iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** III **Month of publication:** March 2018

DOI: http://doi.org/10.22214/ijraset.2018.3350

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

Design and Fabrication of Diaphragm Displacement Measuring Machine

K.M. Senthil Kumar[1], C. Thamaraiselvan[2]
[1]*Associate professor ,Department of Mechanical Engineering, Kumaraguru College of Technology. Coimbatore*
[2]*Pg-student,Department of Mechanical Engineering, Kumaraguru College of Technology. Coimbatore*

Abstract: ***The main purpose of this paper is to reduce the requirement of human resource by eliminating the useless complications and simplifying the whole process to improve the output and making it more efficient. It involves the design and analysis in the horn division to the grouping of two processes in the assembly line and making it into a single machine which reduces man power and increasing production.***
The present setup which is located in the assembly line consists of a diaphragm and the tone disc that is assembly in the armature rod. The height measuring is done individually. To perform these operations two operators are necessary. Hence these two stages are united which reduces the requirement of human resource and the time of production.
This paper is aimed to design a new fixture which would eliminate process analysis of the material and to increase the productivity. In this paper LVDT sensor is being implemented for the measurement of height instead of a dial gauge the normal pneumatic tighter is also replaced by a pneumatic torque gun where a pre-set torque value is given to the initial diaphragm tightening process and with the help of LVDT setup, where the height can be easily checked and dispatched to the next level of process. The height in between the armature rod and the diaphragm is an important factor that determines the frequency of the sound produced by the horn. When there is a variation in the desired frequency, then it means that desired height is varied. To measure the height in a effective and more accurate way LVDT is used.
Keywords: Armature rod, Diaphragm, Dial gauge, Copper Coil, Housing, LVDT, pneumatic cylinder, pressure gauge.

I. INTRODUCTION

With manufacturing becoming more and more spirited market companies globally struggle to increase their efficiency. Increasing labor costs in many industrialized countries, as well as reducing and calculating operating costs are just a few reasons companies choose to move or outsource their operations. Typically a popular of companies outsource to countries somewhere remuneration are low and production costs are lower. To decrease cost and remain spirited with manufacturers abroad, individual of the most important methods is called “lean manufacturing.” The major principle of lean manufacturing is to decrease waste in an operation such as long lead times, defects and objects waste. This paper addresses the purpose of lean manufacturing concepts to the permanent production process sector with a focus on the horn manufacturing company. The assembly section has different stages to manufacture the fully assembled horn. The stages are as follows

A. Spool assembly locking point holder&tuning screw assy
B. Thermal base assembly riveting continuity checking
C. Diaphram assembly riveting&height measuring
D. Horn pre crimping & final crimping
E. Air gap measuring &adjusting
F. Pretuning &mounting bracket assembly
G. Fire well testing
H. Tunning range checking &adhesive application
I. Batch no. stampling adhesive application
J. Quality 100% inspection

The presentation is measured by dB (decibel) and it is mostly dependent on the air-gap of the horn. This air gap can be adjusted by varying the height of the diaphragm from the armature rod end. The frequency varies on the horn type, Low tone - 335 Hz, high tone - 450 Hz. The remainder of the paper is organized as follows.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

II. PROBLEM IDENTIFIED

Two labors are compulsory to activate the two fixtures which involves the assembly of the diaphragm and for measurement of the height of the armature rod

1) This causes a time delay in the industrialized because process is done physically.
2) Combining both the process will increase the efficiency and decrease the work load.
3) Only experienced labor can operate.

III. METHODOLOGY

5-M Method or 5-Factor Method is a simple method of analyzing the causes and consequences (problems) based on the following five causes. For request, time study is a work dimension method planned to create the time for a practiced worker to take out a particular job at a definite level of performance. On the other hand, method study is the systematic recording and important inspection of presented and planned ways of doing job as a means of increase in easier and extra useful methods and reducing cost[2]

A. Man power

Man power causes are in humans people. We can raise the efficiency of labor force by following some greatest practices in manpower management.

B. Machines

It may cause in apparatus such as apparatus computers tools instruments technology. Design, installation and continuance of strong precise machines will reduce waste saves money and generate more accurate products.

C. Materials

It may cause in defect or material properties. Attention to quality purity
Performance and atmosphere will help increase in manufacturing process.

