Chain Making

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Introduction

The following tutorial is by no means intended to represent any sort of expert advice as to how to make a Gunter's chain. It will show you how I accomplished making my own chain that will hopefully be an heirloom for my family for many years. A few years ago I originally intended to buy an old chain just to have one around for historical discussions. I then decided I wanted something unique that would be more personal and not just something that was once mass-produced without any special significance.

The cost of constructing a chain is not cheap if you use high-quality materials, but it does bring a lot of satisfaction when completed, and of course it was fun making it.

I completed my chain in the fall of 2005.

Enjoy!
Jerry

Making the Connecting Rings

For the connecting rings between the links, I chose to use steel welded chain which can be found on the reels in the local hardware store.

The oval appearance of the welded chain links is similar to the look on a vintage Chesterman chain.

When I say “connecting rings” I am talking about the rings that connect the actual links to each other.

Campbell #3 straight link “*Brass-Glo*” chain.

Catalog #072 3367 - 270 lb. rating.

One advantage of using chain is that all of the connecting rings will look the same and will have the same length. The Campbell® brand #3 "*Brass-Glo*" chain appeared to be about 1/8" thick which would match the same diameter as the links I would be making. The disadvantage is the price at $2.49 per foot. The coating is what makes this chain so expensive. If this same type of chain can be found in regular galvanizing I am sure it would be cheaper.

Alternative Chain

I did find an alternative to the "*Brass-Glo*" chain which is the Campbell® #2 galvanized straight link chain. The individual chain rings or links seem to be about the same in length, but the links appeared to be somewhat thicker than 1/8" which might create a weird appearance with thicker connecting rings between the actual links. The above photo really doesn't show the slightly thicker chain, but it was evident when compared to the "*Brass-Glo*" chain. At $1.79 per foot it would certainly be less expensive.

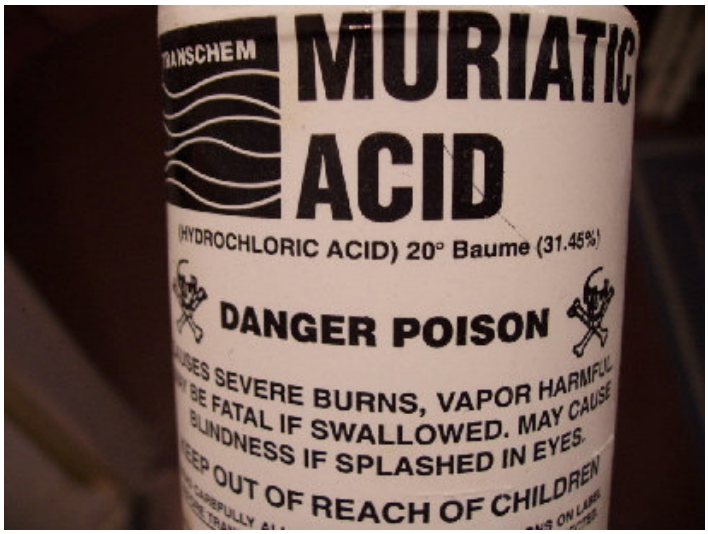
Catalog #536 5242 - 325 lb. rating.

How much chain (connecting rings) is needed?

There are 200 connecting rings in a 66' chain. Remember that you will have to cut off every third link if you have two rings between each link, so that adds another 100 rings that are wasted. Each ring measures 0.8", so that makes 20' of chain. That put my cost at nearly $50 just for the chain since I used the more expensive type.

Removing the Galvanizing

The shiny galvanized chain used for the connecting rings will certainly look odd, so you'll want to remove the galvanizing. The galvanizing can be removed from the chain very easily and quickly with Muriatic Acid which can be found at most hardware stores. You will need to use a plastic container since the acid will eat or corrode a metal container, but is harmless to the plastic. De-galvanizing occurs immediately.



