Assembly of automated processing setup using conveyor system

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KEYWORDS

Industrial Washing, Demagnetizer, Automation.

ABSTRACT

The industrial cleaning today is complex undertaking. Each cleaning problem is unique from others because of many variables in manufacturing process integrating the cleaning process with production & plant requirement through a proper equipment sizing & selection is very important. The Project presented mainly focuses on an effective solution for conventional processing systems carried out in industries to reduce the manual efforts. The simplest version for automation in the field of demagnetizing, cleaning & counting is the result of our research & project. The main idea of our Project is to fabricate a simple conveyor belt system and automate the processing of Machined Components. By developing such system the production rate of the manufacturing industry will be increased since these systems replaced the human resources. Also, the accidents in manufacturing industry can be prevented because the uses of operator in manufacturing floor had been reduced.

1. Introduction

Automation is the use of control system for handling different processes and machineries to replace human efforts. Now a days, more and more companies are switching to automation. The implementation of advanced automatic control system on the basis of industrial controllers enables us to systematically perform a main handling system effectively. A Multistage washing machine with different stages such as demagnetizing, washing, drying & counting with these functions, a Machine is to be designed for the continuous demagnetizing, cleaning, counting of manufactured components like bearings, gears and its accessories. So basically, there is a need to manufacture a special purpose washing machine. To demagnetizing component & clean the debris and unwanted chips even in the most intricate parts, which are difficult to wash after manufacturing the component. To use chemically mixed water flow to clean and wash the component and then compressed air to dry the same components. To manufacture the conveyorized washing machine as per the requirements based on the machine cycle time and the dimensions of the components. It is important to reduce washing cycle time and to achieve a Millipore value of 5-10 mg. per component.

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1.1 Existing system

The conventional system that can be seen in many present Industries are manual type where in the operator handpicks the machined component and subjects it to demagnetization and cleaning

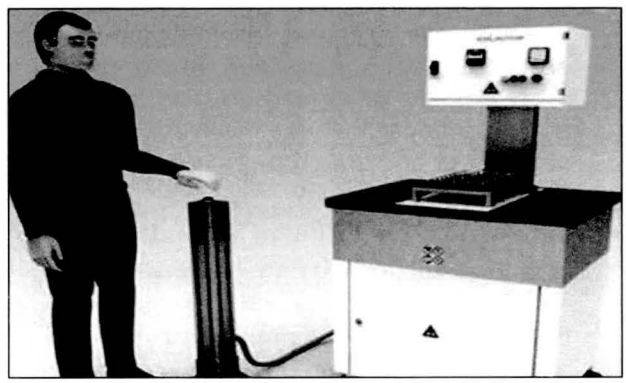


Fig. 1. Manual Demagnetizing.

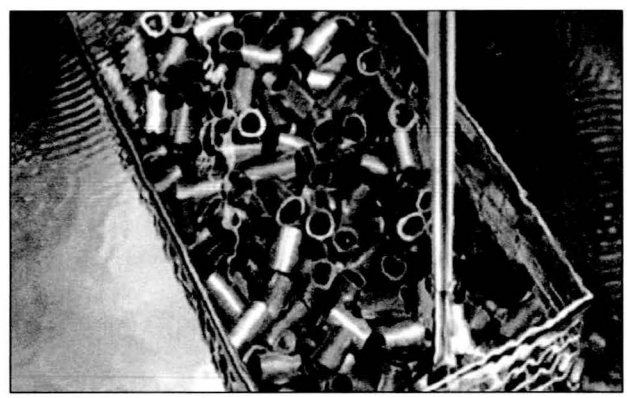


Fig. 2. Liquid cleaning.

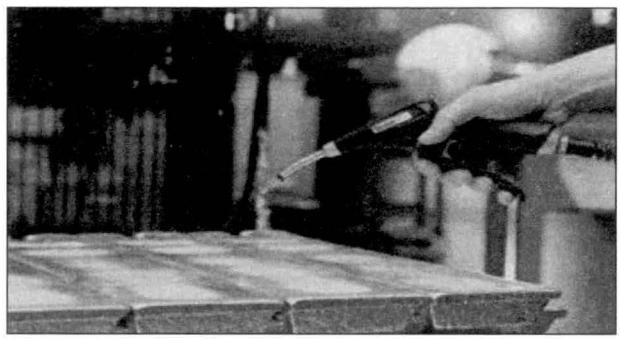


Fig. 3. Air spraying and visual counting.

separately & takes the count which tends to consume the time. The process is tiresome, tedious and are prone to errors more often.

