

Platinum Chain Making

Tino Volpe • TIFFANY & CO.

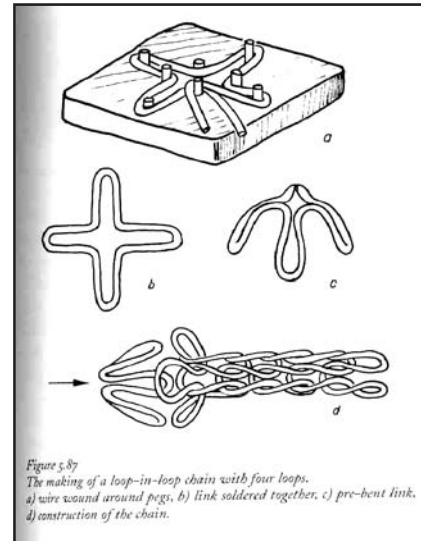
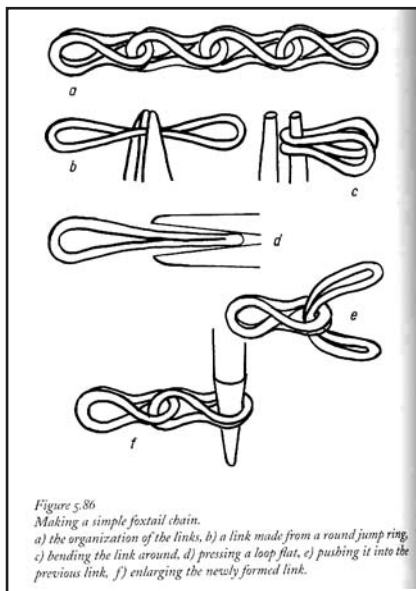
History

The definition of chain is as simple as interlocking links of metal. If the metal happens to be precious metal, then we consider the chain jewelry.

In preparing for this paper, I began my research with the understanding that finding information on chain making, especially historical information, would be a fairly simple task. However, after looking through old copies of jewelry history books, surfing the internet, and interviewing people with a long history in the industry, I arrived at the conclusion that the history of chain making is either a well kept secret or just not of much interest to anyone.

Precious metal chain for jewelry has been around for a long time. Basically when man first began working extensively with gold back in Neolithic times he found that certain metals, most notably pure gold, were extremely ductile and could be hammered and stretched to a great degree. With the invention of wire, man could now take something rigid like metal and turn it into something flexible like chain.

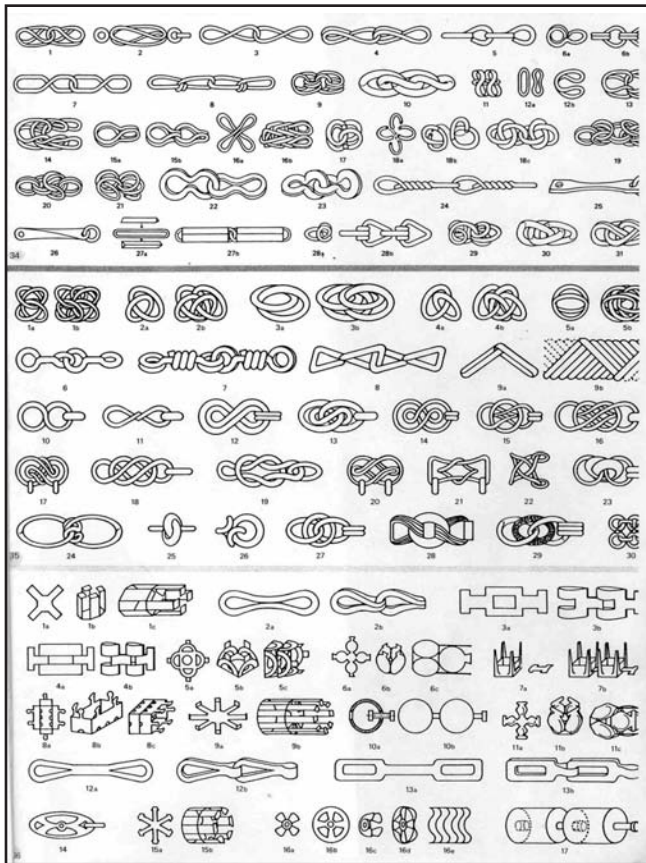
Chain making has always been, up until the middle of the 18th century, a labor-intensive time consuming hand operation. It was a well-versed art and most books on jewelry will demonstrate basic techniques on making chain by hand.



Before automated wire drawing machines, the craftsman had to hammer down and pull metal through succeeding smaller dies to form thin wire. Once the wire was pulled down to the needed diameter, it was wound around a mandrel forming loops. Then, the craftsman would make a cut through the looped wire down the length of the mandrel forming individual offset loops. The craftsman would then interlock the loops, bend each link closed, and then solder each link. Tedious indeed, if you considered making an 11-32 chain (.011" wire at 32 links per inch) by hand, it would contain 512 links for a 16-inch chain! Although the Persians and Romans were making chain, the best and most extensive use of forming wire into interlocking loops was during medieval times when armor was made by forming loops of wire and sewing it to an attached garment. If all the loops were interlocked together it was called chain amour. In fact chain mail (or chain maille) is a term that came from this time period referring to flat chain. ⁽¹⁾

There are many, many different kinds of chain. All can be made by hand. Some can only be made by hand. Some would be foolish to make by hand.

Chain making was mostly a hand operation all the way up until the middle of the 17th century. At this time, we saw the invention of the chain machine. It is very difficult to determine where the chain machine was invented, and talking to different people will get you different versions of history. There is an unauthored



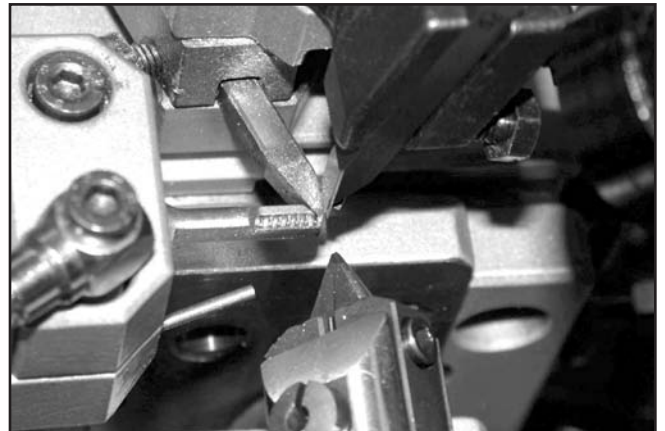
Examples of chain⁽²⁾

article from World Gold Council brochure that claims the first machine that could be called a chain machine was invented in France in 1750 by a Jacques de Vaucanson.⁽³⁾ The machine was actually used to make u-shaped wire for mesh chain. By 1782 a true machine for the sole purpose of making chain was built. The machine, driven by cams and powered in the early days by a belt connected to some external source of power (probably including human peddling), was a toolmakers marvel that has changed very little since then. Other machines started appearing in England in the early 1800's and by 1830, machine chain manufacture was coming on strong. The Germans came into the picture at this time making fine chains while the English were making ball chain and other heavier styles. By 1870, chain making was found all over Europe and it was a jealously guarded secret. Around this time the technology had made its way across the Atlantic to America where the Americans focused on high-speed machines. In fact high-speed chain machines were exhibited at the 1893 Chicago World Exposition. However, a German by the name of Kollmar took this technology back to Germany and in short order made Pforzheim the center of chain making in the world.

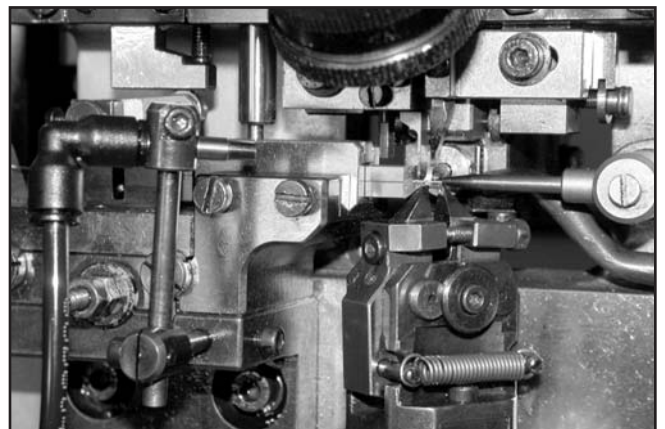
As world wars one and two ravaged Europe, many of the craftsman immigrated to America, taking up residence in the Providence area of Rhode Island, which was the center of the American jewelry industry at the time. They brought their craft with them and chain manufacturing took hold here. After the wars and into the 60's, the Italians grabbed the technology and soon became the masters of chain making machines and remain so to this day.

There have been few technological advances to the basic chain machine over the centuries. The method of powering them has kept up with the times, with all of today's machines powered by their own electric motors. Tooling, which is the heart of the machine that forms the various types of chain, has fallen under technological advances also, with today's tools made from very hard carbide steels, which now allows the machines to handle platinum chain making.

Over the years, machines have evolved in their ability to make an incredible number of different type chains. The machines have fallen into several basic types, which make most of the chains.



Curb Chain Machine



Cable Chain Machine

Briefly there are two major types of chain machines, cable machines and curb chain machines.