WARNING: Extreme caution must be used when using Muriatic Acid. Wear protective eyewear and avoid getting it on your skin or breathing the fumes. This stuff is really powerful!

Secure a method of removing the chain from the acid by attaching a wire to the end of the chain. When the acid removes the galvanizing it will bubble and foam. Use only in a well ventilated area which would be best done outside. Avoid having the acid near anything metal since the fumes alone can cause tools or other metal objects to loose their protective coatings and then rust. When finished, dilute the acid with plenty of water to neutralize it before disposal.

The de-galvanized chain will need to be immersed in water to neutralize the acid that is still on the metal. Wipe the excess water off with a towel and protect the chain from moisture since it will be highly sensitive to rust at this point and you may actually see rust form within a very short time.

Making the Links

I chose to make the links from 1/8" steel rod instead of coiled wire. Although wire would probably work, you must straighten it from the coiled condition and you might always have sort of a slight bending look to the links. I found the steel rod to be high-tensile and not easily bendable like wire, so the rod gave a uniform look.

Most local hardware stores will have a small display area for the hobbyist where you can purchase various sizes and shapes of individual pieces of steel.

SteelWorkS® Weld Steel Round Rod

I have seen it available in both 3' and 4' lengths in the display sections. The 4' sections cost $2.49 each.

1/8" – 3 FT
SKU #5079082 INV 450078

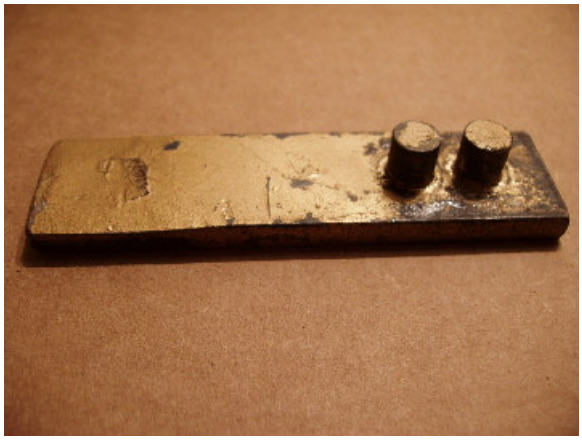
1/8" – 4 FT
SKU #5014303 INV 455282

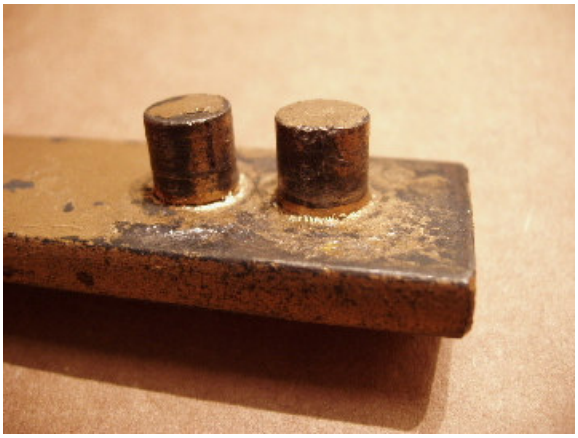
How much rod is needed?

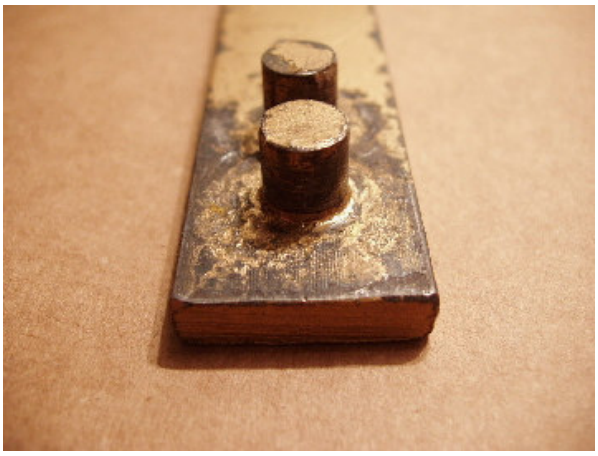
My links were approximately 8¾" long each (before making the loops on the ends), so from a 4' section of rod I could get 5 pieces with long scrap piece on the end. Using the 3' section of rod I could get 4 pieces with a small scrap piece on the end. You'll need 100 links, so if you use the 4' sections of rod you'll need 20 pieces. At $2.49 per piece the rod cost just about another $50.