D. Methods

It may cause in the rules, regulations laws or standards. By combining most recent methods in green developed with time experienced methods from history will create efficient developed process.

E. Management

It may cause in unacceptable management. Precise measurement of data within machines and across the manufacturing floor provides response which helps to keep our function performing at highest profitability.

1) *Diaphragm Assembly Machine (Existing method):* This consists of a double acting cylinder which is actuated by the compressed air of pressure ranges from 4 to 6 bar. This double acting cylinders rod end is linked to the fixture centre section which is a moving part. The compressed air is total by a pedal press which is fixed at ground level as per the operator's convenience. During the forward stroke the rod end pushes the set up upwards as the chuck opens and thus the coil centre rod can be inserted. But we have planned a design to merge two workstations to a particular workstation. By combine we comprise to alter several changes in normal operation process or generate fresh regular operation procedure of machine.[1]During the return stroke of the cylinder the rod end retract thus makes the chuck to hold the spool centre rod firmly.
2) *Pneumatic Cylinder:* Pneumatic cylinders (sometimes known as air cylinders) are devices which use the power of compacted gas to produce a force in a reciprocating linear motion. Similar to hydraulic cylinders great forces a piston to move in the preferred way. The piston is a disc or cylinder and the piston rod transfers the force it develops to the object to be moved. Engineers prefer to use pneumatics a short time since they are quieter cleaner and do not require great amounts of space for solution storage. Since the operating fluid is a gas outflow from a pneumatic cylinder will not drop out and infect the atmosphere manufacture pneumatics extra attractive where cleanliness is an obligation.
3) *Dial Gauge:* A dial gauge is a accuracy measure normally used to measure machined parts for manufacture tolerances or wear. Dial gauges are capable of producing particularly fine size values increments of 0.00005 inch (0.001mm) may be probable with some gauges. Extent inputs are transfer to the gauge via a plunger hinged lever or the jaws of a vernier. Plunger instruments are

in general used in combination with a clamp or stand which holds the gauge in a fixed position in relative to the work piece. The work piece is then moved to take the measurements. Dial gauges are existing with analog pointer and dial indicators or digital liquid crystal displays (LCDs). The dial gauge has long been an average with engineers, High levels of precision are possible in particularly small increments with typical extent ranges running from 0.015 inches to 12 inches (0.25 – 300 mm) in increments as small as 500 thousands of an inch (0.001 mm). There are two basic dial gauge formats the first is the plunger or lever type gauge. The second type is the vernier dial gauge which receives its measurement input from the movement of the jaws of a conventional vernier.

F. Type Of Cylinder

1) *Double-Acting Cylinders:* Double-acting cylinders (DAC) use the force of air to move in both extends and withdraw strokes they have two ports to permit air in one for outstroke and one for in stroke. Stroke length for this proposes is not limited the piston rod is more exposed to buckling and bending.
2) *Material:* Leading job requirement the material may be select Material range from nickel-plated brass to aluminum and even steel and stainless steel. Depending on the height of loads moisture high temperature and stroke lengths individual the suitable material may be selected.
3) *Height Measuring Fixture:* After the assemblage of various machinery in the earlier stage then it has to be inspected for its height .As depending on the height of the diaphragm plate from the armature rod end its air gap varies based on the air gap variation only the occurrence at which the horn must create the sound .Thus the dimension of the height is must at this stage. At here the height is exact in a part fixture that consists of a double acting cylinder a dial gauge upper plate .base plate with sliding support. in this process developing product improving production rate and reducing cost and various process[3] The assembled part is located inside the lower base part as the compressed air is complete by the operative the upper plate slides down and holds the part. The agreement is made in such a way to touch the needle and gives the equivalent readings as far the plunger moves in the dial gauge. If the necessary height is not achieved then it is used to with help of the screw driver set up. Further change is made only by divide outside power (man power).dial gauge reading is noted and the required rectification is done physically which requires an extra skill

