

# THE VILLAGES® GEM & MINERAL SOCIETY

## OPERATING INSTRUCTIONS FOR ROLLING MILL

### **Introduction:**

The rolling mill is a machine designed to produce thinner gauges of sheet metal and wire. Most studio jewelers use a hand cranked mill (although automated mills are used as well). Each mill consists of two smooth, highly polished, hardened steel rolls, mounted in the housing parallel to each other. The rolls for wire are cut with 'V' shaped grooves arranged in decreasing sizes, allowing for gradual reduction of wire diameter and producing a square cross section of wire. Most studio jewelers choose a 'combination' mill – half of the roll is smooth (for sheet metal) and half is grooved (for wire). This limits the width of metal to be rolled (averaging about 2"–2.5").



### **Set up for use:**

1. The rolling mill is mounted on a board and stored on a bottom shelf of the Titan cart. Carry out the mill and place it on a table. DO NOT carry it by the hand wheel or levels. You may want to have help in carrying it.
2. Rolling mills are extremely heavy. Make sure to mount the rolling mill to a table using the two c-clamps. When you clamp it to the table make sure the clamp will be on the thick table support rather than the bottom of the table top.
3. Make sure that the rollers are not completely closed.

### **Procedure for Rolling**

1. DO NOT use your mill with the rolls completely closed.
2. DO NOT roll ferrous metals such as iron or steel through the mill.
3. ALWAYS release pressure on rollers after you have completed your job.
4. Anneal the piece of sheet or ingot, pickle it, and rinse it with clean water. Now dry it.
5. Put Your Texture in Place: Place your texture on your metal. How you do this depends on what your texture is. You can use a skeleton/dry leaf and emboss that onto your metal, but you have to think how it will be held in place as the metal passes through the rollers. Maybe your texture is coming from a piece of lace laid over the metal. You can use masking tape, scotch tape, or even craft glues to hold everything in place - and just masking tape alone can even give a nice simple texture.
6. Open the Rollers: The first thing you need to do is to turn the handles at the top of your rolling mill to open up the gap between the two rollers. You can tell how far apart the rollers need to be by passing your piece of sheet metal through the gap until it just starts to feel like the metal is about to get stuck - then remove your items and turn the handle about a quarter turn so the rollers are tighter/together.
7. Feed the dry metal into the mill, applying snug (but not overpowering) pressure on rollers.

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8. Keep the Metal Square to the Rollers: When you pass your metal and texture through the rolling mill you must keep it as straight and square to the rollers as possible, to reduce any curling of the metal as it passes through and to give a more even texture.
9. Turn the Handle: Now all you have to do is turn the handle. You should aim to turn the handle in one smooth move if you can - there's no need to go slowly, but you should aim for a steady speed - one revolution in 1-2 seconds is fine, the speed isn't really crucial and once you've passed a few pieces through your rolling mill you'll find it's just second nature.
10. After rolling metal through the mill, flip the piece end to end before you roll it through again. You will get a more even roll.
11. Before passing the metal through the rollers, lower the rollers until you again have a snug fit (as in step 2).
12. If the metal becomes too hard to roll, it must be annealed again. Then roll the piece through the rollers, repeating as necessary until the desired thickness is achieved.
13. When rolling silver sheet, it may be necessary to anneal the sheet after rolling it from 3.0mm to 1.0mm in thickness. For 14Kt gold, the annealing may be necessary after rolling from 3.0mm to 2.0mm

### **Cleaning and Storing the Machine:**

1. Clean the Rollers: Once you've finished, just have a quick look at the rollers and make sure there's nothing stuck on them. If you're texturing metal using leaves you can find some will break up so there are some bits of dead leaf that need wiping away. Do not touch the rolls. Oils and acids from your body can damage the rolls leaving behind small marks and eventually rust. Only roll through dry materials.
2. Make sure that the rollers are not completely closed.
3. Loosen the c-clamps and remove them from the table.
4. Put the rolling mill back on the shelf in the storage room. Do not lift mill using the hand wheel. Only lift from base.
5. Put the c-clamps on the shelf with the rolling mill.
6. Clean your work area.

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**PROCEDURES FOR SPECIFIC USES OF  
ROLLING MILL**

**WIRE ROLLING**

1. Reduce wire by rolling two or three times in each groove, rotating the wire 90 degrees on each pass.
2. Rolls should be nearly closed for last pass before moving to the next groove. Depending on material, passes of up to 30% can be achieved.
3. The material should be annealed as often as necessary to avoid excessive force when rolling. Indications of excess hardness are frayed edges, wrinkling of surface, surface cracking or excessive force needed to turn the rolls.



**PRINTING OR TEXTURING METALS**

Introduction to Printing or Texturing

Metal which is passed through the rolling mill under pressure with another material will become embossed with a pattern exactly the same as the material being used. Any small particle trapped between the metal and roll will 'imprint' on the metal. If you are attempting to roll a perfectly smooth piece of metal, this is not desirable. But the principle can be put to use to create embossed patterns and designs on metal.