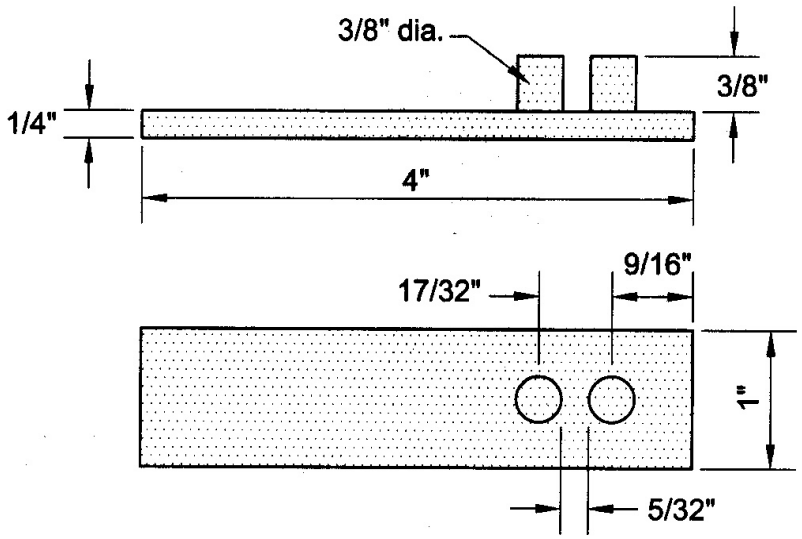
Link Jig

You'll need to have a jig made to make the loops at the ends of the links. I had a machinist make this jig with the specifications as shown below. The length of the jig can vary, but I made mine 4" long so it would be more secure when held in a vise. This is the only special tool that you will need.



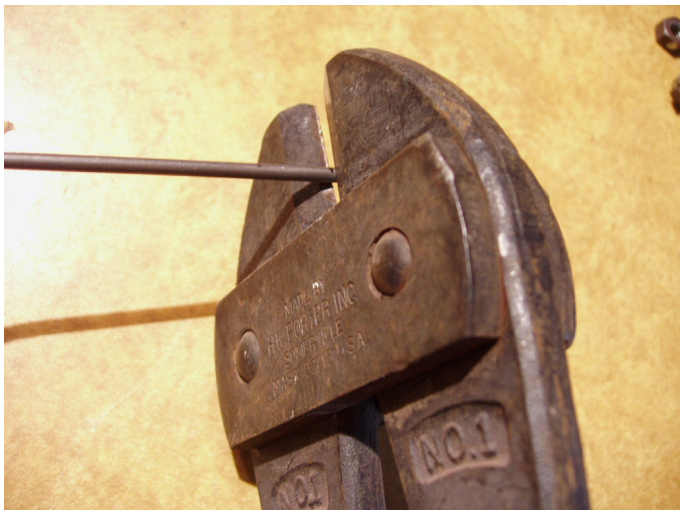






The above drawing shows the dimensions of the jig I used. Two 3/8" bolts were tapped into the steel plate and then cut off above the threads. The critical dimensions are the 3/8" round studs and the spacing of 5/32" between them which allows just enough space for the 1/8" steel rods to be inserted between them.

Making the Links



Cutting the rod with bolt cutters.

Removing the sharp edges with a grinder.

The 1/8" diameter steel rod can be easily cut with a pair of bolt cutters. This will leave a sharp edge on the end which can be smoothed, and the edges rounded with a grinder.

