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DESIGN AND FABRICATION OF COVERING ATTACHMENT FOR PAINTING SUBMERSIBLE PUMPS

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Abstract: The purpose of this project is to assist the painting division in painting special cases of submersible pumps by the covering attachment which improves the quality of painting process. The purpose of painting is to provide the layer of protection against corrosion and weathering. The main aim of this project is to optimize the present work of laboriously attaching and removing the sheet, which is used to cover the non-corrosive parts of pump. This project involves the process of designing an attachment by considering the shapes, functionality, space and the manufacturing cost. The project also required analysis to make sure the strength of the product to ensure the safety of the user. After all the process has been done, this attachment helped us to understand the fabrication and designing process that involved in this project.
Keywords: submersible pump, painting, painting time, operator safety, economical process

I. INTRODUCTION

Submersible pump is centrifugal type of pump which pumps out water from the bored hole or well. The shape of the pump is cylindrical and the pump remains dipped in water due to which there will not be any suction trouble. There are two main portions of submersible pump which are coupled together, one is electric motor and the other is pump which is manufactured single stage or multi stages. Pump has number of parts which are made out of various metals such as CI, GM, SS, and EN Steels etc. In case of multi stage pumps, each pump may have different number of stages and because various parts are made out of various metals the non corrosive parts are not required for painting. At present in the company the work is manually done to cover those non corrosive parts by simply pasting and removing a sheet also there is a huge risk in the worker safety as he climbs over a stool to do the particular job. Our objective was to eliminate the worker doing the particular job and reduce the time consumption and to make the process more efficient and also to improve safety conditions, and tried to implement the covering attachment for painting in the company which increases the quality of the work. By this covering attachment one does not need to repeatedly paste and remove the sheet on the non corrosive parts of the pump. The responsibility of maintaining the quality of painting is now shifted from the operator and given to the covering attachment. The attachment consists of a pneumatic rotary actuator which rotates for 180 degree and the shaft mounted on it. The shaft consists of number of clamps arranged linearly. The clamps are fitted with springs to absorb the shock. The clamp also contains the bearing which makes contact with the pump.

II. LITERATURE REVIEW

Keerthanaa et.al [1], developed an Automatic Wall Painting Robot which helps to achieve low cost painting equipment. Despite the advances in robotics and its wide spreading applications, interior wall painting has shared little in research activities. The painting chemicals can cause hazards to the human painters such as eye and respiratory system problems. Also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. When construction workers and robots are properly integrated in building tasks, the whole construction process can be better managed and savings in human labor and timing are obtained as a consequence. In addition, it would offer the opportunity to reduce or eliminate human exposure to difficult and hazardous environments, which would solve most of the problems connected with safety when many activities occur at the same time. These factors motivate the development of an automated robotic painting system. Rajesh Kanna et.al [2], has designed an intelligent pneumatic wall painting machine and fabricated using vision and neural system. Painting the wall is normally done manually, which is very difficult and troublesome for humans to work in an upright position and also very dangerous for eyes and skin. Due to fatigue and surrounding environment, painting might not even all over the wall. To overcome these difficulties, the machine was designed. The machine has the arm which can extend up to 25 feet by carrying the pneumatic spray gun. The camera in the arm captures the image of the wall and the obtained image has been processed and gives as the input to the trained artificial neural network. The output from the network is used to control the pneumatic pressure supplied to the air gun. Apart from the automatic control, manual control switches are also used for the operation. Thus the developed intelligent machine is a low cost machine with automatic and manual control for perfectly painting the wall with reduced human fatigue, time and paint, even with an un-uniformly painted wall. Berardo Naticchia et.al [3], developed a novel robot device for high quality multi-colour interior wall painting carried by a robot arm and successfully tested. It is shared that construction projects are getting bigger and more

complex, hence also the productivity of the construction industry must be improved, while preserving its labour from hazardous job sites. Such requirements can be accomplished by the adoption of robotized products, which, however, need to be quickly developed and marketed. Thanks to the new 1:6 scaled down laboratory and its six degree of freedom robot arm on an hexapod for horizontal moves, we tested the opportunity to introduce also in the building sector miniature robots that can change the ergonomics standard adopted by construction workers. It is analyzed how and why switching from full size to miniature robots is convenient in construction. In addition, a new system adding further features to robotized painting has been conceived. Our new multi-colour spraying end-tool was developed and fixed on the robot arm, in order to be able to reproduce coloured artworks. Finally, a methodology to reproduce colours from digital format of artworks is presented, showing how accurate and efficient is this new robotized spraying device.

III. WORKING

The operation of the covering attachment for painting in submersible pump is that when the submersible pump comes into the painting section the pneumatic rotary actuator is given the calculated amount of pressure and the shaft along with other supportive elements undergoes a 180 degree rotation. This rotation makes the roller attached to the clamp to make contact with the pump. The pump is continuously rotated in the overhead conveyer to get painted in all the areas this causes a little vibration and causes a lateral movement of the pump. Due to this the roller gets a radial load to absorb this shock a set of springs is attached to the clamps. A thin layer of sheet is attached on the top of this clamp so that when spray painting is done the paint doesn't leaks to the lower portion. There are several sets of clamps, for each stage in the pump it requires two set of clamps to prevent the paint applied to the non corrosive parts of the pump. Thus when the painting operation is completed the pressure is released and the pneumatic rotary actuator comes to its normal position

IV. REALTIME MODEL

The submersible pump has number of stages each stage is made out of by casting. The part from casting is not resistant to corrosion. So a layer of painting is sprayed on the surface of the pump. This makes the pump to resist corrosion. But there are some special types of pump in which the material used to make the stages of pump is stainless steel which is a good corrosion resistant material. So it is not necessary to paint that special stage of pump. There are some other different types of special cases submersible pumps. The number of stages is based on the power requirement, the submersible pump has different no. of impellers on each stages. The attachment we designed has maximum of six to eight painting setup to cover that number of stages. The final attachment what we designed is shown in the figure. This attachment covers the special stages in the submersible pump.