G. Horn test specification

Table 1

Horn Code	Operating Voltage In V			Current Drawn In`A`@Nomvolt		Sound Pressure Level In Dba @ 13v		Frequency@ 12 v in HZ		Air Gap Mm		Tunning Range		Insulation Resistance In M Ohm@500 v
	Nom	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
R9CT12L	12	10	14.5	--	30	105	118	320	380	0.55	0.70	0.10	0.30	3m ohm
R9DU12L	12	10	14.5	--	30	110	118	320	380	0.55	0.70	0.10	0.30	3m ohm
R9SM24L	24	22	29	--	30	105	118	320	380	0.55	0.75	0.10	0.30	1m ohm
R9UO12L	12	10	14.5	--	30	105	118	320	380	0.55	0.70	0.10	0.30	3m ohm
R9UO12H	12	10	14.5	--	30	105	118	395	455	0.45	0.60	0.10	0.30	3m ohm
R9UO24L	24	22	29	--	30	105	118	320	380	0.55	0.70	0.10	0.30	3m ohm
R9UO24H	24	22	29	--	30	105	118	395	455	0.45	0.60	0.10	0.30	3m ohm

H. Lvdt (Linearvariable Differential Transformer)

The linear variable differential transformer (LVDT) (also called just a differential transformer) is a type of electrical transformer used for measuring linear displacement (position). The dislocation length of the LVDT is 4mm.

I. Operation

The linear variable differential transformer has three solenoid coils placed end-to-end around a tube. The centre coil is the primary, and the two outer coils are the top and bottom secondary's. A cylindrical ferromagnetic core, attached to the object whose position is to be measured, slides along the axis of the tube. An irregular current drives the primary and causes a voltage to be induced in every secondary comparative to the length of the core linking to the secondary. The is usually in the range 1 to 10 kHz. As the core moves the primary's connection to the two secondary coils changes and causes the induced voltages to change. The coils are linked so that the output voltage is the differentiation (hence "differential") between the top secondary voltage and the bottom secondary voltage.

When the core is in its middle position central between the two secondary's, equal voltages are induced in the two secondary coils but the two signals cancel so the production voltage is in theory zero. In practice small variations in the way in which the primary is coupled to each secondary means that a small voltage is production when the core is central.

When the core is displaced toward the top the voltage in the top secondary coil increases as the voltage in the bottom decreases. The resulting productivity voltage increases from zero. This voltage is in phase with the main voltage. The air gap length measuring is difficult same difference and frequency varying value proper sound and design proper component magnetic field[4] When the core move in the additional direction, the output voltage also increases from zero but its phase is opposite to that of the primary. The phase of the production voltage determines the direction of the displacement (up or down) and amplitude indicates the amount of displacement. A synchronous detector can determine a signed output voltage that relates to the displacement. The LVDT is carefully designed with long and slender coils to make the output voltage essentially linear over a wide displacement that can be several inches (several hundred millimeters) long.

The LVDT can be used as a total location sensor. Even if the power is switched off, on restarting it, the LVDT shows the same measurement, and no positional in sequence is lost. Its major advantages are repeatability and reproducibility once it is properly configured. Also apart from the uni-axial linear motion of the core any other events such as the revolution of the core around the axis will not affect its capacity. Because the descending core does not touch the inside of the tube it can move without friction making the LVDT a highly reliable device. The deficiency of any sliding contacts allows the LVDT to be finally sealed against the surroundings. It is the diaphragm meeting fixture in which the diaphragm sheet and tone disc is mounting on the armature rod. Air gap various proper sound reflect and high volt current supply and low volume sound different noise produce proper measure the gap checking frequency and distance[5]This fixture behaves as a chuck to hold the armature rod. Double acting cylinder is fitted to bottom of the fixture to relate force to the chuck to hold the rod. After this stage only the part moves to the next height measuring stage. With the help of the pneumatic gun the nut is stiffen to a certain least torque on the armature rod enclosing of epoxy washer , polyurethane spacer, diaphragm , shim , washers and tone disc.

This is the affecting part that fitted to the top plate. Top plate is set in such a way that slides by means of two supporting pillars. The supporting pillars are actuated by the pneumatic double acting cylinder. This section is the base part of the height measuring contest and is called as the female part of the fixture. In which the assembled diaphragm is located in order to determine its height. This part is fitted to base plate and is considered in such a way to handle the module to be measured easily. It is a inactive part as it is fixed to the table and made stable. In this fixture the height of the diaphragm sheet from the armature rod end is calculated without the connection of man power. Linear variable differential transducer is installed on the top plate. It is used to measure the height which gives a accurate reading than the dial gauge.

