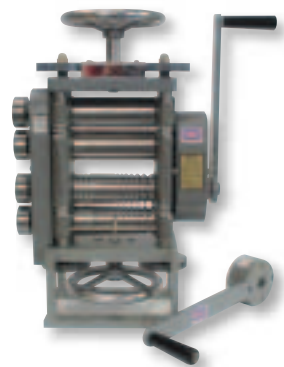


Instructions for Using and Maintaining

DURSTON ROLLING MILLS

(Including ideas of some techniques of jewellery manufacturing)



Rolling Mills
Laminadores
Laminatoio
Valsemaskine
Walzmanschine
Laminoirs

12-1/2" 3162"

Registered British Design

British Made
In use Worldwide

DURSTON

ROLLING MILLS

ESTABLISHED 40 YEARS

...thank you for choosing your Durston Rolling Mill which will give you many years of trouble free and high performance use.

INSTRUCTIONS / MAINTENANCE FOR HAND OPERATED ROLLING MILLS

Removal of rust preventive paper and rust preventive liquid from rolls

Please unpack machine very carefully. After taking machine out of box, attach the turning lever (Please see separate sheet for instructions). Now open the rolls up approximately 1 turn of the hand wheel and remove the rust protective paper. You will now need to remove the rust preventive liquid on the rolls. Apply some white spirit (ordinary household paint solvent) onto a clean cloth and hold the cloth into the gap of the rolls and roll backwards. Do not use any stronger liquid than white spirit i.e. lacquer thinners. It will take a little longer on the grooves as you have to do one at a time

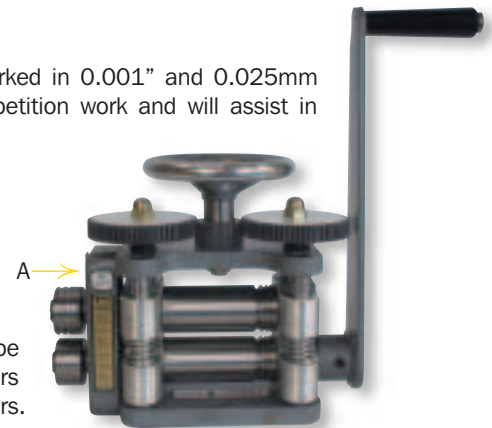
General

All machines have calibrated discs fitted to the top and are marked in 0.001" and 0.025mm increments and give the roll gap. These discs are useful for repetition work and will assist in providing a constant product size.

See separate instructions for the Power Rolling Mills.

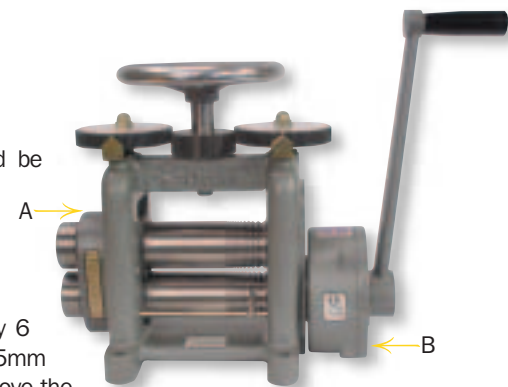
MINIMILL 80mm and 100mm

- The bearings are self lubricating and need no maintenance.
- The drive gears at left hand end (behind the cover "A") should be greased every 6 months. Remove the circlips and extension rollers and then the two screws for the cover for access to the 2 gears. Use standard gear grease.
- Oil the 4 end faces of the rolls daily. ("F") See enlarged view of rolls on page 3.



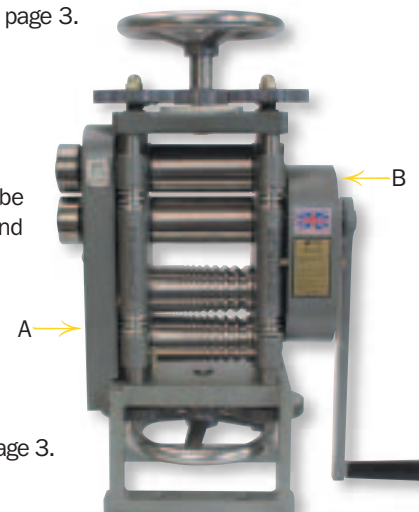
DRM 100mm, 130mm and 150mm

- The bearings are self-lubricating and need no maintenance.
- The drive gears at left hand end (behind the cover "A") should be greased every 6 months. Remove the circlips and extension rollers and then the two screws for the cover for access to the 2 gears. (On the economy models you will only need to remove the two screws.) Use standard gear grease.
- The gearbox at the right hand end ("B") should be greased every 6 months. Remove the lever. Slacken the 10mm set screw first (5mm Allan key). The lever should slide off. If not, gently tap it. Now remove the four 5mm cap screws (4mm Allan key). The lid of the gearbox should now come off. You may need to gently tap this as well. Use standard gear grease.
- Oil the 4 end faces of the rolls daily. ("F") See enlarged view of rolls on page 3.