1.2 Objectives

- Obtain the better cleaning results.
- Increase in production rate.
- Less time - consuming compare to manual cleaning.
- Reduction in labors.
- Enhanced process Quality
- Improved working conditions

1.3 Scope of the study

- The present scenario of the industry is observed and it has been found that the processes are being carried out manually in a conventional, which involves designated man power and are prone to errors leading to Decreased productivity.
- Data has been captured from the existing system of an Industry by using conventional system.
- Data will be analyzed and total cycle time of an existing System involving conventional system is evaluated.
- An Effective solution to the present drawback is idealized.
- A fully equipped Working model will be assembled by integrating different sections.
- Model assembled will be proposed to an industry as an effective solution.
- Real time Data of Conventional System & Automated system is compared statistically and is recorded.
- Findings, possible outcomes from the project have been drafted & concluded

1.4 Assembly setup

The Assembly setup consists of five main components:

- Chain conveyor
- Demagnetiser
- Air blower
- Liquid Sprayer
- IR Sensor with Digital counter

- *Chain conveyor*

Chain conveyors is a system which utilize are powered by continuous chain arrangement, carrying a series of single pendants. The chain arrangement is driven by a motor, and the material suspended on the pendants are conveyed. Chain conveyors are used for moving products down an assembly line and/or around a manufacturing or warehousing facility.

- *Demagnetiser*

Demagnetiser is a system which remove residual magnetism or reduce it to a harmless level. It reduces bearing wear, makes welding possible again and prevents measurement errors.

- *Liquid sprayer*

A sprayer is a device used to spray a liquid such as degreasing agents and other cleaning liquids and also sprayers are commonly used for projection of water.

- *Air blower*

Blower is equipment or a device which increases the velocity of air or gas when it is passed through equipped impellers. They are mainly used for flow of air/gas required for exhausting, aspirating, cooling, ventilating, conveying.

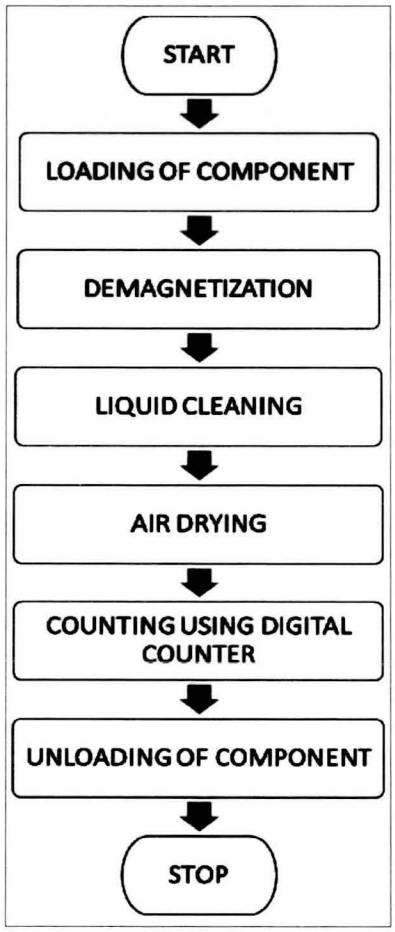
- *Infrared sensor with digital counter*

An Infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment, as it emits IR radiations the components indenting against it can be detected as output, the digital counter is connected to give a count of components passing through.

1.5 List of components required

- Base frame (25mm Square tube)
- Bearings (Diameter 25mm)
- Washing nozzle
- Outer casing Conveyor frame (25mm Square tube)
- Shafts
- Conveyor chain
- Pneumatic systems
- Conveyor Motor
- Demagnetizers
- Drying Nozzles
- Aluminum sheet metal
- Micro controllers
- Submersible water pumps
- Sprocket
- Key
- External casing
- Compressor

2. Flow Chart of the Process



3. Working Principal

Once the pneumatic air-drying pressure reaches to the set pressure, the operator will press the "start" button then operator will place the components on to the conveyor with proper orientation. Components are passed through the series of stations like demagnetizing, high pressure Liquid washing, high & pneumatic air drying and then digital counting.