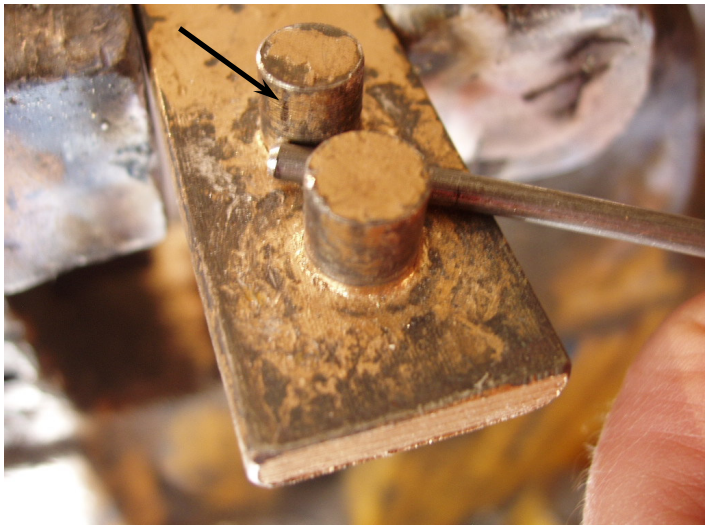
Your goal is to cut the rod into lengths that will create a link that when added to the center of the double connecting ring on each end will add up to 7.92" or 0.66'. This will take some experimentation depending upon what you decide to use for the connecting rings. I found that by cutting the rods into 8¾" lengths that was about the right amount to create the loops on each end and come out to 7.92" when using the Campbell® #3 "*Brass-Glo*" straight link chain for the connecting rings.

You'll quickly discover just how difficult it is to make each link exactly the same length after you have affixed the loops to each end. It is a matter of precision in bending the loops around the jig each time. If, for instance, each link was only 1/32" off, you would be off 5/16" by the end of constructing 10 links. I found that I was anywhere from right on to 3/32" off when creating each link.

To fix this situation I marked off the right distance on a flat hard surface floor with the steel tape that would equal 8 links (5.28'). After constructing 8 links I would compare it to the distance measured on the floor. Say I was 1/4" too long, I would cut the next four rods each 1/16" less to hopefully correct the situation in the next 8 links. It was always a check, and then correct the situation, but you really could not notice this small difference in lengths by looking at the individual links. I was always just a little short or long when checking, so it is important to not try to make an entire chain assuming everything will turn out okay at the end.

I continued this process and would occasionally measure off longer sections to check the overall length of the chain. At 50 links I would need to match 33.00' as measured on the floor with the steel tape. I did this process for all 98 links (minus the handles) and checked the distance of 64.68'. The steel tape distance measured on the floor was corrected for temperature.

The final distance of 0.66' on each end would be determined upon which type of handles I developed. This called for shorter steel links than what the 98 links between the handles were made.



Start each rod bend in the same location.