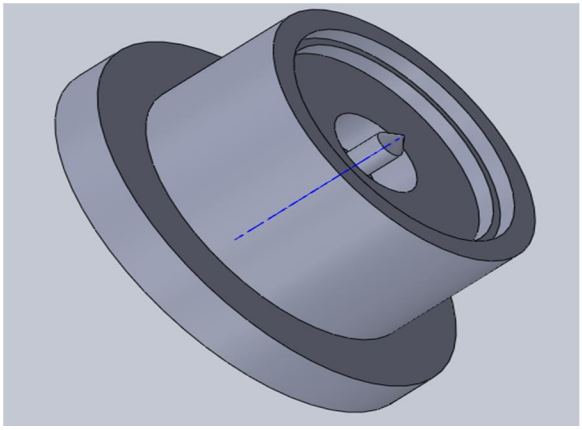


Fig 1 Bottom fixture

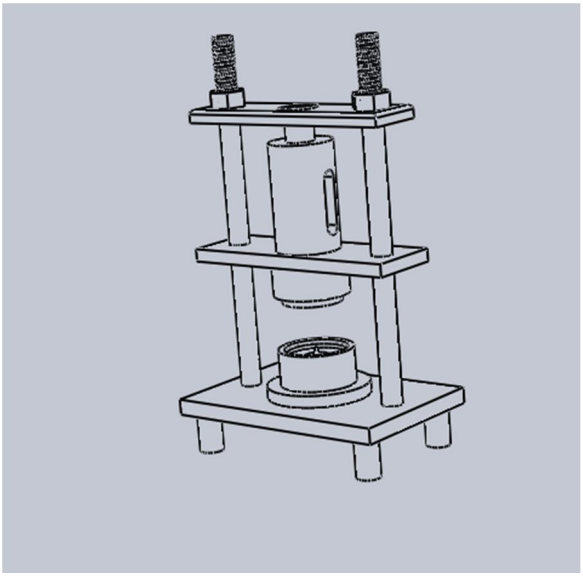


Fig 2 Over all Fixture

Table2 Time study of exiting assembly process

Sl. no	Operation	Average time in sec	No of operators	Normal time in sec.	Standard time in sec
1	Spool assy&locking point holder&tuning screw assy	13.81	1	13.12	14.01
2	Thermal base assy riveting&continuity checking	21.05	1	20.95	21.92
3	Diaphram assy riveting&height measuring	21.15	1	21.82	22.02
4	Horn pre crimping & final crimping	21.46	1	20.39	22.04
5	Air gap measuring &adjusting	29.35	1	29.85	30.02
6	Pretuning &mounting bracket assy	26.94	1	27.95	28.25
7	Fire well testing	10.74	1	11.95	12.03
8	Tunning range checking &adhesive application	13.20	1	13.97	14.56
9	Batch no. stampling adhesive application	18.02	1	18.32	19.54
10	Quality 100% inspection	7.76	1	7.37	8.18

IV. CONCULSION

By brief this paper various time consuming activities in assembly line can be reduced. This will not only increase the productivity of horn but also reduces human intervention in the assembly line. If this system is alternative and used in the assembly line of roots mini, the height measuring will be easy and no need of a skilled operator. Accuracy of measuring will be far better than the existing method.