The best way to imprint metal is to create a 'metal sandwich' with two pieces of metal (to be impressed) on the outside (the 'bread' in the 'sandwich') and the material being used as pattern between them (the 'filling').

If you're making jewelry with sterling silver, copper, or other metals, you'll quickly discover that a rolling mill is a great way to texture metals. You simply pass the metal between the two rollers so that a pattern is made on the surface of the metal.

One-sided versus two-sided Imprinting

If you wish to imprint on one sheet of metal only, roll the metal together with the imprinting material, using the roll as the other side of the 'sandwich'. This technique is preferable when using expensive materials (gold and sterling) but has its drawbacks, as there is more possibility of damaging the rolling mills if materials that are too hard are used for imprinting. It is best to make a 'metal sandwich' whenever possible – it produces two pieces of usable, imprinted metal with mirror image imprints (especially useful for earrings, being symmetrical, but reversed).

Roll Printing Process

1. Metal to be imprinted must be annealed, dry and clean. Depending on the use of the metal after being imprinted, you may wish an emery finish or tripoli or rouge polish.

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Usually the metal that is the pattern (the 'filling' in the sandwich) should not be annealed—if it is hard metal you will get a better imprint and may be reusable.

2. Pattern imprinted will be a reverse of the design (important to remember if using letters and numbers in the design).
3. An object placed between two pieces of metal will create a recess in the metal (intaglio; a mechanical 'etching' effect). As the 'metal sandwich' passes between the rolls and is compressed, the imprinting material is pushed into the metal. Be careful not to roll the imprint so that the metal becomes too thin.
4. Make one pass only! Carefully adjust the gap by attempting to roll the first 1/2" (1cm) or so. Trial and error and experience, along with written notes, are all part of this process. Once the correct gap is calculated, roll the whole piece in one continuous roll. Try not to stop part way through the pass.
5. To emboss: use a plate with negative spaces so that when rolled the metal plates push into the recessed shapes on the pattern.
6. Start with Flat Metal: For the best results, the metal you put through your rolling mill must be absolutely flat. You can use a nylon mallet to flatten out any small bends, ideally though you should use brand new and perfectly straight and flat metal. When the metal passes through the rollers of the rolling mill the texture is "squashed" into the metal - so any variation or bend in the metal would cause a potential crease, mark or inconsistent texture.
7. Fully Anneal Your Metal: When using a rolling mill for texturing silver or copper or any metal, it is essential that the metal is fully annealed - or fully soft. You can buy your metal fully annealed/soft, or you can anneal it yourself.
8. 100% Dry! Never, ever, ever, put metal through a rolling mill if it isn't 100% dry. Any water that gets onto the rolling mill rollers has the potential to become rusty and render the rollers useless. Although you can buy new rollers it's not something you want to do simply because you didn't wipe your copper or silver with a dry rag before you started!

### Objects and materials that can be used to make patterns:

Objects that are too thick or three-dimensional may not be appropriate for roller printing (the metal is usually not thick enough to encompass the object and give a good imprint). Hard metal objects (steel) should only be used in the two-sided ('metal sandwich') method, as they may damage the steel rolls. The rolls should be cleaned thoroughly after using gritty materials like sandpaper. Thin metal should only be used with thin objects—thick imprinting patterns will make the metal too thin and weak. Some materials and objects that can be used (and there are many more; experiment and document) are:

Paper	Metal	Lace	Washers	Leaves	Sandpaper
Fabric	Screen	Wire	Plastics	Doilies	Masking tape
Thread	Feathers	Sequins	Netting	Thin keys	Chain

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### WIRE SECTION OF ROLLING MILL:

Rolling sheet metal through the grooved wire section of the rolls produces a corrugated effect. If the metal is passed through again at a different angle a cross-hatched pattern is achieved. Turned 90 degrees produces a checkered effect.

### MASKING TAPE:

Masking tape will provide a textured pattern recessed into the surface of the metal. Lay tape out on a sheet of glass and cut desired shapes with a blade. Because the shape adheres to the metal, there is little movement of the design during the rolling process. Multiple layers can be used to give variety of depths.

### PAPER:

Paper provides a wonderful, sharply detailed imprint on well-annealed metal. The metal picks up a matte texture from the paper. Where shapes have been cut out, metal will contact metal leaving a shiny pattern in contrast to the paper texture. Shapes can be cut out with a knife, with fine nail scissors or by folding the paper and cutting into the folds (good for an overall repeat pattern). Multiple layers of paper can be used – giving both embossed and recessed designs. A paper pattern can only be used one time. If you wish to repeat a pattern you can photocopy the design and cut out each time. Experiment with different sorts of paper from regular bond, to tissue to heavy watercolor papers.