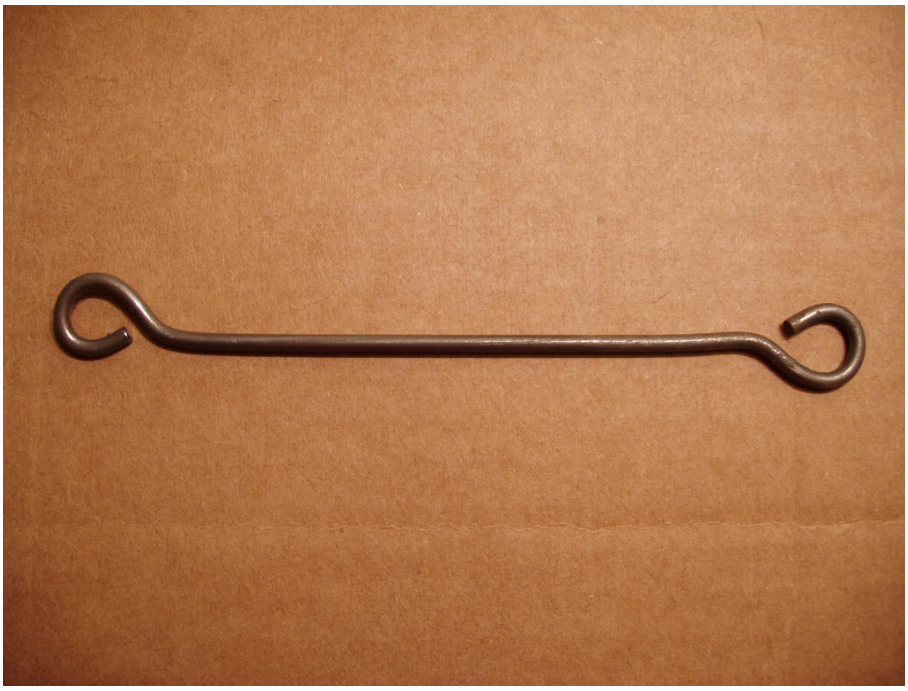
Begin the bend keeping it tight against the post.

Continue all the way around the post.

Place link on back post to begin reverse kink.

Bend around until link is straight with loop.

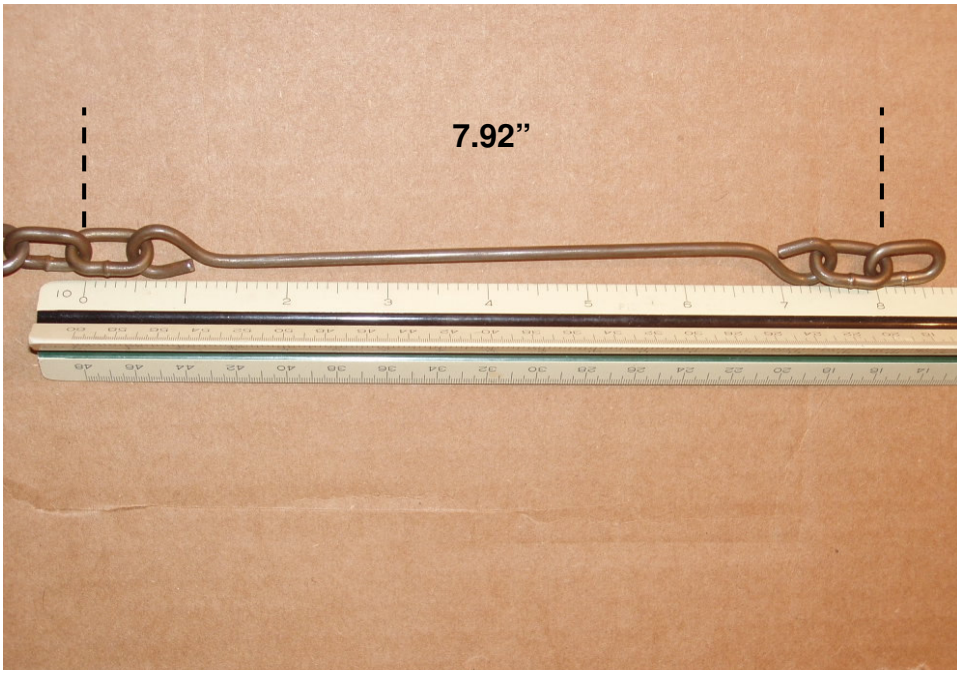
Completed loop.



When making the loop on the other end of the link place it in the jig so open end of the completed loop faces away from you. This will create a reversed loop on the other end.

Connect the links with the connecting chain rings.

This will require using pliers to bend the loops completely around. Get the pliers right up to the end of the rod to bend that tip in close. File off any burrs made by the pliers.