REFERENCES

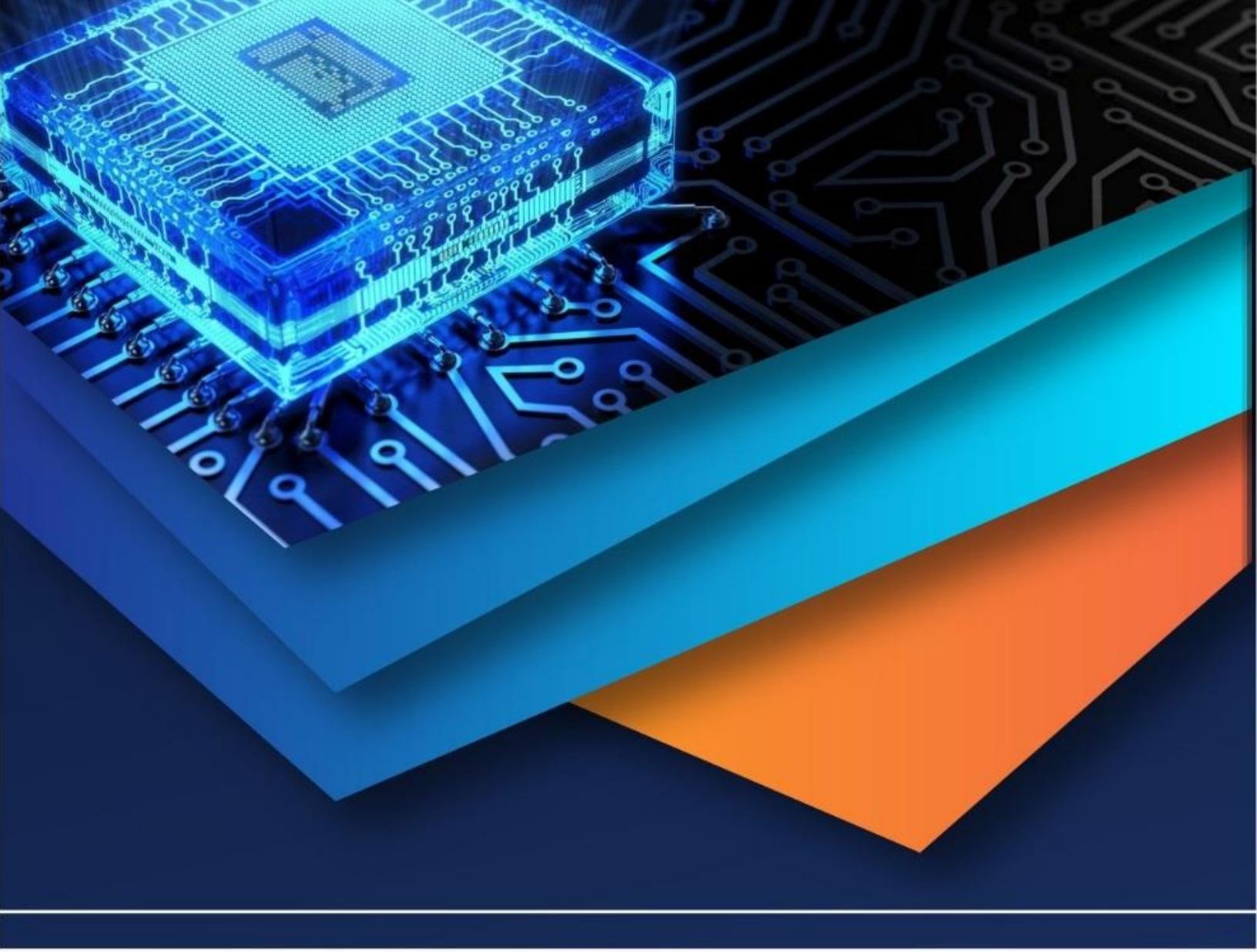
[1] Mr.V.N.Loganathan, M.Meghanathan, S.B.Praveen, S.Rajapandi, M.Ramesh kumar, Design of Diode Voltage Measurement and Tuning Screw Insertion by Using a Single Fixture. International Journal of Intellectual Advancements and Research in Engineering Computations.ISSN:2348-2079 Volume-5 Issue-2

[2] H. Sabatini, V. Sharanya, G. Sakthivel Anand , K. Deepak Lawrence.Productivity enhancement in the assembly line of a horn manufacturing company. Int. J. Management Practice, Vol. 4, No. 2, 2010

[3] Sindhuja. D, Mohandas Gandhi. N, Madhumathi. P Redesigning of Horn Assembly Line Using Ecrs Principles International Journal of Engineering and Innovative Technology (IJEIT) Volume 1, Issue 3, March 2012.

[4] Radoslaw Jez, Aleksander PolitInfluence of air-gap length and cross-section on magnetic circuit parameters. ABB Corporate Research Centre, Starowislna 13A, PL31-038 Krakow, Poland

[5] V. E. Legg, Optimum air gap for various magnetic materials in cores of coils subject to superposed direct current, Transactions on Electrical Engineering, Volume 64, 709-712 (1945)



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY