In.FIN.ity Tube Finning Machine

Mechanical Engineering

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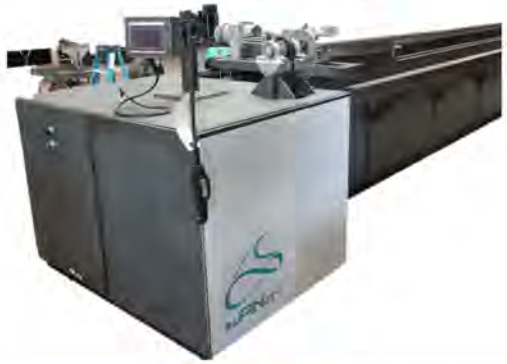
Abstract

The in.FIN.ity Engineering team and its sponsor company MBT Steam began conceptualizing this project back in June of 2017. The idea was to design a production quality tube finning machine. The machine we designed is capable of wrapping steel coils around tubes used for exchanging heat inside of boiler walls. The machine can accommodate 1" to 3.5" diameter tubes and apply tension wound fins at a variable pitch of 4, 5, and 6 fins per inch. The tubes can be produced in either carbon or stainless steel. A PLC allows the operator to control the machine and vary part parameters. Fabrication of the machine was handled in house by MBT Steam. The production speed for a 21 foot tube is approximately 5 minutes.

Tube Finning Machine



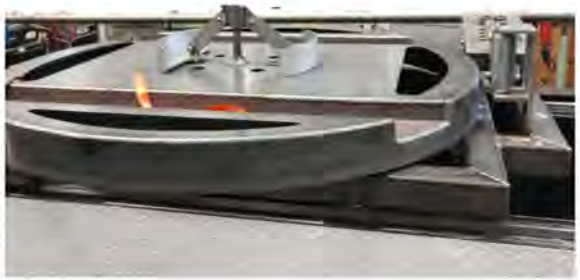
Design

The machine went through a few different design iterations; from feeding the pipe through a fixed station to the final solution of moving the material and fining tool along a spinning tube. We used SolidWorks to design, model, and simulate loads on the machine. We also performed calculations for sizing motors, gears, and drive train assemblies. The brain of the tube finning machine is an Allen Bradley Micro 850 PLC controller with a human machine interface (HMI) touchscreen. The HMI will give the operator the ability to program and configure the tube finning machine to produced tubes with different fin pitches, lengths, and diameters.

System Control Panel

The system control panel was fabricated by the senior design team. We created the wiring schematic and panel layout using AutoCAD. The panel is divided into three sections: the top is controls and power banks, the middle section is DC controlled motor drives, and the bottom is high voltage components.

Payoff Wheel



Material Pre-Processing Tooing

The material pre-processing tool is used to prep the fin material before applying it to the tube. The plate straightens the material off of the coil and then crimps the bottom and stretches the top to make winding around the tube easier.

Sponsor Company

MBT Steam Technologies

Sponsors/Conclusion

As a team we gained experience in machine design, PLC programming, HMI creation, and project management. With the guidance from MBT Steam, our project sponsor, we were able to build a production quality machine. We would also like to give a special thanks to Allied Electric for all of the count less they spent sharing their PLC and HMI knowledge and experience.

Senior Design Team

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