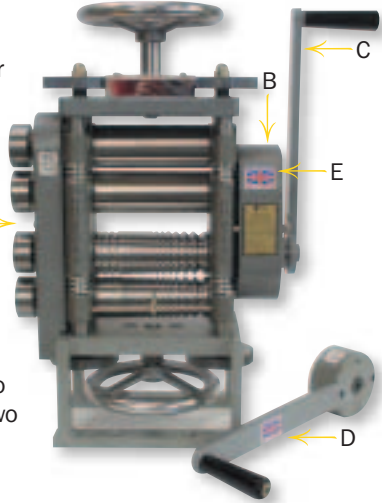


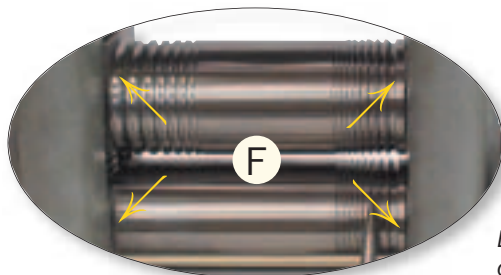
D2 120mm, 140mm and 158mm

- The bearings are self-lubricating and need no maintenance.
- The drive gears at left hand end (behind the cover "A") should be greased every 6 months. Remove the circlips and extension rollers and then the two screws for the cover for access to the 4 gears.
- The gearbox at the right hand end ("B") should be greased every 6 months. Remove the circlip (black ring) and then the lever with the gear attached. Now remove the two 6mm nuts and washers (10mm spanner). The cover can now be removed. Use standard gear grease.
- Oil the 8 end faces of the rolls daily. ("F") See enlarged view of rolls on page 3.



D4 158mm

- The D4 158 has an optional second lever (“D”) which is used for doubling the turning speed of the rolls. This second lever is useful when you are rolling out the smaller jobs where not so much effort is required, making the rolling quicker. For the larger jobs the lower lever, (“C”) which is located on the wire roll, is the best to use as it gives you the maximum reduction ratio on the gearbox. 
- To change from the standard lever (“C”) (lower lever on wire roll) to the second lever. Remove the circlip on the wire roll right hand side and the first lever will slide off. Now insert the second lever (“D”) into cover on the lower sheet roll (“E”). The two hardened dowels will locate into the gear. Now tighten up the two 10mm bolts (17mm spanner).
- When turning with standard lever turn lever anti-clockwise. When using second lever turn clockwise.



Enlarged view off rolls

PROCEDURE FOR ROLLING

Please note that the following is only a guide.

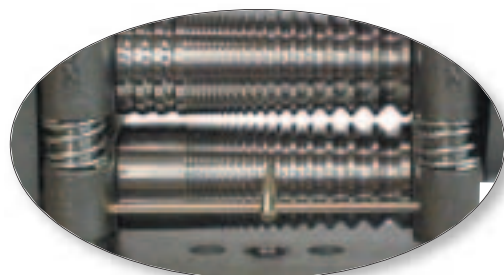
1. Anneal the piece of sheet or ingot, pickle it, and rinse it with clean water.
2. Feed the metal into the mill, applying snug (but not overpowering) pressure on rollers.
3. After rolling metal through the mill, flip the piece end to end before you roll it through again. You will get a more even roll.
4. Before passing the metal through the rollers, lower the rollers until you have a snug fit (as in step 2).
- 5 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.
6. 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.



WIRE ROLLING

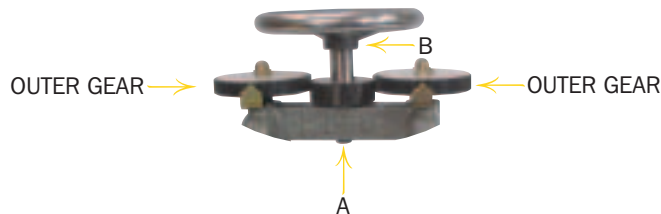
Please note that the following is only a guide.

Reduce wire by rolling 2 or 3 times in each groove rotating the wire 90 degrees on each pass. Rolls should be closed for last pass before moving to next groove. Depending on material, passes of up to 30% can be achieved. 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.