Cable machines feed wire off a spool into a set of straightening rollers. It then goes through a guide and gripper, which feeds it against a stop, which determines the length of the wire and thus the size of the link. Unless this is the first link, the wire is also fed through the previously made link. A forming tool then pushes down on the wire forming it into a U. Just before this forming happens, a cutter cuts the wire from the feedstock. After the U forms, a bottom set of jaw type tools holding the wire closes and a top-forming tool comes down to complete the shape and close the link. The link is then rotated 90 degrees and the process starts all over again.

A curb machine takes a slightly different method by feeding the wire into a helix type tool which forms it into a spiral. As the helix turns, the spiral wire is fed through the previous loop. The loop is closed as it is grabbed and cut off the spiral. The link is then rotated as the next loop of wire is fed through.

There are also machines, which make chain from flat stock, sometimes called snake chain machines. Ball chain machines make ball chain from both wire and flat stock with the flat stock being formed into a ball around the wire. There are Figaro chain machines, which have two heads for making two size links.

There are other types of machines making many other types of chains, some of which can be seen in the illustration. For many, many years most machines made chain from either non precious metal such as brass or copper or precious metals such as sterling silver and the various karat golds. Platinum chain came into the marketplace much later due to the fact that platinum itself was a relative latecomer to the high production jewelry industry. Being difficult to work with and destructive to tooling, very little platinum chain was made until recently. The gap for a white metal chain was filled in with white gold (which may have been rhodium plated) or silver.

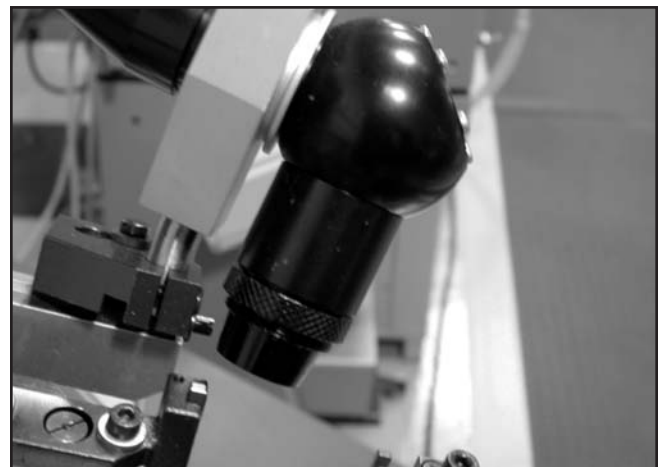
There were two main reasons for the very small amount of platinum chain being made on machines. One was the difficulty of producing fine platinum wire as well as solder filled platinum wire, which was very common with silver and gold chain making. The other was the rapid tool wear the machines experienced when running platinum wire through them.

As platinum started to grow in popularity again in the 90's, there was a demand for platinum chain. In the

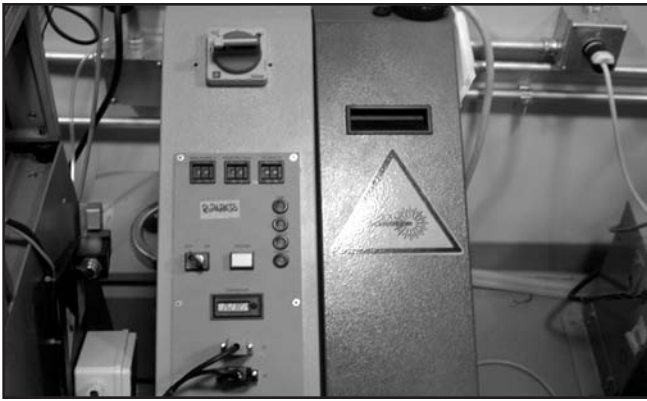
past that demand was met with white gold chain that was Rhodium plated. However, as people began demanding high-end quality items, manufacturers needed to make platinum chain in bulk. However, the problem of tool wear remained. Some manufacturers took the novel approach of plating the wire with a thin coat of copper to act as a lubricant as the wire went through the tooling. After the chain was formed the copper would be stripped off. This was time consuming. Some manufacturers chromed their tooling. Eventually the use of improved grades of carbide solved the problem or at least slowed it down.

Soldering the links closed was another issue. Most platinum solders have little or no solder in them at all, creating a color match and tarnish issue, especially solders at the lower end of the temperature scale. The need to make platinum chain on machines spawned several different methods for closing links.

