IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Design and Development of Shot Blasting Machine for Special Container

[1]Mihir.M. Bahulekar, [2]Prathamesh .A. Khamkar, [3]Aarti .A. Hande, [4]Omkar.P. Bodke, [5]Tanmay .P. Diwate, [6]Mr. Piyush Rode

[1, 2,3,4,5] Mechanical Engineering at Keystone School of Engineering, Pune, Maharashtra

[6] MTech Vellore Institute of Technology, Vellore, Tamil Nadu 632014

Abstract-

Shot blasting machine is broadly utilized for surface treatment and completing of castings to eliminate the deposits of the trim and center blend to get the necessary surface quality and condition. Constructional and functional boundaries of shot-impacting machines are firmly identified with the proficiency of the shot-impacting activity. The essential cycle engaged with shot-impacting is the course of a grating specialist, accepting the type of heterogeneous blend. This heterogeneity is related with:1 organization of different sorts of grating materials (for instance metal shots and scrap material isolated from the surface being treated,2 shape and size of shots and extent of specific grain size divisions. The fundamental rationale of this shot impacting machine is to eliminate interior scaling or rot brought about by oxidation. The interaction of this machine begins from container, corn meal (shots) moving with the assistance of air at explicit pressing factor travels through lancet which moves in straight movement with the assistance of screw jack assembly. The special Container is associated with engine which turns at explicit RPM which is synchronized with directly moving lancet. In shot Impacting machine 2 cycles happens for eliminating scaling.

***Keywords*-Shot blasting Machine, Surface treatment, Lancet, scaling**

1 Introduction:-

According to ebb and flow situation and exploration investigation of the stunner the primary issue of the sensation is scaling. Scales are the flaky surface of manufactured and moved steel, comprising of the blended iron oxides iron (II) oxide (FeO), (Fe2O3), and (Fe3O4, magnetite). Scales are shaped on the Inward surfaces of shells, when they are being created by fashioning and hot rolling. Scales are generally pale blue dark in shading. It is typically under 0.1 mm (0.0039 in) thick. During hot moving hot strip preparing, tertiary scale structures on the steel surface subsequent to descaling or between each factory remain, at temperatures under 1000°C. The frictional marvels and warm conductivity at the interface between the roll and the steel will influence the moving interaction, by changing moving powers, forces, power utilizations, temperature inclination close to the steel surface, roll wear and surface quality and surprisingly the mechanical and different properties of the mass materials. On carbon steel, the tertiary scale formed at tall temperatures for the foremost portion comprises of three iron oxide stages, the internal wuestite (FeO), magnetite (Fe3 O4) and the external layer hematite (a-Fe2 O3). The thickness of these three stages will be differing with the movements of oxidation conditions, steel structures and surface completion. The arrangement of oxide scales on steel at high temperatures has been broadly considered due to its significance during the hot preparing of steel. These examinations were typically restricted to explicit materials at fixed temperatures and compelled oxidation times in test reenactment.

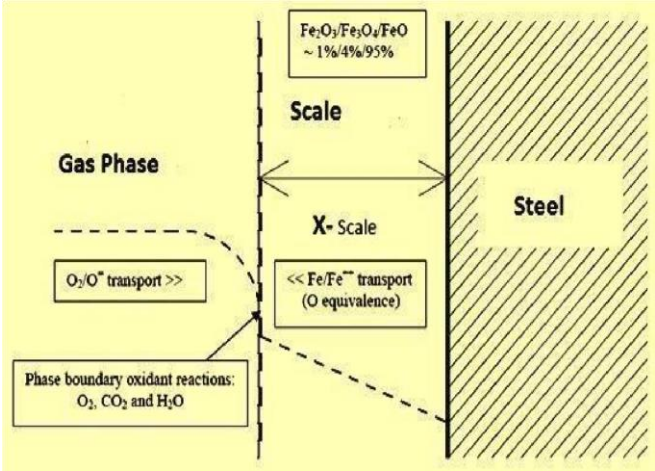

Fig 1:- Scale Formation on Metal

2. Problem Statement: - In Industry while manufacturing uneven inner surface of the bombshell, scale formation takes place on these surface due to oxidation, which affects the fragmentation. Other manual process consumes time which causes low productivity. The manual shot blasting machine is exceptionally hazardous due to back pressure of balls with high speed which may be unsafe for administrator while handling.

