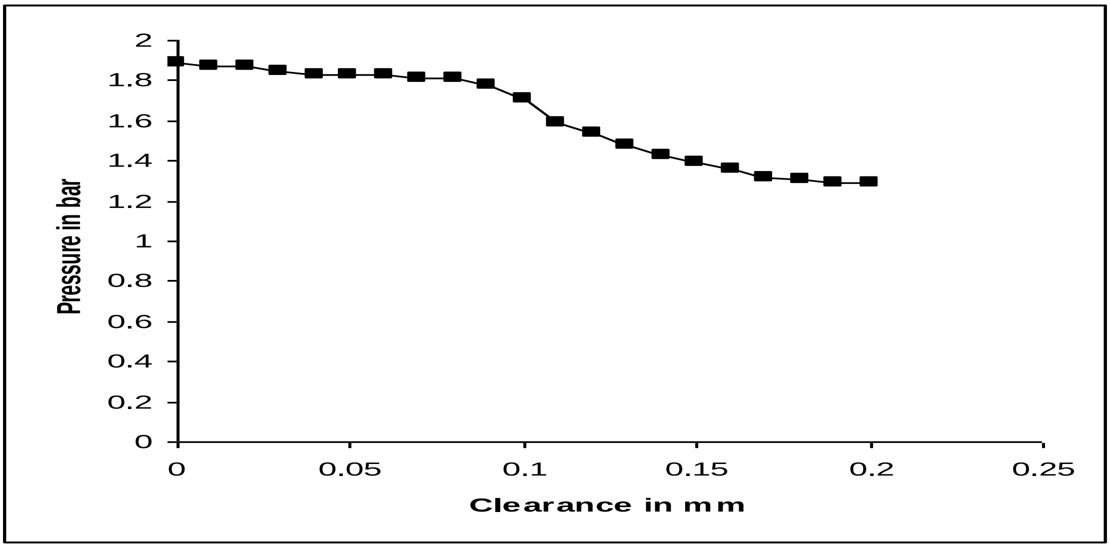


Fig3- Clearance vs Pressure

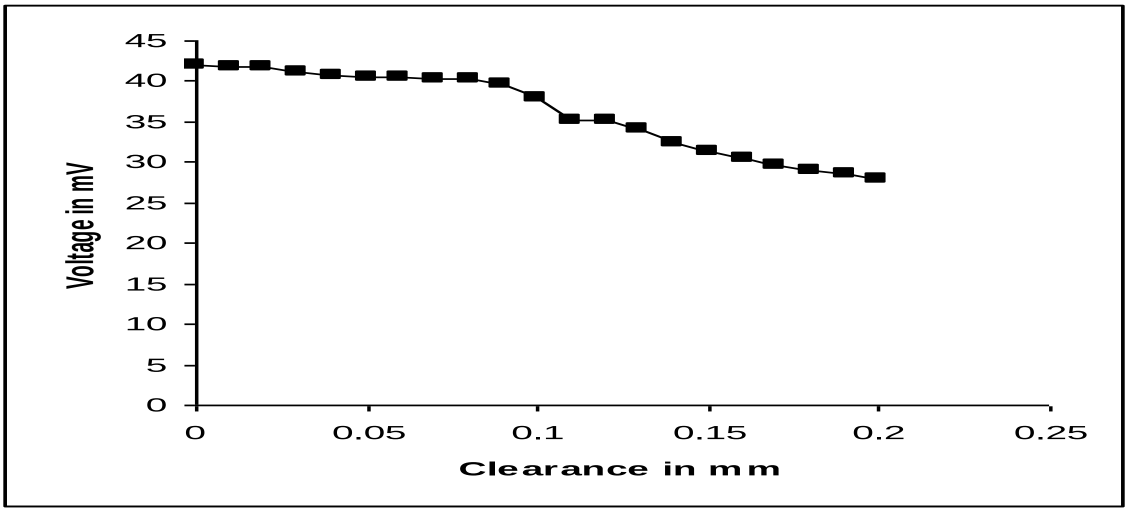


Fig:4- Clearance vs Voltage

Experiment No. 2: Pressure in = 8 bar

Clearance in mm	Pressure in bar	Voltage in V
0	1.93	1.891
0.01	1.93	1.889
0.02	1.93	1.888
0.03	1.92	1.886
0.04	1.92	1.880
0.05	1.91	1.878
0.06	1.90	1.872
0.07	1.90	1.867
0.08	1.90	1.862
0.09	1.89	1.857
0.1	1.89	1.851