- *loading station*

Robotically or by Operator components will continuously loaded on to the conveyor in such a way that at optimum speed maximum output can be achieved. The operator should take care of the component orientation as well for effective washing and drying.

- *Demagnetizing*

The parts are transferred from this station one at a time, inside the demagnetization coil. When the part is in the middle of the coil, the demagnetization impulse is imparted without it being necessary to stop the part and without any magnetic retention.

- *High pressure liquid washing*

In Liquid washing, the pump on the tank intakes the washing media and transfers into the secondary type fine filtration system. After filtration, the washing media will be sprayed on to the components through the set of jets in to the washing chamber at the selected RPM and pressure. Then the washing media drains to the tank through primary type wire mesh filtration system. And thus, the washing media can be made to re-circulates.

- *Drying*

After water washing, the components are passed through high pressure pneumatic air-drying station where the components are dried out when they come out of washing station. Here the air is supplied by the compressor through the set of jets. The high-pressure pneumatic air-drying chamber is provided with set of air nozzle.

- *Digital counter*

At digital counter the components passing by are detected through an IR sensor and the count of

components passing through them are shown in a digital counter display.

- *Unloading Station*

At unloading station, the components are then available to be picked up by the operator or robotically moved

4. Advantages

- Production rate increases due to batch wise cleaning of components before assembly or dispatched.
- Easy to use.
- Complicated structure components can be washed on all faces.
- Substantial reduction in man power due to machine is wholly atomized.
- Low cost compared to other cleaning processes.
- Reduction in cleaning time and complexity.
- Can enable shorter working week

5. Disadvantages

- As manufacturer view there is no disadvantage of machine.
- As customer's view capital investment and maintenance cost is very high.
- Machine is bulky. So, there is many difficulties transportation.
- Over weight on conveyor may reduce speed of conveyor & breakage of wire mesh chain.
- Leakage in pipes may cause loss of pressure of water
- Automation could increase monopoly power
- Loss of human interaction.

6. Applications

Useful for industrial components for washing components like,

- Bearings
- Gears
- Tools
- Shafts
- Mechanized components
- Piston rods
- Connecting rods

7. Design

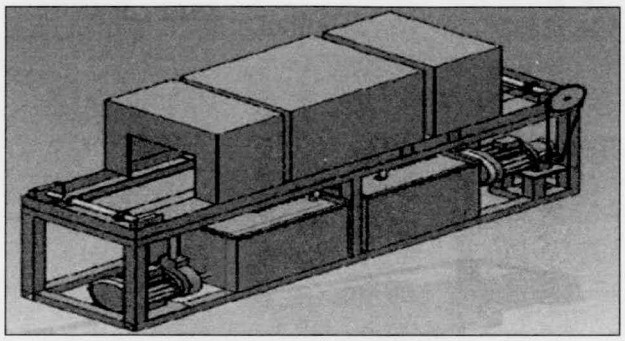


Fig. 4. 3D Based model.

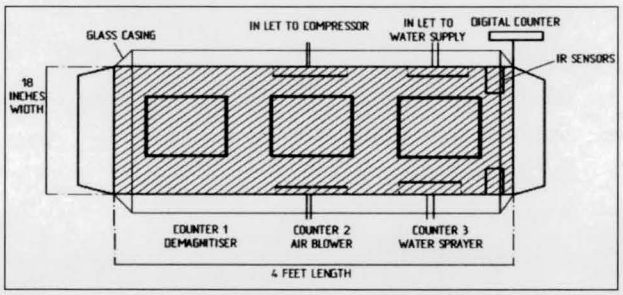


Fig. 5. Top view.

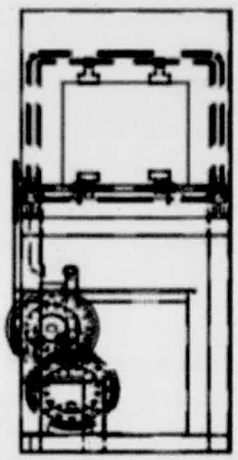


Fig. 6. Side view.

