

REPORT

Forging versus Cast Product

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1-800-HL TOOTH

FORGE MANUFACTURING GUIDE TO THE H&L TOOTH COMPANY

Forged Bucket Teeth Offers Greater Strength!

H&L Tooth began producing forged digging teeth in the early 1930's with original patents being issued to Partners Chester C. Hosmer and Ernie L. Launder. The first two-part tooth systems were manufactured in Southern California.

2015 updated Engineering publication

H&L Uniforged® process is the reshaping, resizing and the continued reduction of grain flow of steel alloy metals under extreme pressures. H&L horizontal up-setters uniquely produce the desired tooth configurations for all style and offering of Teeth for ground engaging application!



*H&L Tooth Company forge facility in Tulsa Oklahoma, a 200,000 sq. foot manufacturing home for **QUALITY FORGED WEAR PARTS.***

At H&L's facility in Tulsa Oklahoma, *forging* of tooth tips are done horizontally on machines known as Up-setters. Under the roof in Tulsa are two-4" upsetter lines that produce small backhoe teeth weighing under 3 pounds and up to 10 pounds; parts are shaped in 30-second cycles. Two- 6"-upsetters producing teeth up to 30 pounds.

Ripper teeth are produced on a 7 1/2"-upsetter, allowing the creation of teeth up to 100 pounds in size. Large mining teeth are produced on two 9"-upsetters that produce parts in excess of two-hundred pounds in many styles. Each Uniforge® production line is also equipped with up to six additional supporting units, including electric induction heaters, vertical secondary presses for part trimming, hole punching and coining operations.

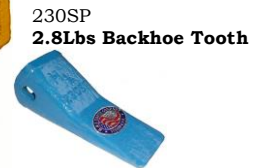
H&L upsetter "closed-die" design controls steel deformation of alloy steels by reducing its grain flow, this results in superior metallurgical soundness, and improves the mechanical properties of digging teeth for extreme and severe field digging applications.

In contrast; a *casting* process is the pouring of molten steel metals into a sand or similar type mold. This produces a finished style configuration without steel grain flow.

The H&L® Tooth Company forge teeth and adapters from 3LBS/1.4kgs to 220LBS/100kgs in many exterior styles, supplying sharper penetration and longer life.



546RXH-R
220.0Lbs Mining Tooth



230SP
2.8Lbs Backhoe Tooth

Figure 1

H&L teeth are *forged* from quality steel mills, and uses a high Silicon HL400 alloys. All steels used in our Ground Engaging Tooth Products must first meet the metallurgical specifications set forth by ASTM Standards that govern the production of alloy steels. H&L inspection checks and balances of raw steel purchases guarantee that only quality forge teeth are produced time after time!

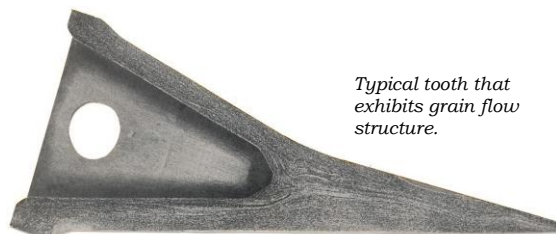
As for a *casting*, the Cast Tooth Manufacturer melts and pours their blended steels. If the mechanical or metallurgical properties are marginal, they must then make the decision whether to scrap an entire heat, or take a chance that 100 to 300 teeth will be supplied to the end user, or not.

In most cases H&L® stock material to be *forged* has already been reduced in size by the steel supplier to refine the dendrite structure of a steel ingot. By doing this, it removes steel defects that are inherent in the cast processing. This continued refining is achieved by successive rolling operations, which reduces the cross section of the steel size under pressure. Rolling eliminates small process porosity, creating bar crystalline structure refinement of the base metal, and orienting any steel alloy segregation in the direction of the rolled work. We call this directional alignment *grain flow*. Grain flow produces directional characteristics which enhances steel properties such as strength, ductility and resistance to impact.

The H&L® *forging* process uniquely aligns this directional flow of the *Uniforged*® tooth created by H&L's horizontal upsetter.

Positioning of this grain flow within H&L's teeth is accomplished during the successive rolling and four-stages of upset working of the hot steel. Grain flow is controlled through H&L's unique closed die designs and experience of over eighty-(80) years.

Forging gives an important advantage over a cast counterpart by orienting grain flow in the direction acquiring maximum strength.



Typical tooth that exhibits grain flow structure.

Figure 2

Chemical analysis, microstructure, macrostructure is regularly monitor in the production of H&L® forged quality teeth. Raw steel certification coupled with our in-house magnafluxing and mechanical testing assure that only approved alloy steels are used to produce *genuine H&L Uniforged Teeth*.

Tooling and patterns;

A *sand-cast* process starts as a positive (male) pattern with pocket and hole core components being required. The cope and drag molds are made from a pattern, which makes a female cavity in the sand. This in turn will produce a rough semi-finished tooth configuration per their design.

H&L's *Uniforged tooth* by contrast starts with tool steel up-setter tools, four female cavity impressions that produces a forged quality tooth. One less process change that's required within the cast process. I.e. female-to-male tooth process, one less process then the cast process.

H&L® *Uniforge*® process will typically develop approximately one-third more material elongation and ductility then its cast counterpart. This gives a higher dependability factors that is associated with forgings, ultimately reducing downtime and lower maintenance costs to the *End-User*.

Further improvement comes during the horizontal Up-Setter forging process with the working and re-sizing of the alloy steel billet by no less than four-(4) upsetter die impressions. This greatly refines the material grain flow by producing a uniformed forged tooth cross section for optimum heat treatment response.

Because of the greater strength and ductility in any given steel alloy material, soundness, uniformity in chemistry, along with a finer grain size; *Uniforge*® teeth by horizontal up-setting is better suited for heavy ground engaging applications over its cast counterpart.

Quote from John Deere's Master Match Catalog

"FORGED TEETH ARE THE PREMIUM, HEAVY DUTY TOOTH FOR THEIR APPLICATIONS"

The H&L® *forged* process: *Made in the USA!*

First upsetter pass balls the pocket area to ensure material flow

Cavity defines of the tooth blade area

Cavity 80% of the forming and defining of pocket and blade area.



Figure 3

Final forge cavity fully develops the tooth configuration.

Horizontal and vertical head trims excess steel from the part.

Each **TulsaMADE** tooth is de-burred, heat-treated and painted.