The first method involved having a small water torch (basically a hydrogen oxygen torch) mounted on the machine that with a very small flame can produce a temperature hot enough to effectively solder a link closed. This was used either with solder filled wire or a solder wire feed. However, this did not solve the color or tarnish problem, as it would only really work for very large links. Overall it wasn't very satisfactory, and this method apparently didn't get very far. A better method was to use a plasma arc to weld the links closed. The Italians first tried this successfully in the late 80's. This eliminated the need for solder and limited the oxidation problems. However, it was tricky to get a properly formed arc that would make a nice weld. It also was another step in the link making process and thus slowed down the speed of the machine.



Laser optics



Laser Power Generator

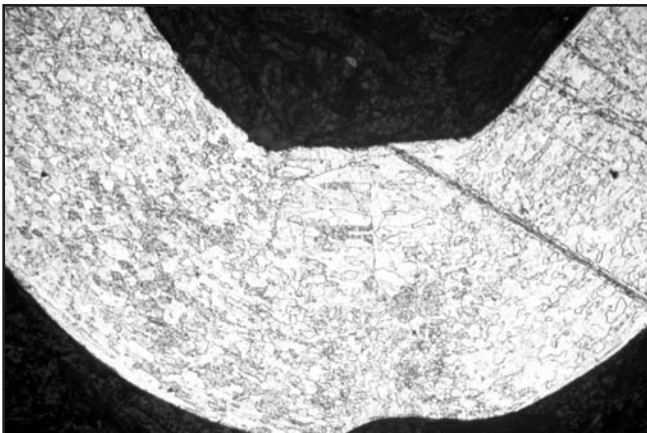
Perhaps the most evolutionary change has been the advent of laser welding, which seems to solve all of problems with platinum chain making. The laser is a non-contact method of welding the link, which is very accurate and produces a very clean weld.

The beam power is tunable, which allows one to finely adjust the power delivered to the link. Platinum's thermal qualities make it perfectly suited for lasers. It has a low to zero oxidation characteristic, and the power generated by the beam is held at the weld zone.

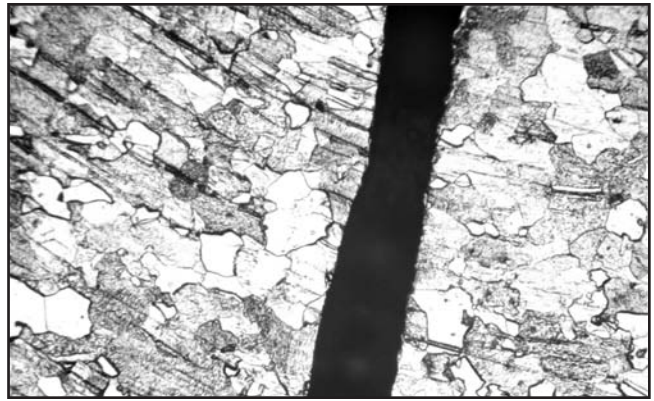
If it has any shortfall, it is that as the wire diameter gets bigger, the ability to get the laser to penetrate the whole wire becomes more difficult.

In the following photos, one can see the joint of a link soldered by hand vs. one that is laser welded.

It is documented that laser welded seams are stronger than brazed seams.⁽⁵⁾ This is due to the fact that there is a lack of a heat affected zone. Also, solder joints are prone to porosity and gas bubbles, which would weaken them.

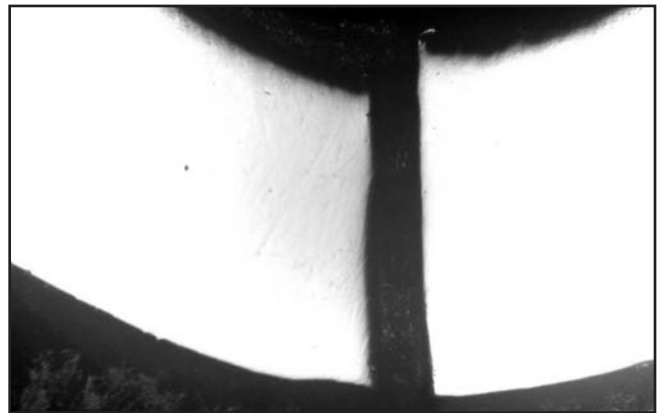


Laser Welded Chain



Soldered Chain

The original intent of this paper was to perform tensile tests on chains that were hand soldered vs. oven soldered vs. laser welded. However, due to the success and popularity of laser welding, it has been just about impossible to source chain made any other way. Should the opportunity arise to procure the different types of chain, then the data derived would be interesting. Is the laser welded chain actually a higher quality product, or just a cheaper, faster way of making chain?



Unetched solder joint

Acknowledgements

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2. Aurum Magazine Issue 34, 1988
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4. Wolters, Jochem, Gold Chains and Mesh IV Aurum Magazine Issue 36 1988
5. Volpe & Lanam, Utilization of Lasers in the Joining of Gold and Platinum Jewelry. Santa Fe Symposium, 1998