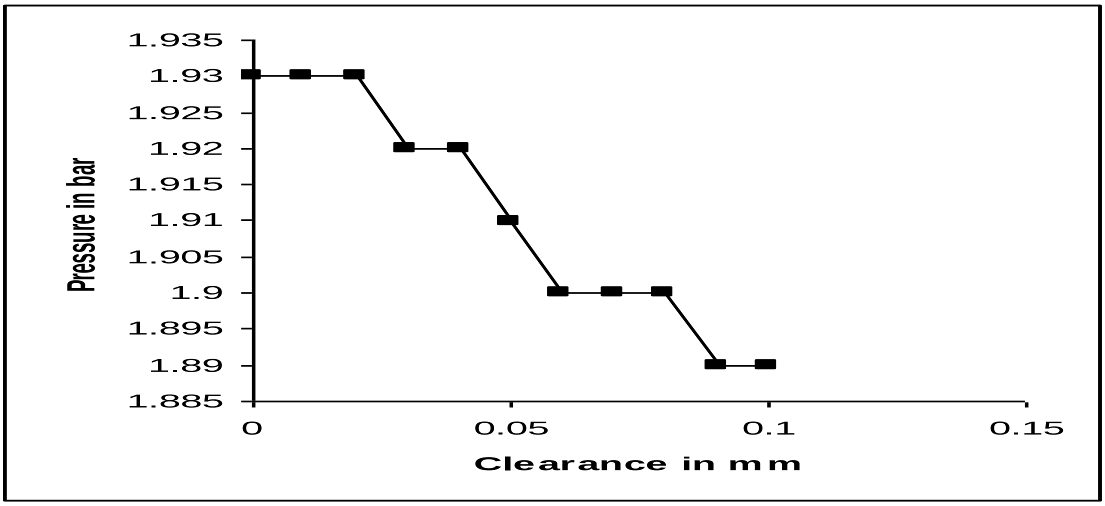


Fig:5- Clearance vs Pressure

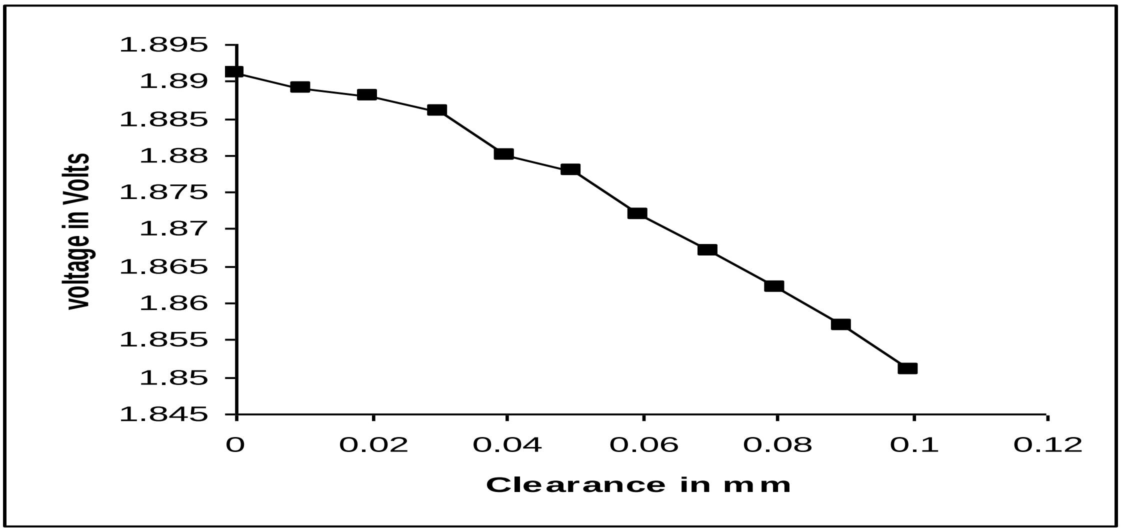


Fig:6- Clearance v/s Voltage

Experiment No. 3: Pressure in = 7 bar

Clearance in mm	Pressure in bar	Voltage in V
0	1.93	1.893
0.01	1.93	1.893
0.02	1.93	1.893
0.03	1.93	1.892
0.04	1.92	1.886
0.05	1.92	1.879
0.06	1.91	1.873
0.07	1.90	1.861
0.08	1.89	1.855
0.09	1.89	1.850
0.1	1.88	1.845

