



Steel Founders' Society of America
Cast in Steel 2021
Thor's Hammer

Youngstown State University

Student Team

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Foundry Partner: Trumbull Metal



Design

The objective of the competition was to design a “Thor’s Hammer” not exceeding 20 inches in length and a total weight of 6 pounds. According to the competition organizers, these two decisions were based on the need for the hammer to be wielded with only one hand. Additionally, the decisions were made to only use these restrictions so student teams could be creative with hammer designs.

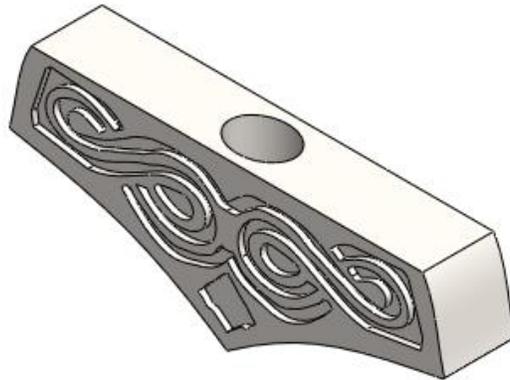
According to legend, the god Loki challenged the dwarven blacksmiths Brok and Sindri to make 3 powerful relics in exchange for his head. After 2 of these relics were completed with relative ease, Loki decided to sabotage the dwarves by turning into a fly to distract them. Loki succeeded, causing Brok to break his stoic concentration only for a second to swat at the fly. This distraction caused some of the metal unusable for the final relic, Mjolnir, which explains its characteristic short handle. The hammer was of course gifted to Thor who actually preferred the shorter handle causing Loki to lose his wager with the dwarves.



Our design is based heavily on traditional descriptions and artwork of Mjolnir including a symmetrical head design and shortened handle. We have also included an intricate pattern reminiscent of Nordic Runes that would have been present on the original Mjolnir.

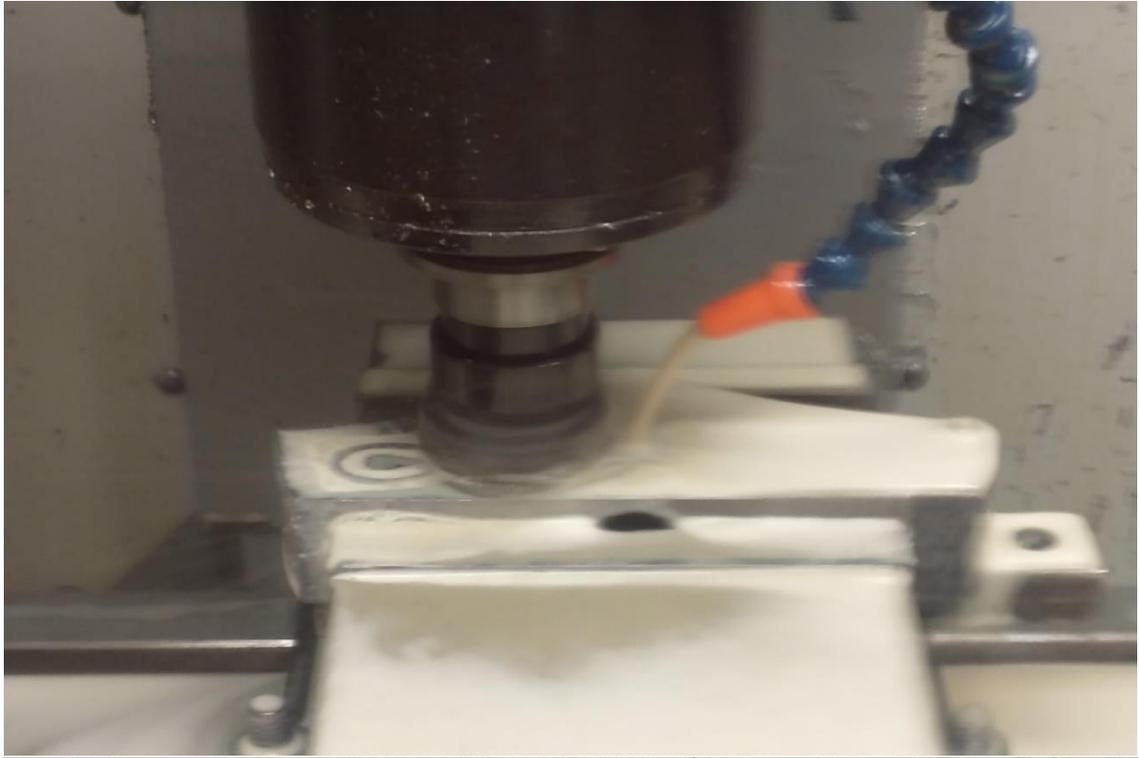
Process

Our team decided to use A217 steel for our hammer. This material was selected primarily due to availability and time constraints related to project planning. The hammer and the mold were designed in Solidworks. After that, the mold was created with 3D printing using a binder jetting printer to create a sand mold. This process allows for rapid development of a mold design without needing time to produce a pattern.



Following the printing of the molds, the hammers were cast at Trumbull Metal in Niles, Ohio. We chose between the heads we cast by inspecting them for casting defects and shrinkage, and then selected one to turn into our competition submission. The head went through some light surface machining to finish the two flat sides of the hammer.





Following machining, the hammer went through heat treating to increase its hardness. To heat treat, we held the hammer head in a furnace for 2 hours at 700° C, followed by quenching in oil. After the hammer was cool enough to remove from the oil, it was left to air cool. Heat treating and quenching also gave the hammer a dark appearance and highlighted the runic design more, finishing the appearance of the head itself.



A simple axe handle was purchased from a hardware store and was cut to a length where the entire length of the assembled hammer would fit snugly into the elbow if held by the head, as shown in the informational video found on the competition website. The handle was sanded down in rough, sharp areas and to fit the head we cast. The finalized hammer is picture below. There is also a comparison between a prototype hammer we built and the final competition hammer.







Acknowledgements

The YSU team would like to thank our industry partner Corey Jarvis (Trumbull Metals) for his continued involvement and support with the YSU AFS Chapter.