3. Project Objectives:-

- To study Shot Blasting Process in Detail.
- To understand literature review.
- Experimental & result analysis.
- The main aim of the machine is to remove diametrical scaling (formation of oxides).
- Quality surface finish in bombshell.
- To design an automatic shot blasting machine.
- To reduce cycle time of the machine.
- Desired Required Accuracy.

4. Literature Review: - Disa GmbH, Wheelabrator Allevard, Pangborn [01] Catalogs and brochures manufacturers of foundry machinery and equipment. Technical,. Lists and leaflets makers of foundry apparatus and hardware. Specialized,. While a great many people consider shot and sand impacting to be a moderately current idea, the primary shot impacting machine was really licensed in 1870 by Benjamin Tillman to tidy up painted and rusted surfaces prior to utilizing the thing once more. Then, at that point, in 1904 Thomas Pangborn further created Tilghman"s development to incorporate packed air close by sand impacting to profound clean metal items. From the outset sand impacting was utilized for mechanical purposes, for instance to eliminate rust or to clean metal prior to applying paint. These days the procedure has enlivening purposes, including cutting and texturizing. Current uses incorporate etching grants, for example, prizes and gem grants, creation of 3D signage, glass embellishment, and building repair, notwithstanding probably the soonest thing to be sold subsequent to being sandblasted was Alfred Dunhill's tobacco pipes which he found sold for more cash than his smooth- line. Notwithstanding back in those days the strategy would've brought about changed and erratic examples and shapes. Sandblasters these days are made out of a rough molecule, an air blower and a blaster spout.

R.Wronaa, P. Zyzaka, E. Ziółkowskia, M. Brzezinski [02], "Methodology of Testing Shot Blasting Machines in Industrial Conditions", ARCHIVES of FOUNDRY ENGINEERING, ISSN (1897-3310) Volume 12 Issue 2/2012 The last stage in the assembling of cast items includes the surface treatment and completing of castings to eliminate the buildups of the embellishment and center blend to get the necessary surface quality and condition.

C.Nouguier-Lehon, M.Zarwel, C.Diviani, D.Hertz, H.Zahouani, T.Hoc, [03] It is conceivable with the shot shooting activity to acquire great cleaning and surface groundwork for auxiliary completing activity. The shot impacting is a virus surface treatment which includes extending dots on the work piece to change its surface state. The effects are made at high speeds (a few m/s) and these rehashed activities

cause the plastic disfigurement of the work piece and the improvement of remaining weights on a thickness of a couple of hundredths of a millimeter. This treatment works on the mechanical attributes of pieces by expanding their protection from weakness and erosion.

C.Krishnakumar , S.Chandralekha [04] "Neurotoxic impacts of aluminum among foundry laborers and Alzheimer's Illnesses" In foundry industry the shot impacting measure assumes an indispensable part for clean, reinforce or clean the metal, in foundries the treatment of shot impacting machines having most perils identified with wellbeing, security and Climate are included. Especially in aluminum foundries the aluminum dust discharge item is a white glasslike powder and it has the attributes of shaping touchy residue noticeable all around blends. In this residue outflow the intense impacts are wellbeing dangers; particulates may make bothering the eyes, nose, throat and lungs. In the event of inward breath by the administrators and colleagues it very well might be aggravating to the respiratory parcel and cause respiratory turmoil. In the event of persistent impacts it might prompts cellular breakdown in the lungs and the danger of extreme impacts relies upon term and level of openness. The course of section is inward breath, skin and eye to eye connection and the influenced target organs are respiratory framework, lungs. Skin and eyes. The strange fire and blast risks are dust in high fixations may shape hazardous combinations with air. The unsafe burning items are recorded as aggravating gases, fumes, exhaust and oxides

