AUTOMATIC DENIM CREATOR (ADC): FOR SPRAYING POTASSIUM PERMANGANATE ON DENIM.

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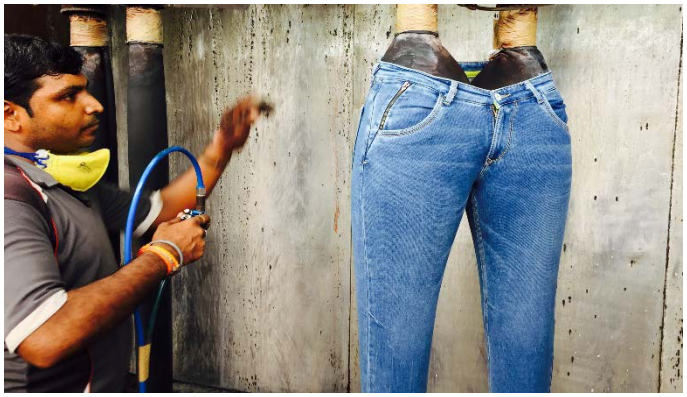
Abstract: Automatic Denim Creator (ADC) is a worktable designed such that it is an automated CNC denim sprayer that can coat denims with miscellaneous chemicals to produce fading effect on jeans to live up to the expectation of the latest market trends. This machine is designed to reduce the impact of the harmful chemical used during the process on human body and environment. The working principle of this machine is same as that of a 3 Axis CNC. The coating of various chemicals on denim such as Potassium Permanganate ($KMnO_4$) oxidizes the natural color of the indigo material and hence produces a fading effect. Due to increasing trend of denims in today's date, ADC not only ensures high accuracy of spraying technique which is very important in today's competitive market, but also ensures its adaptability to upcoming trends. This will facilitate the consumer in optimizing the same machine for upcoming years. Hence proving to be cost effective.

Keywords: CNC, KMnO4, Hazardous.

INTRODUCTION

We have designed Automatic Denim Creator to eliminate the perilous effect on human body during the manufacturing of denims. ADC is a CNC machine which can replicate human arm motion to spray denims with different chemicals in an isolated environment. This machine can spray each denim within 20 seconds which is 4 times faster than a human. Thus reducing requirements of skilled labor and reducing the overall cost of manufacturing.



I. REVIEW OF LITERATURE

Potassium permanganate spray is done on jeans to take a bright effect on sand blast area. An important thing about potassium permanganate spray is, this is usually a sporting process to increase the effect of sand blast. Potassium permanganate solution is sprayed on sand blasted area of jeans garment with the help of normal spray gun. This chemical spray appears pink on garment when fresh and turns to muddy brown on drying. The garment is hanged in open to dry after spraying and when the potassium permanganate turns its colours completely then it is considered to ready for next process.

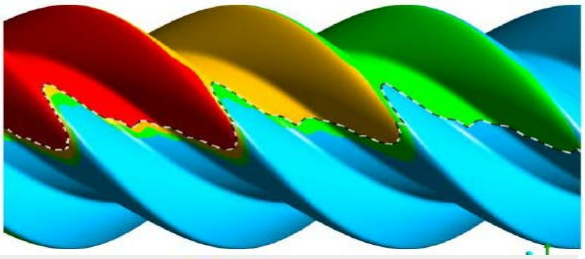
KMnO4 being caustic in nature, high concentration can cause skin burn. Prolong contact with skin can lead to de-fatting of skin, where natural skin fats are gradually removed by chemicals. It further causes irritation, redness and pain in your eyes. Ingesting KMnO4 can be life-threatening. Hence workers are required to wear breathing masks all the time.

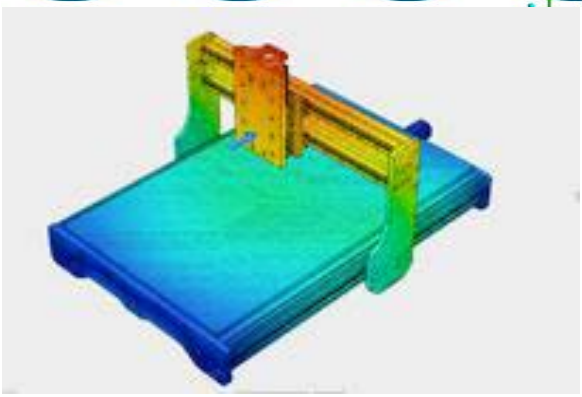
II. METHODOLOGY

We will be dividing the methodology into 5 major steps: -

- We have done a tie up with Spykar which is one of the biggest denim manufacturing brands in India. This tie up gives us the crucial insights and access to all the manufacturing plants of Spykar along with the data of the chemicals and processes used to make high quality jeans. By studying the manufacturing processes, first we are learning how denims are made from scratch.
- Prototype designing using SolidWorks: Using solid works we are designing the machine part by part and then assembling it. This will help us later during fabrication as the Solidworks design will be directly fed to the CNC Laser Cutting. Also we will get a better vision of how the prototype will look. We can also recourse to 3D design data to quickly communicate complex technical details with animations and visual instructions.

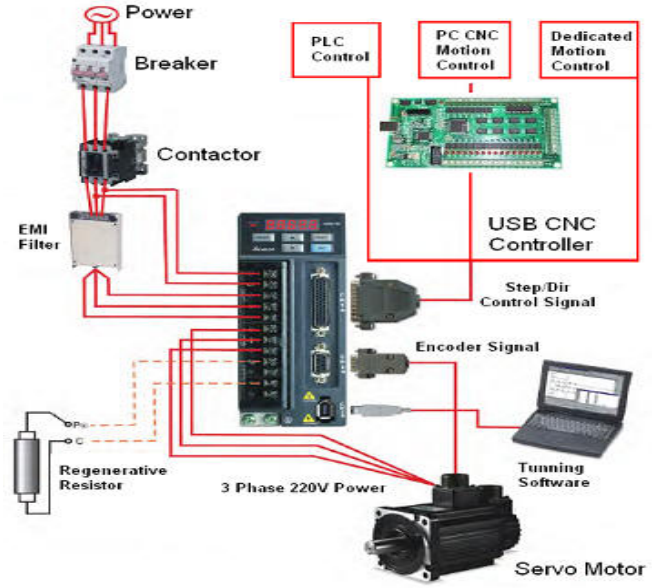
- Stress analysis using ANSYS WORKBENCH: As our requirement for quality standards were high, there was no room for mistakes and errors. To make sure that no slip-ups are left out, we are using ANSYS to check for all the possible stresses and strains to make sure that no part under goes failure once the machine is made.





- Laser cutting and frame development: Since the machine we have intended to make requires very high precision, such high quality of manufacturing cannot be achieved by conventional manual methods of fabrications.

- Installation of electronics: The most important components of any automated machine are its electronics. We will be installing servo kit by **Motiontek**, which will include a driver, controller, breaker, contactor, AC servo motor, and a PLC.



III. WORKING

ADC is designed to minimize the impact of the chemicals used to manufacture the denim on human health. Thus the process of spraying KMnO4 is done in an isolated chamber. The loading of denim has to be done manually. A loader initially loads completely stitched denim on the Air Filled Rubber Dummies (AFRD). Once the placement of the denim is crosschecked by the operator, he starts the machine. The AFRD then goes into an isolated chamber with the help of overhead conveyors. Once the AFRD is in position the 3-Axis CNC starts to coat the jeans as per the design that was primarily fed into the master computer. Once the spray is completed the AFRD exits the chamber with the help of overhead conveyors. Here, the process of unloading the coated denim and loading the new denim is done.

IV. ACRONYMS

Air Filled Rubber Dummies (AFRD),

Automatic Denim Creator (ADC),
Compound Annual Growth Rate (CAGR),
Computer Aided Designing *(CAD)*,
Computer Numeric Code (CNC),
Potassium Permanganate (KMnO4).

V. CONCLUSION

ADC is not only an effective but also a cost efficient way to replace the conventional method of spraying KMnO4. Manufacturing and setup costs will be far less expensive then alternatives such as Robotic Arms. Also, our main objective of successfully creating a safe work environment for the workers is achieved. India being one of the biggest manufacturer and consumer of denims, it lacks automation and hence we aspire to change this. We hence conclude that ADC has a vast scope not only in India but also in international markets and will help India achieve number one position in denim manufacturing industry with synchronization of humans and machines.

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