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Design and Development of Ball Dispenser Machine through Lean Manufacturing Tool Poka-Yoke Technique in Automobile Industries

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Abstract

In the current scenario manufacturing is the most challenging task with high quality product in minimum time. In automobile assembly industries is lot of small-small part are assembling for make one product. If any small part is missing then the quality and safety of product affected. In this experimental paper discussed about the practical case study in automobile assembly industries. Ball dispenser machine design and developed due to Anything that could make the operator realize that the steel ball has fallen inside the housing if it has fallen. An arrangement that allows person from store to fill the container of balls, but should be out of reach of operator such that the operator could not take-out balls directly
Keywords: Lean Manufacturing, Ball dispenser machine, Poka-Yoke Technique;

1. Introduction

Ball dispenser is a machine that dispense either 1 or 4 steel balls at a time according to the need of the operator, this machine is installed at G1 line and CTF line and the balls are used in gear box in gear shifter locking using ball plunger mechanism. Many companies focus on the tools: Five S, Standardize Work, Kaizen (continuous improvement), Kanban (signal), Poka-Yoke (mistake proofing), SMED (single-minute exchange of die), and TPM. The tools themselves, however, are not the point, nor the purpose of Lean. The tools are merely a means to an end, and a clear understanding of the end is crucial to success with Lean. Because many people like “silver bullet” solutions, however, use of the tools is often confused with actually being Lean.

An organization progressing to lean assembling won't have a sound premise of upkeep uphold without first actualizing essential and basic changes in the support activity. The establishment components, specifically TPM should be set up before an association can viably expand on the upkeep the executives pyramid with components like self-ruling support and before it can support constant improvement. Lean maintenance is an essential for progress as a lean maker, Mather (2005). Lean upkeep is characterized as a proactive support activity utilizing arranged and planned upkeep exercises TPM works on utilizing

maintenance strategies developed through application of reliability cantered maintenance (RCM) decision logic and practiced by empowered (self-directed) action teams using the 5S process, weekly Kaizen improvement events, and autonomous maintenance together with multi-skilled, maintenance technician-performed maintenance through the committed use of their work order system and their computer managed maintenance system (CMMS) or enterprise asset management (EAM) system. They are upheld by a disseminated, lean support/MRO (Maintenance, Repairs, Operations) storeroom that gives parts and materials on an in the nick of time (JIT) premise and sponsored by upkeep and dependability designing gathering that performs underlying driver disappointment investigation (RCFA), bombed part examination, support system viability examination, prescient support (Pd.M.) examination, and moving and examination of condition observing outcomes. That is lean support more or less.

2. Problem Formulations

Presently the company is aiming more on quality than production, since our production is ok (though production is also to be improved), but the quality is not up to the mark, and according to market analysis the quality needs to be grown remarkably. In G1 and CTF a defect was very common i.e the steel balls used to fall inside the housing which is a lethal defect that causes gears to break very soon and before that efficiency loss of the transmission, hence of tractor. To achieve the requirement of the market of good quality product this lethal defect was to be eradicated asap.

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2.1 *Current Picture*

Earlier operator used to hold too many steel balls while doing complex operations while assembling G1 and CTF housing, so many times balls used to fall inside the housing and sometimes it was observed and sometimes not observed. If the defect was not observed then the tractor used to go to the customer with a lethal defect which is extremely against us. If the defect was observed, then the process of taking out the steel balls was very tedious and required a lot of time that too at the cost of safety, hence affecting productivity and number of incidents.

2.2 *Requirement*

- Anything that could make the operator realize that the steel ball has fallen inside the housing if it has fallen.
- Some thing that could reduce the number of balls falling inside the housing.
- Solution should attract operator as well.
- Solution must be sustainable.
- An arrangement that stores steel balls that could have fallen on ground by operator's mistake.
- An arrangement that allows person from store to fill the container of balls, but should be out of reach of operator such that the operator could not take-out balls directly.

2.3 *Conceptual Design*

➢ **Work Out Feasibility of the fixture**

Keeping in mind of the worst operator we could get, and the working conditions, following points were considered as important: -

- Easy to use.
- Durable
- Balls should not be directly in the approach of the operator.
- Dispenser should be installed at the height of around 4 feet just behind the line.
- Arrangements to avoid the falling of balls on ground should be given.
- Arrangement to avoid locking of balls is very important.

