

# Ratcheting Wrenches



By: Travis Wagner



# Introduction

## Background:

Ratcheting wrenches, commonly referred to as ratchets, socket wrenches or ratcheting spanners, are a type of wrench used to reduce the time to install or remove fasteners. These wrenches feature a spring loaded tooth and pawl ratchet mechanism, that allows them to spin in one direction but not the other, allowing force to be applied to spin on a fastener, but for the wrench to slip and move freely to reposition.

The wrenches looked at here are socket wrenches, where there are attachments that change the size and/or type of fastener the wrench can be used on. Another common type of ratcheting wrench is a box end combination wrench, with a fixed size ratchet on one end and a fixed open end. These are steadily replacing fixed combination wrenches as sizes get smaller for the mechanism. Ratcheting openended wrenches exist, but are uncommon.

Since ratchets are directional, there are 2 main ways to change the direction of the wrench, flip the wrench over, or a built in switch. This change is classified as on/off, or left/right, which all is a way of saying clockwise/counterclockwise.

Five wrenches were photographed, 2 used wrenches and 3 new wrenches. The new wrenches were purchased from Harbor Freight, and represent a spread of three different price-lines, a low, medium and high. Of the used wrenches, the Crescent branded one is a mirror image of the mid-line wrench from Harbor Freight, with fewer teeth. The other is an old wrench from Syracuse wrench. This wrench looks the most out of place and different, despite being a socket wrench like the rest. This wrench uses a separate square shaft that the sockets attach to as opposed to having an integrated square anvil to hold the sockets.

The Syracuse Wrench is a fixed direction ratchet, so to change direction, the wrench must be flipped over. It is the oldest wrench here, and the most used and it shows.

A large sell point in the wrench industry is number of teeth, which over time has increased in conventional socket wrenches. The more teeth a wrench has, the smaller the swing arc can be while still making progress in adjusting a fastener. The smaller the teeth are, the less angle it takes to click over to the next position. The drawback to more teeth, is reduced strength, and increased manufacture cost. With more teeth, at the same size wrench, the teeth would be smaller, and smaller teeth cannot support the same load. What companies do to counter this is to have multiple pawls engaged into many teeth at the same time, this may the click over angle is smaller, but the strength is preserved.

# Technology Overview

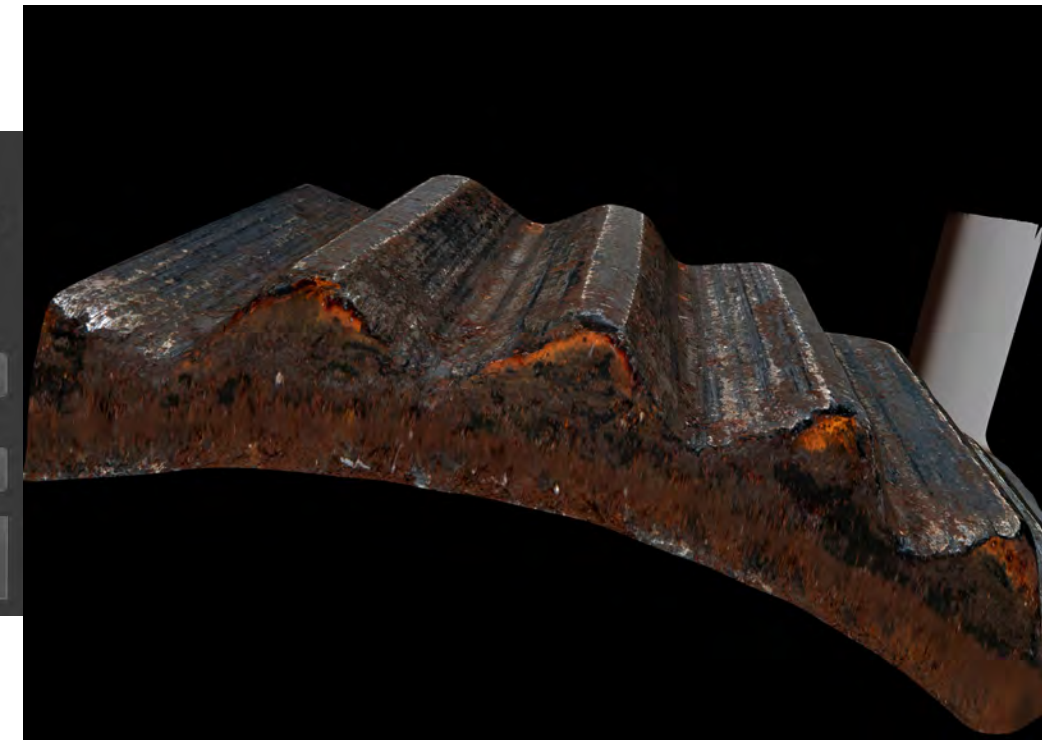
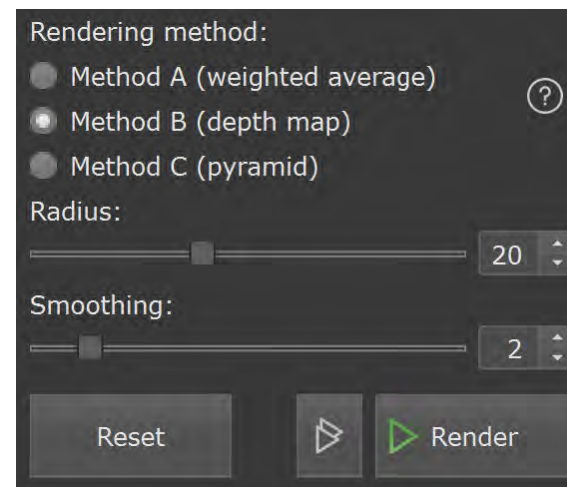
## Equipment:

The Photographs for this lab were taken on a Nikon D7500, a copy stand, a stack shot, and one of 3 lenses: a Laowa 25mm 2.5x-5x, a Laowa 100mm 2x, or a Nikon 50mm f/1.8. A fiber light was used for event illumination, with either a ring light modifier or a light bar modifier. The wrenches were placed on the copy stand, backed by felt. The ring light diffuser was attached to the lens, and the light bar was held with a friction arm. Only one of the two were on at a time. The camera was attached to a stack shot for the focus stack images. The stepdown varied from 50 $\mu$ m to 100 $\mu$ m.



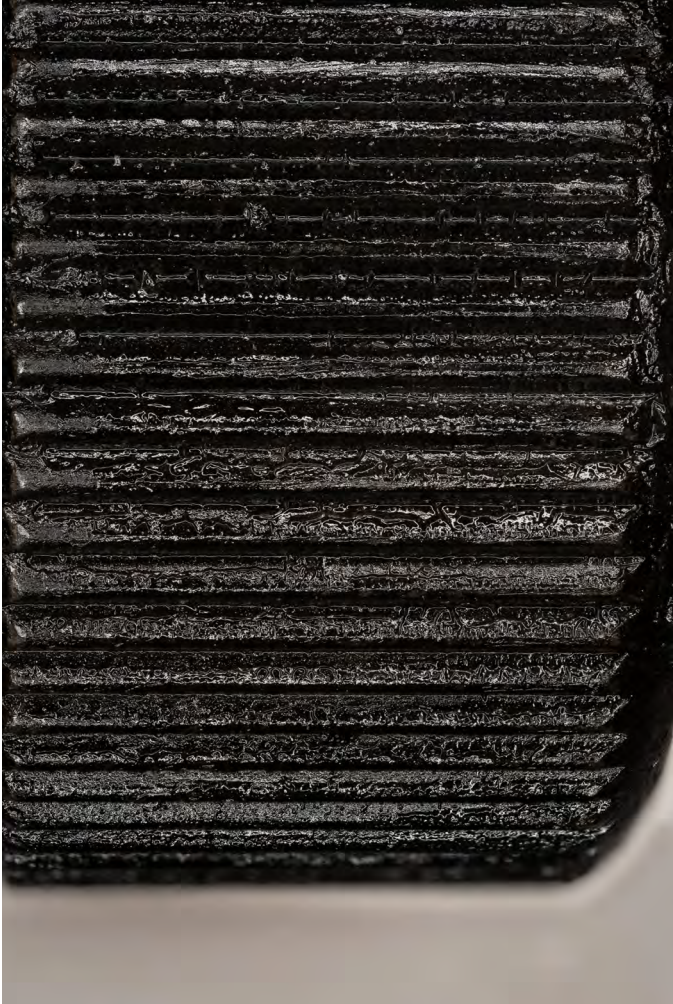
## Software:

Photographs were taken and color corrected with an X-Rite color checker (now Calibrite). Profiling was done with that software and applied in lightroom. For the focus stacks, The images were exported to .jpg and imported into Helicon Focus. The stacks ranged from 120 frames to 250 frames. The settings used for the stacks were consistent for each set, given consistent geometry of the pawls and ratchet wheels. The Method that performed best was B, Depth map, with settings of Radius 20 and Smoothing 2. This yielded the best results, and the resulting stacks created a fairly accurate 3D model of the part from a single view.