### METAL PATTERNS AND PIERCED DESIGNS:

A variety of different shapes can be cut out of metal and used to imprint. Cutting into a sheet of metal can produce intricate designs that will emboss the finished piece. Drilled holes will produce small raised circles; saw cuts will produce fine raised lines. Since saw piercing goes right through the metal pattern, a two-sided imprint will work. Wire can be used effectively to create linear intaglio patterns.

### HAMMER AND PUNCH TEXTURES:

Designs can be made into a sheet of un-annealed metal using punches, coarse files and hammers. This piece of patterned metal can be used for a one-sided imprint (making one copy only). Since the pattern is recessed into the pattern plate, the resulting pattern on the finished piece of metal will be embossed (raised above the surface). An old hammer face can be engraved or filed with textures. When it is hammered onto metal it leaves an embossed pattern. These can be used to give added texture to a pattern.

### ROLLED PLATE AS PATTERN:

Designs can be imprinted onto a metal sheet which in turn can be used as a pattern. If the original design is recessed, it will produce an embossed pattern which has an interesting quality as it is one step removed from the original process.

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### ALUMINIUM PLATE:

Aluminum plates can be engraved easily with gravers or dental burrs on the flexible shaft. They are good for only one or two (at the most) passes. The thicker the aluminum plate, the deeper the cuts and the deeper the embossing.

### ETCHED PLATE PATTERN:

Brass, bronze, copper and mild steel can be acid-etched to create patterns for roller printing. Steel is useful for a plate you may wish to re-use many times. Thick brass and bronze will also produce plates that can be re-used.

**SOLDER INLAY:** Designs can be impressed into a sheet of metal and the recesses filled with solder.

**FOLD FORMING:** Linear patterns can be produced on metal by folding and unfolding the metal. Because metal has a memory due to work-hardening, the fold remains as a raised line on the surface (surface??). Fold metal and pass through the rolling mill to compress the fold. Anneal, unfold the metal and pass through to compress and flatten the top of the fold line. Metal can be folded and unfolded many times, creating parallel or intersecting lines.

**TWISTED WIRE LAMINATION:** Twisted and braided wires of different metals, soldered together, can be rolled to create square decorative wires.

**MOKUMÉ GANE** (means “wood grain”): A Japanese technique of soldering thin sheets of different colored metal together, rolling them through a rolling mill and re-laminating those layers together again. The resulting sheet is then distorted and the layers revealed by grinding the surface down.

**MAKING FLAT OVALS:** If you pass a circular piece of metal or circular jump ring (wire) through the mill under pressure it will be stretched to an oval shape.

**OTHER DISTORTIONS:** Metal shapes can be purposefully distorted using the rolling mill. Drilled holes can become perfect ovals (similar but opposite to making an oval from a circle); edges are softened and straight edges become organic curves. Rolling wire in a paper sandwich gives slightly raised edges to the wire which now has a soft paper texture and is broadened.

**ROLLING A TAPER:** Wire can be forged into a graceful tapered end which can be used in many ways (spirals or tendrils etc.). The rolling mill provides a shortcut version. Anneal the wire to be tapered. Begin rolling at the first groove and roll as far up the wire as you wish the taper to extend. Move to the next groove along and roll part way up the wire, leaving part of the first rolled section unchanged. Continue rolling until the wire tapers in a series of ‘steps’. Once you have rolled the taper continue refining the taper with a hammer on an anvil. Smooth the ridges between the steps with the hammer, turning the wire as you work to round out the squared off

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edges. If you wish squared taper, do not turn the wire. Once the ridges are smoothed out, file, sand and polish the tapered wire. If you wish to shape the taper, anneal and pickle before sanding and polishing.

### NOTES & TIPS ABOUT USING A ROLLING MILL TO TEXTURE METALS

Avoid putting dirty or wet metal through the rolling mill as this can cause damage to the rollers. Protecting the rollers is of the utmost importance—once the rollers become damaged, they can difficult to refinish and costly to replace.

NEVER use abrasive materials, such as emery cloth, in your rolling mill as this may damage the rollers

If your metal bends as it passes through the rollers, you can flatten it out again by tapping it with a nylon mallet.

Keep a notebook of what you've used to create your texture, along with a photo of the results, which you can look back at to remind yourself of the results you got from various ideas and materials - it can be annoying if you've used, say, 30 different pieces of lace over time and then can't remember which lace produced a particular result. In my notebook I affix a piece of the lace in my notebook too.

If you want a deep pattern, place a pad against the rear of the metal - the pad enables the metal to produce a deeper image as it can sink into the pad and won't be restricted by the hard steel roller - you can make a pad from folded tissue or any soft material you have to hand. Think about the back of your metal. You're texturing one side, but think about whether you want a different texture on the rear of your piece. Perhaps just put a light texture on the rear by covering it with masking tape.

Experiment with texturing square, half round and round wires. You can try texturing finished pieces, or texture your wire before you shape it.