➢ *Preparation of Concepts. :-*

Following point's give an overview of what exactly was going on my mind at that varies point of time:-

- The main principle was that, there should be 3 plates 1st one should have a big slot in center front that could contain 6-8 nuber of balls, 2nd plate was to have one hole for accumulating one ball at the front left, and a slot that could contain 4 balls in the front right of the plate, the 3rd plate must have 2 slots in two front ends, all the slots were to be made at same radius, only 2nd plate was rotating, others were fixed.
- The dispenser would work as when middle plate is rotated to align one ball hole in 2nd plate with that of slot in 1st place the balls would fall in 2nd plate and then when the 2nd plate is moved back to original position it should drop the ball from the hole in 3rd plate, similarly with the 4-ball case.
- I wanted to make the system compact, so I made it compact but when 2nd plate was rotating there was a position when 4 ball slots was aligned to slot in 1st plate and with slot in 3rd plate, so if stopped at this position the balls would continuously fall till container is empty, so in 3rd place I made a slot for only 2 balls away from center and for other 2 I made a taper to carry other 2 balls towards the slot.
- Slots in 2nd and 3rd plate were to be kept enough away such that if operator by mistakes moves the middle plate to some extent the dispenser doesn't work.
- All the abnormal ways of using the machine were being thought.
- Proper spacing between the outlets for getting 1 and 4 balls was to be maintained.

- A sieve kind or a funnel type of cover were two options for putting the balls inside the container.
- A separate container and a path with slope were needed for storing balls that were to fall on ground.
- Various possibilities were thought for breaking the locking of balls and finally a pin connected to the handle was decided.
- Constant thinking was being done to make it operator friendly.

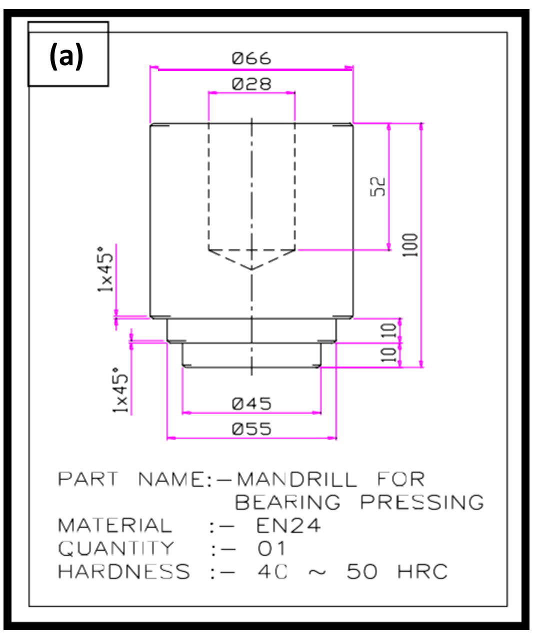
3. Results and Discussion

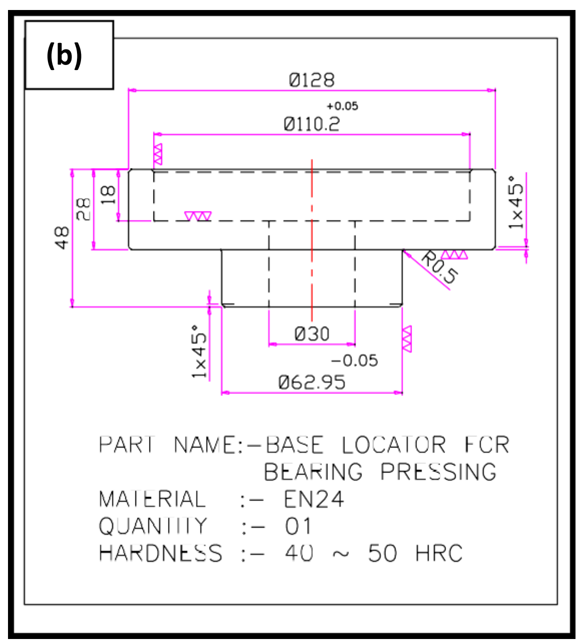
3.1 Final Design

Basically there are three plates with side walls bolted to top plate, the top plate had a hole at front center, big enough to contain 6 balls, middle plate had 2 holes at front ends, 1st big enough to contain 4 balls, 2nd big enough to hold 1 ball, third plate had 2 holes in the front ends, one for single ball just below the hole in middle plate, 2nd for 2 balls in corner and a chamfer in the area corresponding to remaining 2 balls such that the whole arrangement lies below the 4 ball hole in middle plate and chamfer is near to center. The middle plate is free to rotate, other 2 locked. Operator rotates the middle plate to align say 4 ball holes of middle plate with the hole in top plate, balls fall inside the middle plate now operator rotates middle plate back, such that now hole in middle plate comes above in bottom plate such that 2 balls directly come out through hole for 2 balls in bottom plate and other 2 balls slide over chamfer and come out from the same hole for 2 balls.

A handle is bolted to the middle plate and on handle a metal rod is welded that extends upto inside of the container near the hole on top plate, this rod rotates with handle and avoids interlocking of balls. An inclined metal plate is welded to the table that is connected to a container the balls if fallen during coming out of dispenser would fall on the metal plate that would carry it to the respective container. The cover is like a sieve that allows balls to fall inside the container.