5. Scale Formations: - Scaling is an incredible inconvenience when hot manufacturing steel and related amalgam. Scale begins being delivered when the material is warmed to 1200-1300°C, expanding during the fashion activity up to the cool-down period of the parts. Oxidation of the steel segments causes huge material misfortunes, yet in addition contrarily impacts the reshaping cycle. Deformities on the outside of the completed parts require resulting revamping as well as increment the dismissal rate. The rough scaling prompts expanded apparatus wear and lessens the lifetime of the passes on. The costly reshaping apparatuses are a significant expense factor for the all-out creation measure. Incessant instrument substitution, improving, deserts in quality and dismissal lessen efficiency, and with it the productivity of the interaction. Scale arrangement prompts material imperfections, instrument harms (wear), material misfortunes in hot shaping tasks of steel. Decline or forestalling the scale arrangement leads better nature of the forgings, further developed instrument life, less after treatment and decreased oddballs amount. To accomplish these objectives, with LUBRODAL SR 300 another, water based, natural cordial covering, was created which is applied before the warming up just on the billets. Results from training show benefits or more all economy in the correlation with the condition of the procedure (inactive gas, glass coatings and others). The down to earth results are involved by broad research facility tests, which are introduced momentarily. Relative fashioning activity and utilized steel grades based on models the conceivable outcomes likewise, the boundaries are talked about. The present status of the innovation presents two fundamental. Ways to deal with take care of this issue .Defensive gas environment (nitrogen, argon). Coatings on the material surface (ideally glass coatings). The technique or LUBRODAL covering or Hostile to scaling wax is to apply these coatings to segments leave that part for 24 hours. After 24 hours wash the components with water and then wipe the components or cavity affected parts with abrasive (polish paper).

5. Assembly of shot blasting machine (SBM):-

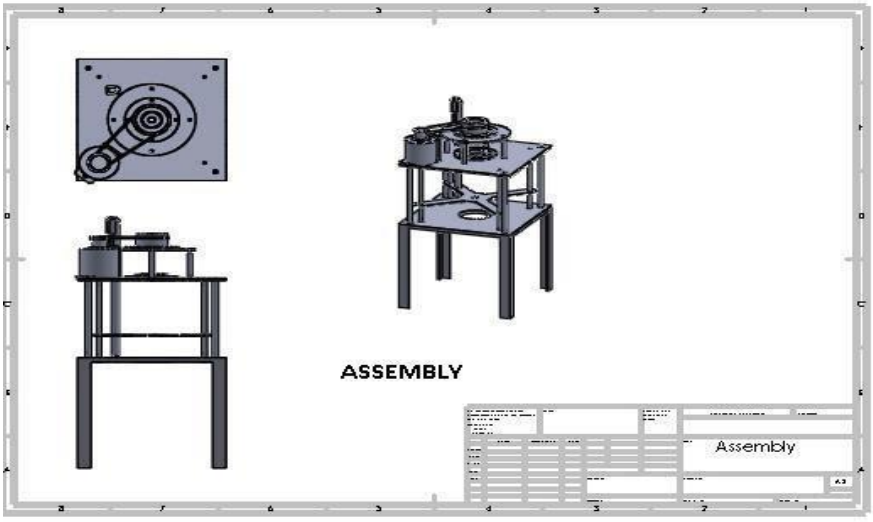

Figure No 2:- Assembly of Shot blasting Machine

Diagram no 5.1 is the assembly of special purpose shot blasting machine. This machine is specially manufactured for internal shot blasting process using the lancet mechanism where lancet act as the working tool. The following Components of the Machine are as follows.

