Acoustic Guitar Side Bending Machine

Pre-War Guitars

Funding Provided by: NCIDEA™ CORPORATION FOR Entrepreneurship & Innovation

Western Carolina University

PROBLEM STATEMENT

Develop a small-shop guitar side bending machine for Pre-War Guitars that is also capable of being marketed to other small luthier shops and hobbyists. This design should increase the repeatability of the side bending process and decrease imperfections and waste when compared to current bending devices.

Pre-War's original side bending machine

	Requirements
1	Adjustable and Monitored Pressure Control
2	Improved Heat Distribution
3	Modular Design
4	Affordable Design & Manufacturability

CONCEPTS

- The initial concept for this project was to innovate both the pressure and heating systems of the side-bending device.
- The manual pressing issues would be mitigated via electric actuators pressing the full surface area of the wood.
- The heating issues would be mitigated via heat cartridges embedded in an aluminum zone on the device.
- An 80/20 frame with swappable guitar side forms to allow the same machine to press numerous guitar shapes.

FINAL DESIGN, APPROACH, & PLAN

- The final design of this project allows guitar luthiers to follow these steps:
  1. Select a wooden form for their desired guitar shape and install it on the machine.
  2. Load a heating blanket and moistened wooden guitar side into the machine.
  3. Use the detachable controller to actuate the machine and bend the wood into the desired guitar profile, while being able to control speed and direction of the actuators.

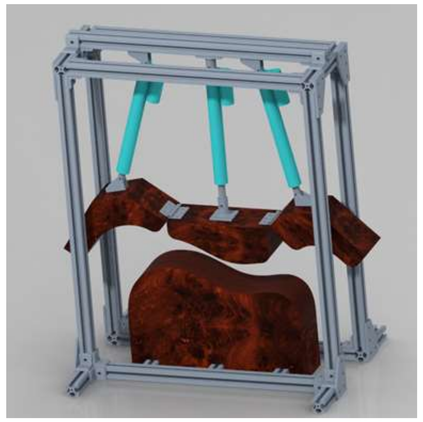
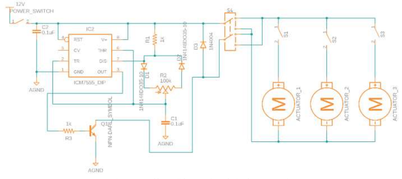


Photo Caption: CAD model of finalized machine operated by three actuators. The forms are made of wood and are used to compress wet and hot wood sides into the desired profile.

Electrical



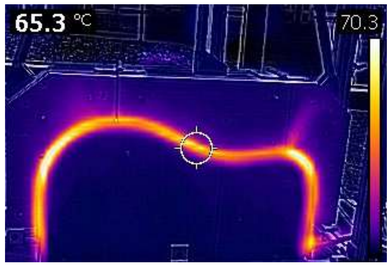
Controller Electrical Schematic

Final Controller

Three linear actuators are used to press the bends in the upper bout, waist and lower bout. The actuators can be selected individually using toggle switches before being controlled by a momentary switch to raise and lower the presses. The speed of the actuators can be controlled using a pulse width modulator circuit. This allows the user to have a large range of control during the bending process.

TEST RESULTS

Heat Concentration and Distribution



Test 1:

Conditions:

- 40 hours compressed.
- 10-15 minutes total working time.
- Heating pad placed above wood.

Test 2:

Conditions:

- 10 minutes compressed.
- 5 minutes total working time.
- Heating pad placed below wood.

Test 3:

Conditions:

- 30 minutes total compressed.
- 10 minutes total working time.
- Heating pad placed above wood.

SUMMARY AND CONCLUSIONS

With the cost of aluminum, the team quickly learned that mitigating the heating source was not feasible because it would take the machine to a cost above the scope of the project. The team pivoted to utilizing a heating blanket as the heat source and concentrated on creating solid wood pressing forms. An advantage of this decision is that heating blankets are universal for bending any guitar shape that Pre-War needs.

After completing the final prototype in February, Pre-War approved the design for a small-scale production. The team would be tasked with manufacturing four separate machines before the end of April.

FUTURE WORK

The future work consists of two main objectives:

1. Manufacture new wooden forms with different guitar shapes for Pre-War to increase production abilities.
2. Order and assemble more machine kits as needed to meet Pre-Wars's production demand, or to produce and sell.

TEAM & ACKNOWLEDGEMENTS

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- Bryce Rogers, Engineering Technology
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- Chip Ferguson, Mentor
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