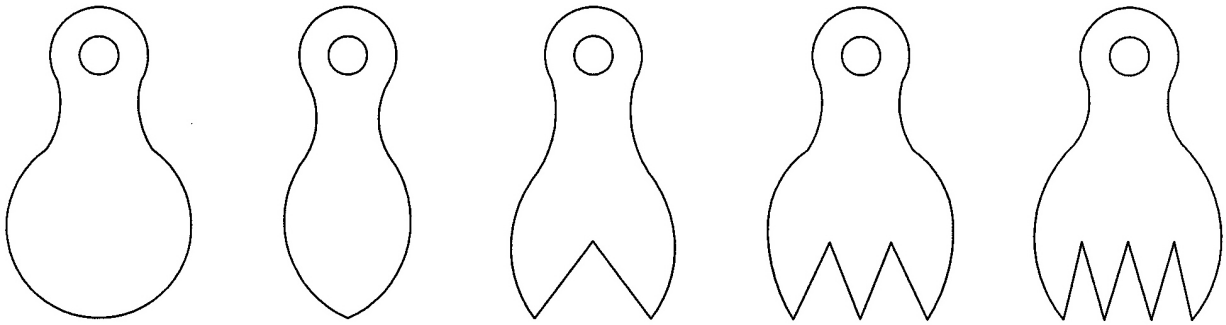
The distance from the center of the connecting rings across the link should be 7.92” or 0.66’ .

Making the Tallies

Some hardware stores will have display areas for hobby pieces of brass which works well for making the tallies.

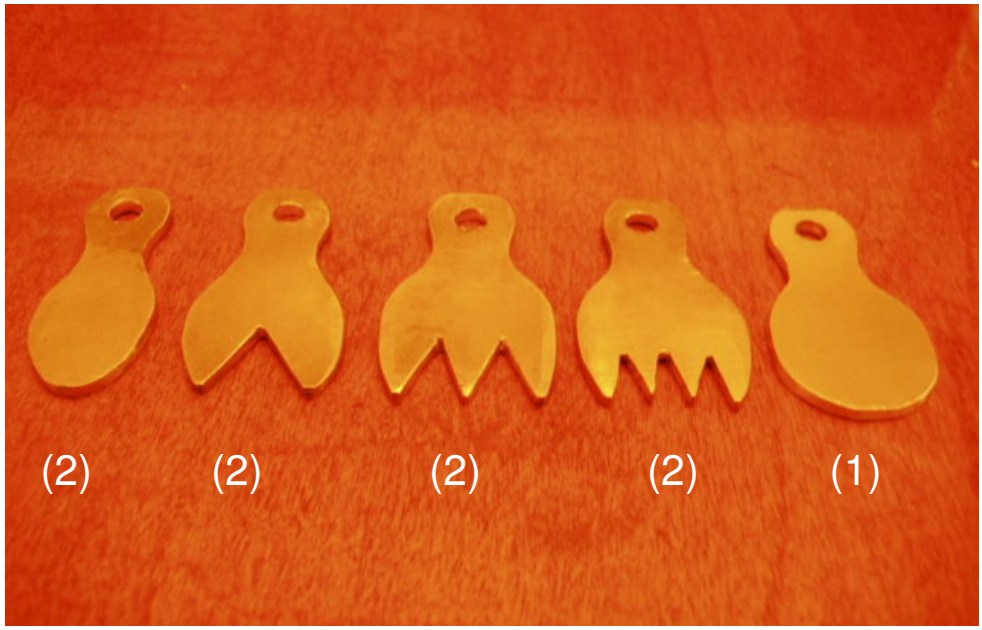
K&S is a well known company that makes smaller brass items.

Use the flat brass that comes in the 0.093”x1”x12” size. This is thicker brass that will not bend.



The above tracing templates were made using CAD and then cut out.

After tracing the design with a permanent marking pen, a hacksaw will cut out the majority of the waste area. Use a grinder or hand file to shape the tally to its final shape, and then drill out the hole.