- Upper Bearing Sleeve
- Lower Bearing Sleeve
- Upper Derline Ring
- Lower Derline Ring
- Upper Rod
- Inner Rod
- Outer Rod
- Lead Screw
- Structural Plate
- Shell Holding Plate
- Circular Shell holding plate
- Nozzle Plate
- Lancet

6. Working of SPM Shot Blasting Machine: - As per Drawing Air compressor is set with the compressed air of pressure 7 bar. The hose pipe is set between the lancet and compressor. The Grit i.e. shot blasting balls moves from Hooper through hose, from pipe to lancet. The lancet is fitted on nozzle plate where the nozzle plate has the support of rods and the lead screw. There are two motors connected one motor is connected to the Work piece and other motor is connected to the lead screw. The main Purpose of Lead screw is to lift the load of lancet and Nozzle plate and guide them to move linearly towards work piece. The linear motion of Lancet and Rotating motion of work piece is synchronized. Once the Process start the Lancet start moving inside the work piece simultaneously the grits started moving with the help of compressed air to lancet. The Grit hits the scaled/decayed part 2 times in the cycle time, once the cycle time is over lancet come. Back to its position. The cycle time of the process is around 5 to 7 minutes.

7. Calculations for screw jack mechanism: - The screw jack is manually operated according to ergonomists hand force should not exceed 130N, Jack is never operated continuously and as such a higher value of 400N is assumed for hand force. It is further assumed that two worker are required to raise the load of 100 kN.

$F = P \times A$

$F = (7 \times 10^5)\ (N/m^2) \times \pi/4 \times (0.02)^2 \times (m^2)$

$F = 219.91$ N

$F = 22$ kg

Weight considered (approximately) = 30 kg = 294.19 N

The portion of screw between handle and nut is subjected to maximum stress when load is being raised.
The screw is subjected to compressive force and bending moment and Torsional moment.

$\sigma C = W/ (\pi d^2/4)$
$d^2 = W/ (\pi\ \sigma C/4) = 2994.1995/ (\pi\ [23333]/4)$
$d = 1.125$mm
When diameter = 10 mm
$\sigma C = W/ (\pi/4(10^2))$
$W = \sigma C \times (\pi/4(10^2))$
$W = (23333)$

$W = 18325.696$ N

W = 1868.700(Maximum Capacity)

Diameter should be increased to account for these stresses, d = 10 mm & p = 2 mm dc = 10 - 2 = 8 mm,

DM = 10 – 0.5(p) = 9 mm.

It is assumed that the screw has single – start threads

L = p = 2 mm $\tan \alpha = L/\pi DM = 2/\pi$ (9) $\alpha = 4.09$

The maximum possible value of coefficient of friction is 0.15 Ø= 8.53 °

Since Ø > α, the screw is self-locking

$Mt = W (DM)/2 \times \tan (Ø + \alpha)$

Mt = 18387.92 N mm

$\tau = 16Mt/\pi dc^2$ τ = 182.90 N/mm^2

$ƟC = W/ ((\pi/4)\ dc3) = 1832.95/ ((\pi/4)\ 8^3$ ƟC = 365.81 N/mm^2.

The hand force P acting on handle causes bending moment a XX section.

The bending moment,

$Mb = P \times L_1$

L_1 = 230 m.

Mb = (0.9 × 2 × 400) (230)

Mb = 165600 N/mm.

Factor of safety is given by,

FOS = Ssy/τ max =0.5(350)/42.78)

FOS = 4.09

8. Calculation for motor selection:-

For 100 revolutions, it requires 60 seconds

100 revolutions = 60 seconds

For 1 mm travel of lancet in job with pitch of screw which helps in lifting lancet is 2 mm.

It means lancet will travel 2 mm for 1 mm distance in job.

So, for 1 mm travel of lancet we require ½ revolution.