V. DESIGN AND ANALYSIS

The final assembly of the overall covering attachment is shown in the figure. On the top of the assembly a bearing is attached to rotate the entire setup without any fluctuations. In the bottom a pneumatic rotary actuator is attached to rotate the entire setup in a preferred degree of angle. The horizontal arm is used to hold the painting structure. The inner c-clamp contains rollers which rotate along with the submersible pump without causing any damage to the surface of pump. Springs are attached between the c-clamps to absorb the vibrations causing by the pump and do not allow the vibrations to pass to the arm and main shaft. The analysis of total deformation and equivalent von- misses stress is shown in the figure, the design withstand the maximum load applied. The deformations and the stresses are within the limit and the design is completely safe.

Fig – 1: Real Time Model

Fig – 2: Real Time Model (Another View)

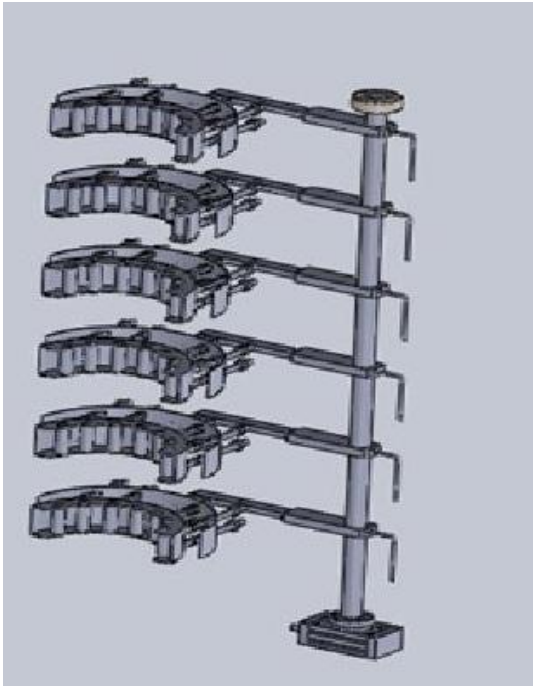

Fig – 3: Assembly Created in Solid works

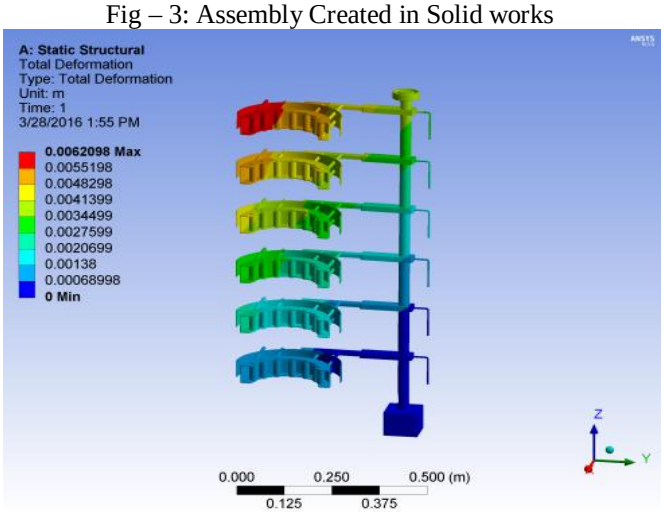

Fig – 4: Total Deformation of the Assembled Model in ANSYS

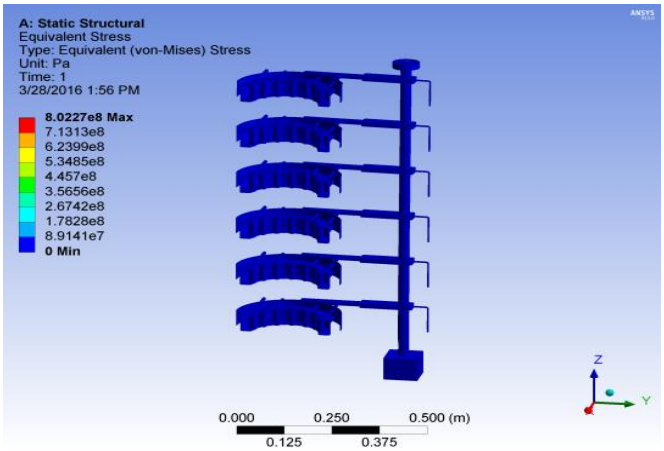

Fig – 5: Equivalent Von-Misses Stress of the Assembled Model in ANSYS

VI. CONCLUSION

The project we proposed is very simple in construction, safer to operate, and also easier to manufacture. This structure eliminates the difficulty undergone by the worker during the peak hours in industry. Thus the proposed machine is an innovative method for painting special cases of submersible pump. At the outset this project will improve the productivity and quality of the product.

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