# Harbor Freight Pittsburgh Pro Composite





# Harbor Freight Pittsburgh Pro





# Harbor Freight Icon Professional



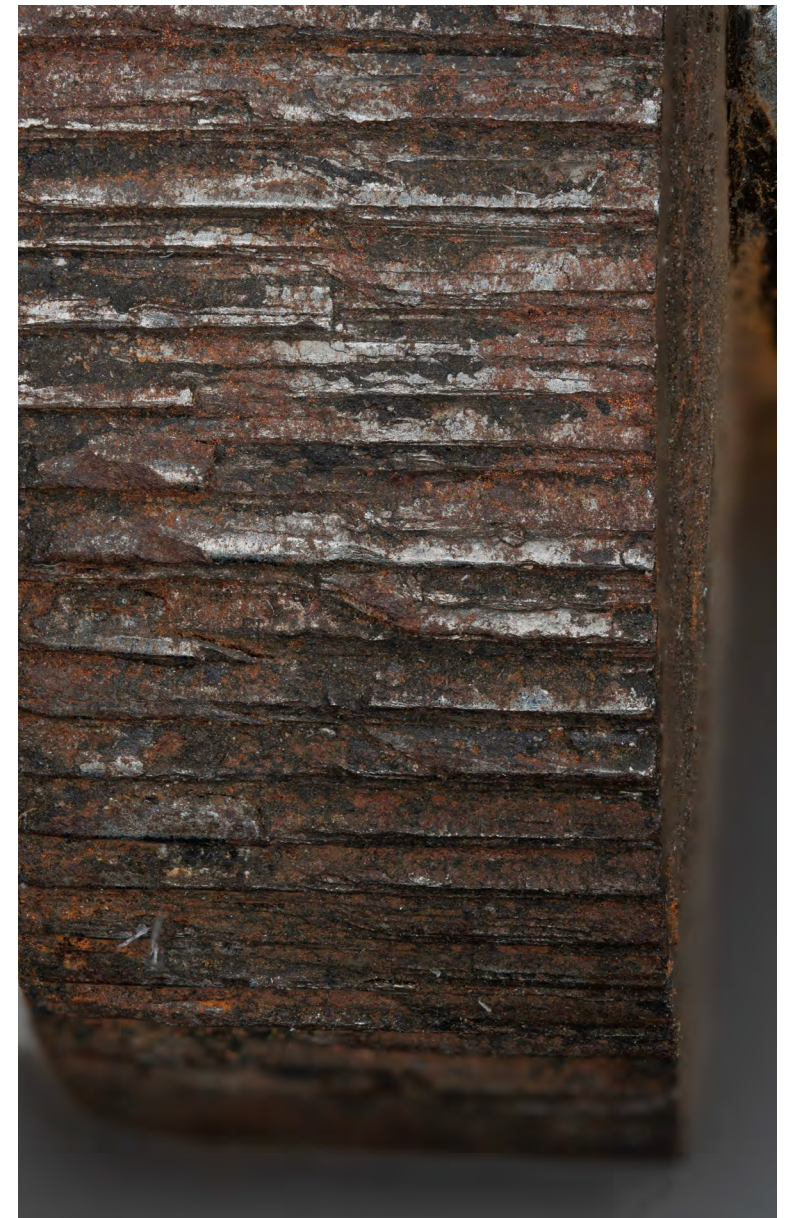


# Crescent





# Syracuse Wrench Co.





# About the Author

Travis Wagner is a fifth year Mechanical Engineering student in the Dual Degree program in Kate Gleason's College of Engineering At Rochester Institute of Technology. He is pursuing his Masters of Engineering and Bachelors of Science in Mechanical Engineering. He is Minorng in Photography, with the Photo Science option.