1 v = 60 sec

1 rev =60/100= 0.6sec

In 0.6 sec we require to travel 1 mm for lancet of pitch screw 2 mm.

Travel achieved per revolution of lancet screw = 2 m

0.6 × 2 = 1.2 sec.

Travel required by lancet screw is 1 mm.

0.5 rev = 0.6 sec

1 rev = 1.2 sec.

So for 60 sec 60/1.2= 50rpm

When job rotates at 100 rpm, lancet will rotate at 50 rpm.

9. Future Scope -The automation is one of the most important aspect. This Semi-automatic machine can be converted to automatic by using Microprocessors or micro controllers. Raspberry Pie is one of the best controller in future scope for automation. The Model raspberry pi includes basically incorporates:-

- 256 MB SDRAM memory.
- Single 2.0 USB connector.
- Dual Center Video Center IV Sight and sound coprocessor.
- HDMI (fire up 1.3 and 1.4) Composite RCA (Buddy and NTSC) Video Out.
- 3.5 MM Jack, HDMI, Sound Out.
- SD, MMC, SDIO Card space on board stockpiling

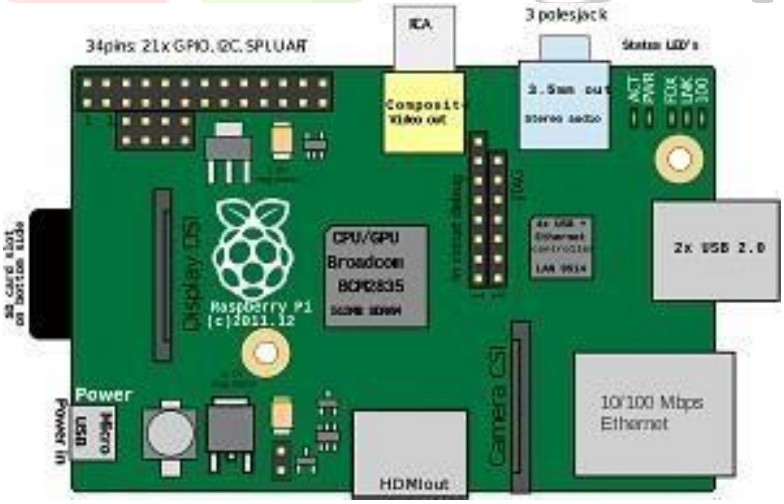

Figure no 3:- Raspberry Pie

There are some basic commands which can be added in Raspberry Pi with the help of program, flow charts and algorithms. They are as follows-

- Led Blinking for machine stop ,damage, hold, work in progress

- LCD Screen Viewing for cycle time
- Sensors and alarms for phase 1 process and phase 2 process
- Led blinking for Proper job clamping

Flow charts in Raspberry pie-

A graphical representation of the sequence of operations in an information system or program. Flow Chart gives information about data movement from controller to computer.

Different Token are used to draw each type of flowchart. This is the following sample flowchart for Led blinking for machine stop, machine breakdown, hold and work in progress

This is the flow chart of Led blinking .The flowchart says that if the machine is breakdown or the machine has stopped than the red light will blink. When the machine is on hold the orange light will blink and when the work is on progress the green light will blink with the help of flow chart and algorithms the data will be fed in raspberry pi.