ROLLING MILL CARE AND TIPS

1. ALWAYS bolt down your rolling mill to a secure bench or secure stand for stability.
2. Ensure guards are in place at ALL times.
3. When the rolling mill is not in use, please apply a thin coating of oil to the rollers. Apply the oil across the rolls and turn them with the rolls nearly closed. This will spread the oil evenly across the surface. It is very important that your rolls are always protected especially in moist/wet/hot conditions or where temperatures are changing. Once your rolls are marked/rusty/corroded they will be like this for life until you have them removed and reground which can be avoided if they are looked after.
4. KEEP ROLLS CLEAN. Do not touch the rolls. Oils and acids from your body can damage the rolls leaving behind small marks and eventually rust.
5. DO NOT over tighten rolls together.
6. If possible use the centre of the roller. This will ensure even pressure on the rollers giving them a longer life.
7. DO NOT roll ferrous metals such as iron or steel through the mill.
8. ALWAYS release pressure on rollers after you have completed your job.
9. DO NOT lift the machine from the hand wheel.
10. To PARALLEL the rolls remove circlip ("A") (black ring) at the bottom of the centre shaft. This is the shaft ("B") with the hand wheel. Lift the whole shaft out with the centre gear attached. Rotate either outer gear by 1 tooth in the correct direction (Please note that moving the outer gears clockwise will lower the roll and anti-clockwise will lift the roll), relative to the centre gear and replace the shaft with gear attached. As a test to see if rolls are parallel, roll out some material. If material exits to the right then rotate left gear clockwise by 1 tooth at a time until material exits in a straight line. If material exits to the left then rotate right gear anti-clockwise by 1 tooth at a time until material exits in a straight line.



TROUBLESHOOTING

Problem	Cause	Solution
The edges of the metal is cracking.	When the metal was poured , the ingot is not uniform in shape or the metal was rolled too much without annealing.	Remove the part of metal with the crack (by sawing), anneal, and then hammer out the metal around the missing section until the edges are even. Anneal again and then re-roll.
The surface of the metal is flaking and/or cracking.	When the metal was poured, the ingot mold was cold -or- there may be too much old metal in the ingot - or- the ingot was annealed too much -or- there may be foreign material in the ingot.	Melt the ingot and reform it in the ingot mold. Roll it out again. If the problem persists, it may be necessary to refine the metal before you use it again.
When wire is rolled out, it is wavy or bent.	<p>a) There was not enough tension applied to the free end of the wire.</p> <p>b) Too much pressure is being exerted by the rollers.</p>	<p>a) Hold the free end of the wire tight with one hand.</p> <p>b) Remove sheet, anneal it, plannish the distorted sections, and re-roll. Apply less pressure on the rollers.</p>
When rolling sheet, it buckles.	Sheet was pushed through rollers after flipping end to end without annealing.	Remove sheet, anneal and re-roll.

Rolling Mill Printing

The following ideas and techniques of jewellery manufacturing are reproduced by kind permission of Sandra Noble Goss.

(These advanced techniques assume that you have basic jewellery and metalworking skills. We offer these technical papers, originally presented as workshops, in a spirit of sharing information. We assume no liability for safety and health issues - those are your responsibility.)



DURSTON
ROLLING MILLS

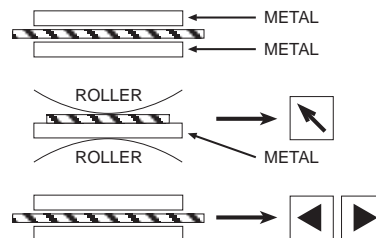
THE ROLLING MILL

The rolling mill is a machine designed to produce thinner gauges of sheet metal and wire. Most studio jewellers 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 rolling mill is used for reducing the thickness of sheet metal. 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 jewellers choose a 'combination' mill - half of the roll is smooth (for sheet metal) and half is grooved (for wire). This limits the the width of metal to be rolled (averaging about 2"- 2.5"). Basic use and care of the rolling mill is covered in most jewellery and metalworking books.

INTRODUCTION TO PRINTING

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')

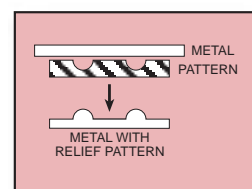
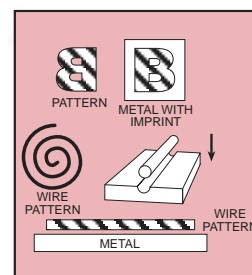


ONE-SIDED vs. TWO-SIDED IMPRINTING

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 it's drawbacks, as there is more possibility of damaging the rolling mills if materials that are two 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. 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 inch (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.

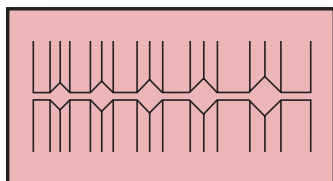


METHODS OF ROLLER PRINTING

OBJECTS AND MATERIALS THAT CAN BE USED TO MAKE PATTERNS:

Objects that are too thick or three dimensional may not be appropriate (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 (there are many more - experiment):

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



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 chequered 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 tape 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 watercolour papers.