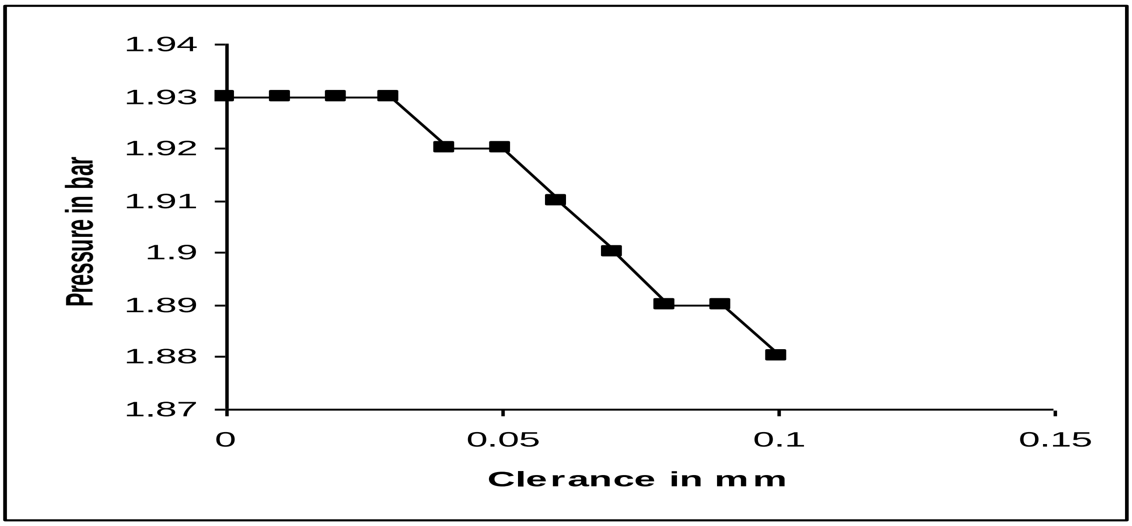


Fig:7- Clearance v/s Pressure

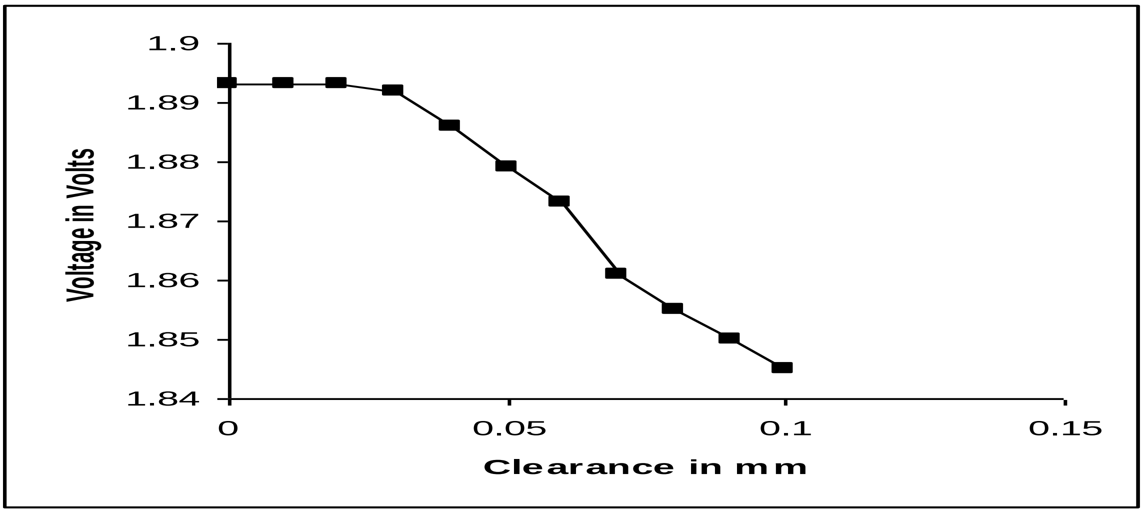


Fig:8- Clearance v/s Voltage

Experiment No. 4: Pressure in= 6 bar

Clearance in mm	Pressure in bar	Voltage in V
0	1.93	1.898
0.01	1.93	1.897
0.02	1.93	1.897
0.03	1.93	1.896
0.04	1.93	1.889
0.05	1.92	1.883
0.06	1.91	1.875
0.07	1.90	1.866
0.08	1.90	1.866
0.09	1.89	1.853
0.1	1.88	1.846

