



MARGARET RAMSEY

While working at the Glass Artist's Gallery in Glebe my interest was aroused by a letter calling for expressions of interest to exhibit in a National Juried Exhibition of Enamels that included works by glass artists using enamels. My particular curiosity was with the diversity of enamel and its relationship to and limited use in studio glass.

My earliest memories - fantastically vibrant coloured chalk at school, a box of coloured pencils that opened out to reveal more tints and shades, decorating my dollhouse with fabric samples of shiny satin and brocades in rich violet, ruby, emerald and peacock blues. This impact by 6 years of age has never waned and it's still there in planting my garden and decorating my home. In my work I am continually drawn back to my past practice of painting which, when I enrolled at Sydney College of the Arts in 1988, I intended to leave behind. Needing glasses I thought large sculptural works would be easy to see. However the power of colour in so many areas of my life never loses its appeal and I can still see it - with glasses.

From 1989-91 I did a BA of Visual Arts at Sydney College of the Arts and for three years I felt like a Jeckyl and Hyde - both art student and suburban dweller. Following this I worked in a studio at Black Wattle Bay paying for the space with part time work at the Glass Artists Gallery. This turned into 3-4 days a week. During this time I experienced the commercial aspects of art, a truly valuable experience. In '95 I travelled to America to attend the Sculptural Objects and Functional Art (S.O.F.A.) Exhibition, a huge affair. I saw many public and private collections of glass. The collectors clubs in the U.S. are very active and the members' knowledge of the artists and history of work is amazing, and they invest big money.

In '96 I returned to suburban studio. Being very much a people person, the isolation and self discipline is difficult after my escape to the other side, the Art World! My work explores a fusion of traditional and modern, myths with personal beliefs, symbolising the invisible ties and restraints of belief and tradition. The "Daydream Series" record some of the myths of the life of women in suburbia. Needlework becomes a measure of time, their work a labour of their love. The thread can go on endlessly, spun from golden daydreams, or a strong sensible twine.

Much experimentation has taken place to find enamels compatible with the glass composition and suitable to the application and temperature needs of the various methods of production, while retaining the qualities unique to glass. I am well aware of the hours devoted to perfecting a technique with the hope of discovering that personal twist that will produce that creation the critics and viewers seek. When making a form, I blow the vessel shape and when cool, apply the enamel in a paste form. The piece is then fired in the kiln at a lower temperature to adhere the enamel. On my platters, the glass base is formed by slumping, then enamels are applied to build up the design - washes of colours, scraffitoed, over-painted, engraved with a diamond burr, gold leaf applied. It can take up to five firings to get the required result.

My working methods are influenced by my need to change. I jump from large to minute, simple to complex, sculptural to painterly. I search for simplification of technique and often uncover laborious activity at the same time. I always find a new way to spend money before I earn money, and still the fire in the heart burns on. I was pleased that glass was included in National Enamel Exhibition and appreciated the opportunity to contribute to it. Many thanks.

Quite a few of our enamellers are enjoying some overseas travel. They are exhibiting, teaching, talking and meeting enamellers and enamellers. I hope they're all having a ball; I am eagerly anticipating hearing many a story when they drag their stimulated but exhausted bodies home.

B Ryman
Editor

NEWS

- Congratulations to Catherine Large on the birth of her baby daughter Isabel, born 24th June. Isabel caused a bit of concern with a breathing problem which needed a little operation, but things are settling down now. Best wishes to you Catherine.
- Congratulations too to Jill Parnell who has won the Award for Artistic Work at the 31st International Enamelling Art Exhibition in Japan which opened on September 27th.
- The local chapter of JMGA's Biennial Exhibition was held at ARICA Gallery in Dalkieth, Perth and included enamels by Kathy Aspinal, Jaquie Sprogue and Jill Parnell.
- Carolyn Delzoppo has work in the Northern California Enamel Guild Second Annual Juried Enamel Exhibition.
- The Contemporary Wearables '97 Exhibition in Toowoomba includes many enamellers - Dick Armstrong, Kathy Aspinal, Pierre Cavalan, Sandra Kerr, Catherine Large, Jill Parnell and Barbara Ryman. There is a small coloured catalogue showing a piece from each exhibitor. After the display has finished, a large selection of the work will be travelling on a 15 month tour to various public galleries around Australia.
- The Jenny Gore workshop in Perth went well with experienced enamellers learning some new skills and one complete novice an instant convert. The group celebrated afterwards with a dinner at the Observation City Hotel.
- The enamel classes held at Sydney Community College by Barbara Ryman were very fruitful with many of the students very keen to learn more. Some were first timers and others were having a second go and the resulting work was exceptional. The College had its first art exhibition and some of the enamel work was shown as works in progress and drew many comments. It will be exciting to have some completed work in next year's show. Another class will be held in the first term of 1998. Enquiries to Barbara Ryman on 02 42672939.