Treasure Pin: Brass (roller printed using pierced metal), Sterling Silver (fused). 5.5cm.
© sandra noble Goss

METAL PATTERNS AND PIERCED DESIGNS:

Metal Shapes: different shapes can be cut out of metal and used to imprint. Cutting into a sheet of metal can produce intricate designs which will emboss the finished piece. Drilled holes will give small raised circles; saw cuts will give 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 unannealed 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 can be engraved or filed with textures. When it is hammered onto to 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.

ALUMINUM PLATE:

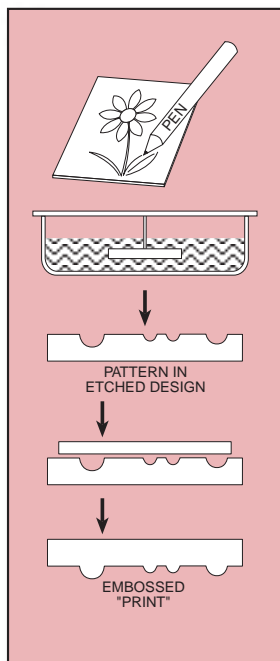
Aluminum plates can be engraved easily with gravers or dental burrs on the flexible shaft. They are good for only one (at the most two) passes. The thicker the aluminum plate the deeper the cuts and the deeper the embossing.

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 reuse many times. Thick brass and bronze will produce plates that can be reused.

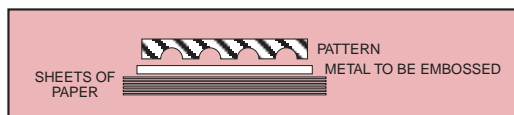
TO ETCH STEEL:

Use one part nitric acid to 3 parts water or 2 parts hydrochloric acid (muriatic) to 1 part water. **ALWAYS ADD ACID TO WATER NEVER THE OPPOSITE!** *If you are not familiar with acids and their dangers, do not try this! Read about etching in a printmaking book for more details before you proceed.* Use resists that a printmaker would use (asphaltum etc.). Use in well ventilated area and wear rubber gloves and eye protection. Do not inhale fumes.



NON ACID ETCHING OF COPPER, BRONZE AND BRASS:

Ferric chloride is a salt which gives a clean etch to copper-based alloys. Follow directions on the bottle. Wear rubber or latex gloves. Tapes such as electrical tape or brown packing tape can be used as resists. The real bonus of this material is that permanent markers used for writing on plastic will resist the etching action which allows you to draw or write (remember to reverse the letters for imprinting) directly on the metal. The ink can be removed with methyl hydrate (alcohol - use a fume hood and rubber gloves). The piece to be etched must be suspended upside down (design facing down) below the surface of the ferric chloride. Agitate occasionally for better action. Check the depth of the bite frequently. Clean the metal very well with dish detergent and water. Then clean with toothbrush or brass brush and baking soda to ensure the etching action is neutralised (important!!!). The finished piece can be used to imprint - the etched away sections will emboss.



INCREASE EMBOSSING EFFECT: When roller printing a thin gauge of metal, you can enhance the embossing by padding the back of the metal with layers of paper and rolling with more compression.

OTHER USES OF THE ROLLING MILL

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 service. 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.

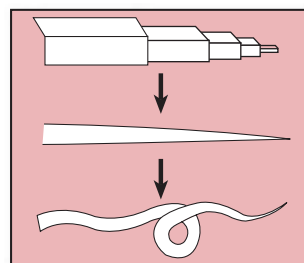


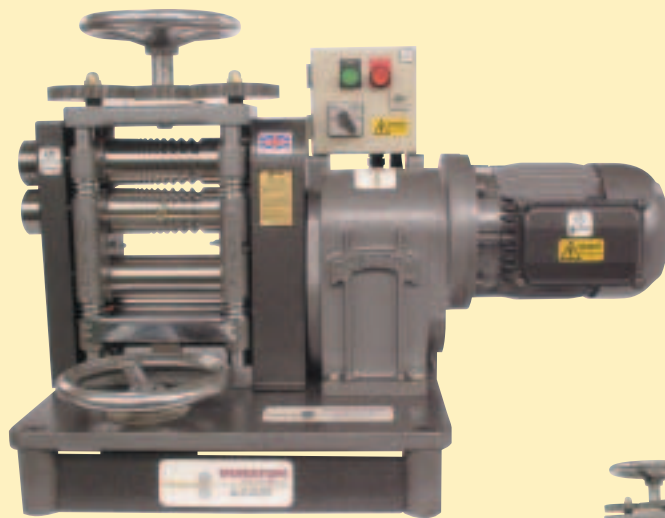
MONKUME GANE: A Japanese technique (means "woodgrain") of soldering thin sheets of different coloured metal together, rolling them through a rolling mill and relaminating those layers together again. The resulting sheet is then distorted and the layers revealed by grinding the surface down.

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 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.





NEW



DURSTON
ROLLING MILLS

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