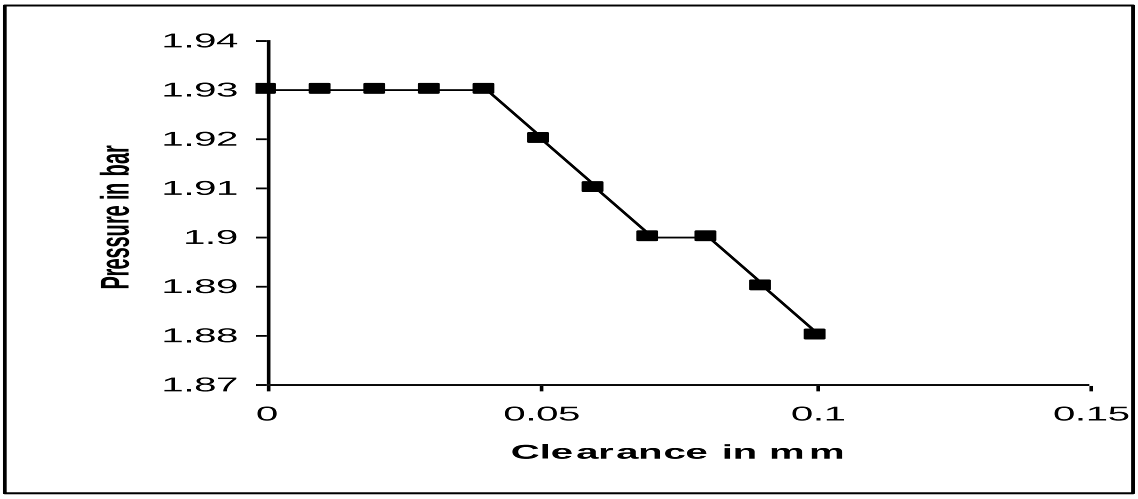


Fig:9- Clearance v/s Pressure

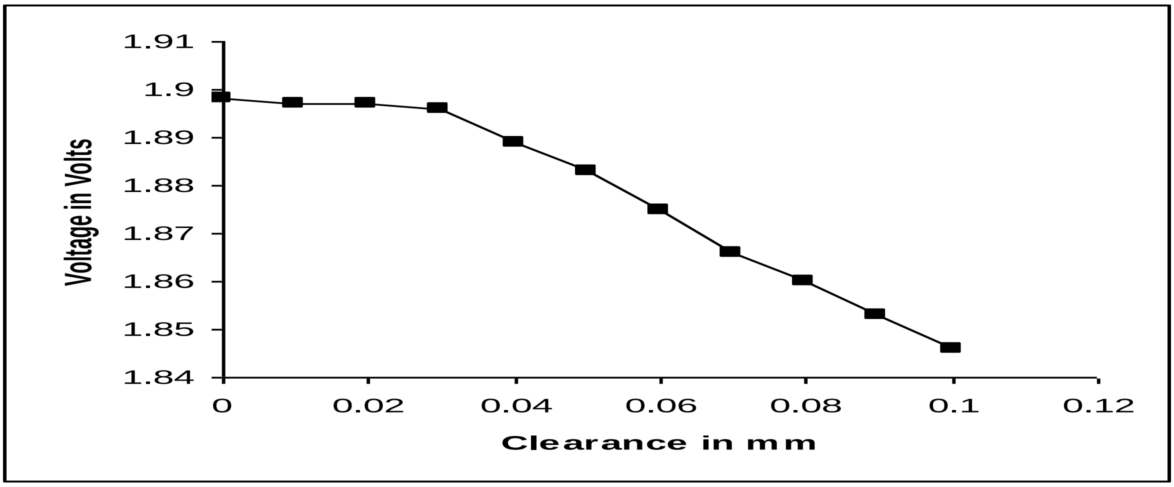


Fig:10- Clearance v/s Voltage

Experiment No. 5: Pressure in = 5 bar

Clearance in mm	Pressure in bar	Voltage in V
0	1.88	1.843
0.01	1.87	1.836
0.02	1.87	1.831
0.03	1.86	1.825
0.04	1.86	1.821
0.05	1.85	1.816
0.06	1.85	1.810
0.07	1.84	1.805
0.08	1.84	1.805
0.09	1.84	1.798
0.1	1.83	1.795