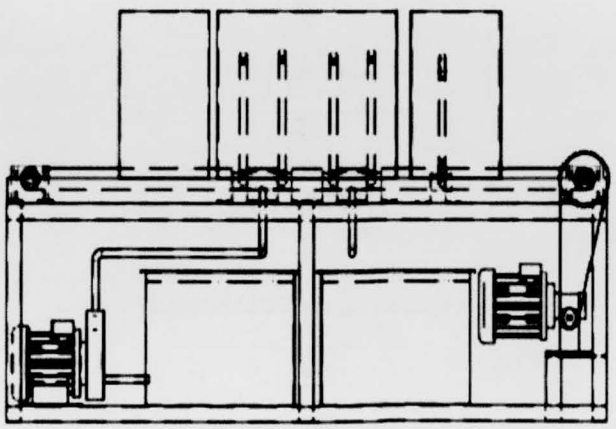


Fig. 7. Front view.

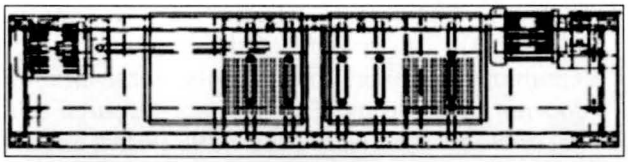


Fig. 8. Top view.

8. Case Study

An industry has been identified where the process is happening in a conventional manner, the data has been captured and compared depicting the changes in Value added and non-value-added activities Time One of the process is considered and the data are as follows,

PRODUCT: TRUCK HINGE PIN BUSH
OUTER DIAMETER= 70mm
INNER DIAMETER= 50mm
LENGTH= 72mm

Currently all operations are done manually except machining in CNC

Sl. No	Activity	Actual Time (sec)
1	Receiving of raw materials	60
2	Inspection of raw materials	30
3	Length cutting	180
4	Burr Removing	120
5	Loading Raw materials to CNC	15
6	CNC Machining	160
7	Unloading products from CNC	15
8	Burr Removing	30
9	Demagnetization	100
10	Liquid washing	80
11	Air Drying	90
12	Counting	2
13	Inspection	40
Total Elapsed time = 922 seconds		

Sl. No	Activity	Actual Time (sec)
1	Receiving of raw materials	60
2	Inspection of raw materials	30
3	Length cutting	180
4	Burr Removing	120
5	Loading Raw materials to CNC	15
6	CNC Machining	160
7	Unloading products from CNC	15
8	Burr Removing	30
9	Demagnetization, liquid cleaning, Air drying and Digital counting	40
Total Elapsed time = 650 seconds		

From the data it is observed that Total elapsed time after automation (650 seconds) is less than Total elapsed time before automation (922 seconds).

The % reduction in time is 29.51%.

9. Conclusion

by using the automated system we designed and manufactured the manual processing sytem has been converted to an automated system using conveyour belt system making it more efficient and error free.

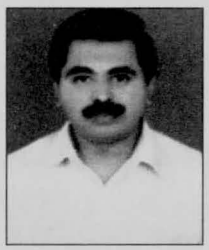
References

Dongre, A., & Mohite, N. Y. (2015). Significance of Selection of Material Handling System Design in Industry – A Review. I*nternational Journal of Engineering Research and General Science*. 3(2), ISSN 2091-2730.

Gaikwad, A., Raut, Y., Desale, J., Palhe, A., Shelar, G., Pawar, S. (2017). Design and development of Automated Conveyor System for Material Handling. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE). e-ISSN: 2278-1684, P-ISSN: 2320-334X, 31-34.

Ito, T., Kasahara, A., Hori, M., (2017). Novel Demagnetization Method after Magnetic Particle Testing. *15th Asia Pacific Conference for Non-Destructive Testing (APCNDT2017)*, Singapore. [ID253], 1-16.

Tandale, P., Shivpuje, S., Ladkat, S., & Simran, K. (2015). Design of Washing Machine for Cleaning of Small Components. *International Journal of Emerging Engineering Research and Technology*. 3(4), ISSN 2349-4395 (Print) & ISSN 2349-4409 (Online), 30-36.



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