3.2 Drawing Preparation.





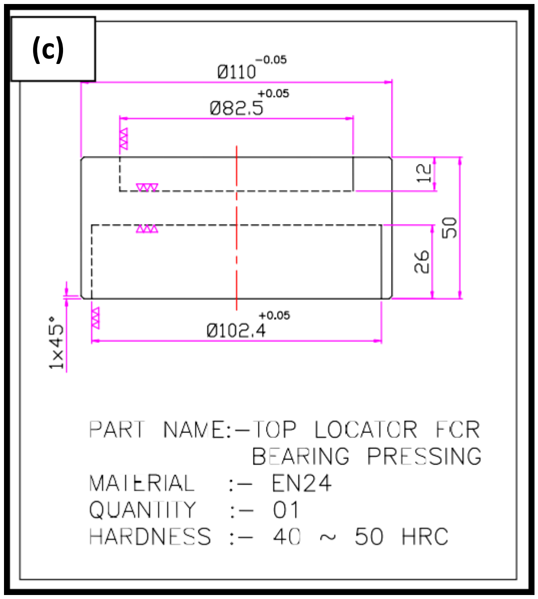


Figure 1. (a) For All Models (b) For Model 241,242,312,368 Single Clutch(c) For Models 380,480,485 S/W Double Clutch

After complete design work is completed, us go for asking quotation from different vendors so as to achieve the correct costing. we have to get the best product at minimum cost. Vendors give their cost of manufacturing as per drawing forwarded to them in non-editable format. Now go for comparing the quotations and select the most appropriate one. Select The best vendor a minimum cost. Give the order to the selected vendor and take the lead time, so as to follow, in order to get the order in time, and thus to ensure that our target Date for the Locator & Mandrill installation and tool trial is achieved on time After the tool is manufactured and received at our end, we go for quality inspection so as to ensure that the tool has been manufactured as per our requirements, this tool is inspected in standards room in the factory premises

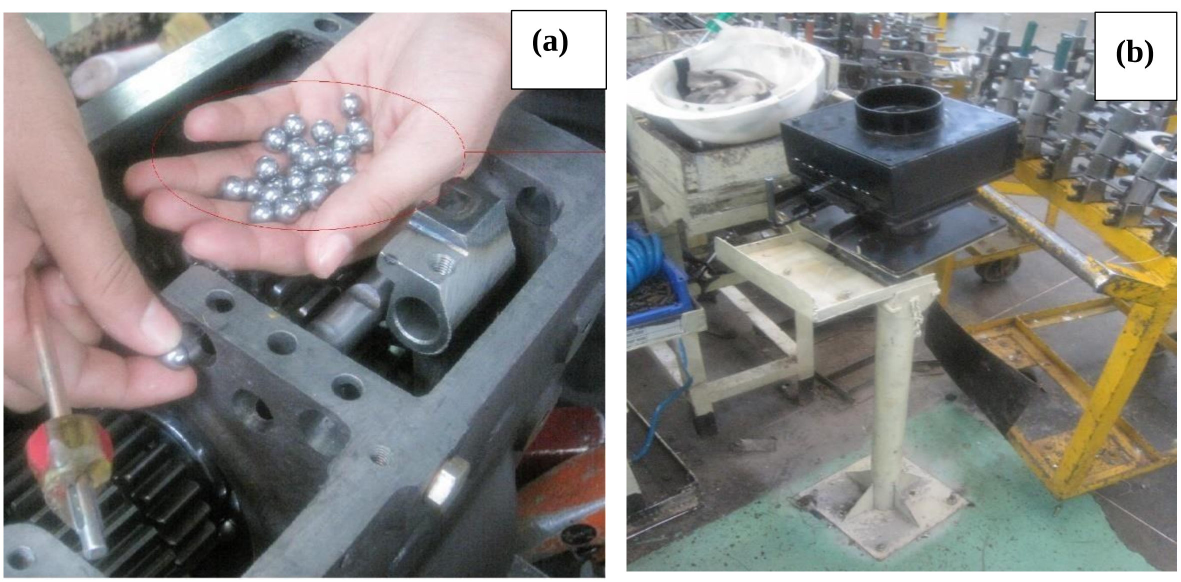


Figure 2. (a) before modification (b) after modification

4. Conclusions

- Since now operator is holding just enough number of balls as required, so now the probability of falling the ball inside the housing is very low, hence improving quality and productivity.
- Now if a ball would fall inside the housing the operator would certainly notice that because he was

holding 4 balls and if he has inserted 3 balls then for sure one ball has fallen somewhere and the defect gets noticed.

- Now since the probability of falling of ball is low so now balls would not also fall on floor, hence 5s is maintained.

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