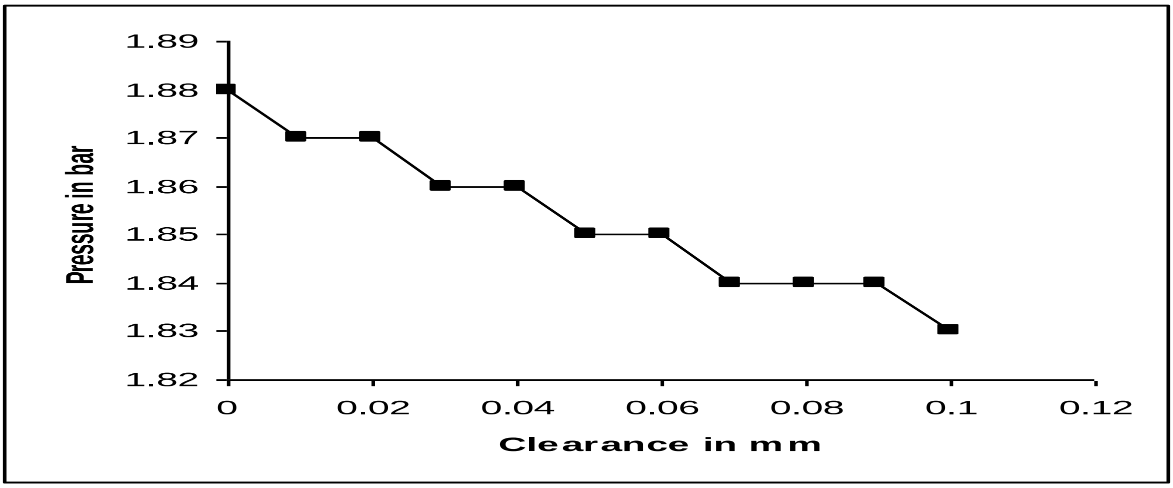


Fig:11- Clearance v/s Pressure

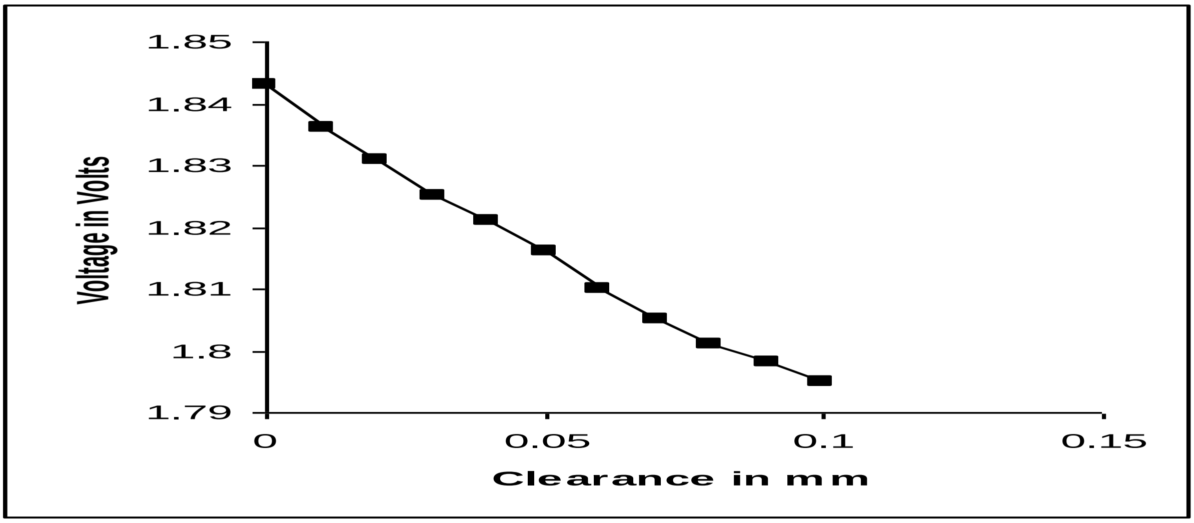


Fig:12- Clearance v/s Voltage

COMPARISON BETWEEN MANUAL AND AUTOSIZING:

MANUAL	AUTOSIZING
1.500 Products/day	1. 800 Products/day
2.200-250 BHN(Hardness)	2.200-500 BHN(Hardness)
3. Man power is high	3.Man power is less
4. Surface roughness is hard	4.Surface roughness is smooth
5.Lower the savings in energy cost	5.Higher the savings in energy cost
6.Low Production	7.High Production

VII. CONCLUSION

From the results and discussions it can be concluded that

- An Autosizing system was developed using pressure cell and microcontroller for the honing operation
- Man power is reduced

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