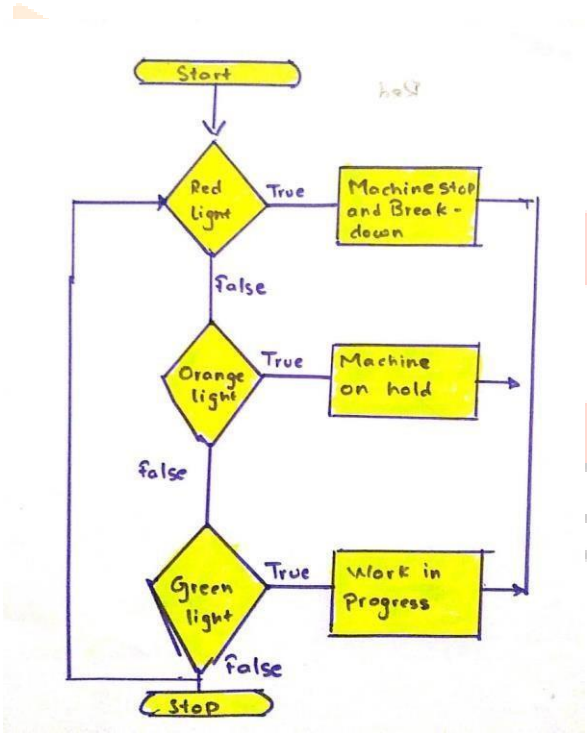

Figure no 4:-LED blinking Flow chart

9. CONCLUSION

It is concluded in project work that the productivity of bomb shell is increased, the machine is having good efficiency .The Scaling of the Special Container is reduced, the quality of the first job after checking with bore scope is as same as of the 100th job. It is also concluded that not only bombshell but any other component having internal scaling or decay can also be done on this machine, the dimensions of clamps will be different. The limitations can take place in future but can be improved by the automation.

10. ACKNOWLEDGEMENT

Authors are thankful to Aim precision Industries Pvt. Ltd. Pune providing industrial help in our experimental approach, Mr. Piyush Rode for guidance throughout the project and the Professors of Keystone School of Engineering for guiding at every stage of our experiment.

11. REFERENCES

- Catalogs and brochures manufacturers of foundry machinery and equipment. Technical, Disa GmbH, Wheelabrator Allevard, Pangborn. R.Wronaa, P. Zyzaka, E. Ziółkowskia, M. Brzezinski, " Methodology of Testing
- Shot Blasting Machines in Industrial Conditions", ARCHIVES of FOUNDRY ENGINEERING, ISSN (1897-3310) Volume 12 Issue 2/2012.
- C.Nouguier-Lehon, M.Zarwel, C.Diviani, D.Hertz, H.Zahouani, T.Hoc, (2013) "Surface impact analysis in shot peening process", Elsevier, Wear 302 1058–1063
- C.Krishnakumar, S.Chandralekha "Neurotoxic effects of aluminum among foundry workers and Alzheimer's Diseases" Neuro Toxicology, Vol. 23, pp. 761-774.
- L.Marmo. (2004), "Aluminum dust explosion risk analysis in metal workings" Journal of Loss prevention in the process industries, Vol. 17, pp. 449-465.
- Deng Jiaxin (2003), "Wear behavior of ceramic nozzles in sand blasting treatment" Journal of the European ceramic society, Vol. 32, pp. 323-329.
- D.Fatta (2004), "Industrial pollution and control measures for a foundry in cyprus".
- R. Wrona, P. Zyzak, E. Ziolkowski, M. Brzezinski, 2012, Methodology of Testing shot blasting machines in Industrial conditions
- Mitul Mali, 2014, Review on Shot Blasting Processes, A.D. Patel Institute of Technology.
- C.Krishnakumar, S.Chandralekha, May June 2016, HSE Assessment and Improvement in Shot Blasting Machine, IOSR Journal of Mechanical and Civil Engineering.
- Raghavan, 1 January 2015, Publication PHI Learning Private Ltd, Material Science & Engineering.
- Vijendra Singh, Tata McGraw-Hill Education, (1988), Heat treatment of steel
- S.G. Kulkarni, Tata McGraw-Hill Education, 2008, Machine Design.
- www.forging-process.com
- Intechopen.com
- www.mech4study.com
- Thomasnet.com
- http://www.technical.com.p
- http://www.raspberrypi.org/documentation/configuration/-config.md
- https://github.com/lemodd/raspberrypi-pyecharts/wiki