A total of 9 Tallies need to be made for a 66' chain. There will be two each of the 1 – 4 pointed Tallies, and one center round Tally.

The center tally at the 50-link mark can be custom lettered. Most trophy or awards shops will be able to do this for you.

I used a piece of smaller diameter rod to make connecting rings to attach the tallies.

Making the Handles

The handles are the toughest part. I have heard that some surveyors have been able to make sand castings and then pour molten brass into the molds to make handles. Unless you have some experience in doing this, most will have to resort to another means of making handles.

One idea that came to mind was having a skilled machinist cut out the handles on a CNC milling machine. The expensive part would be obtaining the thick piece of brass that would be needed for a handle. Aluminum could be used, but the look of having aluminum handles on your chain might not be too pleasing.

I was always looking for ideas for handles. While in a Goodwill store I noticed a section of brass candle holders and other brass items. The idea was born to make my handles out of two identical brass heart-shaped candle holders.

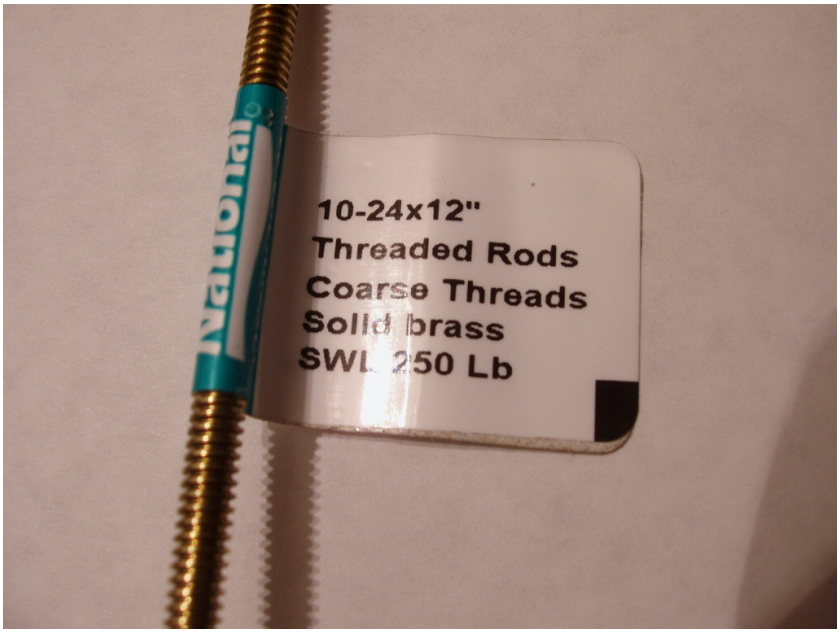
If you do need brass to melt for cast handles, this might be a good source to get it more cheaply.

Probably very few people would see two brass survey chain handles here!

After removing the top and bottom, I transformed this into…

This!

I cut off the top bolt on the heart and then shaped the heart with a round file. The slight indentation of the top of the heart is my “zero” point of the chain. After cutting off the threaded part on the bottom end of the heart I drilled a hole up through the center of the remaining stud. I then used a piece of threaded brass rod and added a nut on one end, and a loop to the other end to connect to the chain. I rounded the edges of the brass nut inside the handle and set the threads in glue. The threaded brass connecting rod fully swivels inside the handle.



This is the trickiest part of making the chain exactly 66.00’. I first estimated how long of a piece of threaded rod I would need and carefully noted the measurement. I attached it to the chain and measured the small link and the handle to see if it was 7.92”. Even if I was off 1/16” I could still make up the different on the other handle end. The connection on the other end was trial and error after checking it against precisely made marks on the concrete floor with a steel tape. If I was off by 1/8”, I cut a new piece of threaded brass rod by that much and remade the loops, attached it and then rechecked again to the marks on the floor.

Your final link on the ends will be short since the handle makes up the rest of the 7.92” for the link.

The end result.