The deadline for material for the next issue is November 23rd. All articles, comments and news welcome. Send to 71 George St, Thirroul 2515. NSW

OPPORTUNITIES TO EXHIBIT

The 11th Cloisonne Jewellery Contest - The Japan Shippo Conference Juried Exhibition.

Up to 5 works can be entered and there is no entry fee. Work due November 1st. No late work accepted. Notification of accepted work will come in December. Accepted work will be exhibited at the Ginza La Pola Gallery, Tokyo in January '98 and at the Syosenkyo Rope-way Shippo Museum, Yamanashi in April '98.

If you want an entry form, send a stamped, addressed envelope to AEN - Pronto!

GIRAEFE - l'Email a Morez, France.

The exhibition date has changed to October 24-26, 1997.

Some more information on GIRAEFE - Group International de Reflexion et d'action Pour l'Email et la Formation D'Emailleur.

Since 1994, the beginning of GIRAEFE, they have had annual exhibitions. The two displays in '95 and '96 created a good level of interest and this year, enamellers from 16 countries are participating. To exhibit, one must join the group at a cost of approximately \$50 Aus. (We hope for some feedback from the current exhibition.)

AROUND THE MAGAZINES

Glass on Metal includes

- interview of Dutch enameller, Ellen Goldman.
- review of Expressions in Glass, The North American East 1997 Juried Exhibition.
- an article on De-Enamelling by Woodrow Carpenter.
- Pioneers of Enameling the USA by Vivian Kline.
- Enamelling Malleable Copper by Tom Ellis.
- review of Northern California Enamel Guild's Second Annual Juried Enamel Exhibition.
- Contest: We have had numerous inquiries for an easy, surefire procedure for soldering findings to the back of a finished enamel. We will publish all procedures received, and give one year's subscription, or a one year renewal to Glass on Metal for the first reliable procedure received.

AUSTRALIAN ART COLLECTOR

Jewels for the Memory is an article written for this new magazine. It features three contemporary jewellers, including Barbara Ryman.

THANKS

AEN would like to thank the following contributors to this issue: Jill Parnell, Carolyn Delzoppo, Cecile Chanterell, Anna -Margot Collins.

TIPS

ENAMEL SYMPOSIUM - 1998

Brisbane Queensland - 25th, 26th, 27th September.

WORKSHOPS

There are three workshops and they will be given by Debbie Sheezel - "Layering techniques for small or larger work", 1 -4th Oct.

Valeri Timofeev - 3 days of two dimensional work, 19 -21st Sept.

Fay Rooke - "Cloisonne and beyond", 22-24th Sept.

There will also be a one day workshop on photographing your enamel pieces, with a professor from the art college, and a 2x1/2 days on each working with "Precious Metal Clay" and "Working with the Hydraulic Press."

All workshops will be limited to the first 12 people who pay their deposit, Preference will be given to people attending workshops and the Symposium if space gets tight. Brochures available from Anna-Margot Originals and will also be sent out in the next A.E.N.

PAINTING WITH FIRE-Michel Sourney Gallery.

Exhibition Report by Anna-Margot Collins

The exhibition held in Brisbane for 3 weeks in September was a success; Barbara Ryman, Carolyn Delzoppo, Mary Raymond, Lorraine Larter, Catherine Large, Joan Millton, Heidi Wellings, Christopher Collins, Janet Baker, Sandra Kerr, Jill Parnell, Anna-Margot Collins, 12 exhibitors in all. We had a good crowd for the opening considering it was on a Saturday afternoon. Sales were good with 8 pieces being sold. The Gallery owner is looking forward to hosting the exhibition next year in conjunction with the 1998 Symposium.

Extract from the Enamel Guild - N E newsletter.

CHAIN MAKING BOOK

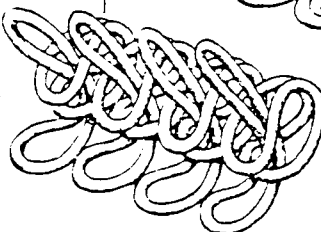
Classical Loop-in-Loop Chains and Their Derivatives - a book by Jean Reist Stark and Josephine Reist Stark. (Chapman and Hall, publishers)

"This large format, soft cover book is a must for anyone interested in making all kinds of classical chains as well as branching out into their own designs based on loop-in-loop chains.

This book is a treasure! It provides clear step by step instructions on how to make the simplest loop-in-loop chain; multiple soldered loop-in-loop; wide collars (which taper); single tapered chains; split chains; you name it.

The book is copiously illustrated with black and white photos and with the clearest step by step drawings I have ever seen. - I.C."

2.



-from Fay Rooke

- In the first wet-packing for plique-a-jour on copper, pack the enamel up against the wall of the opening. This prevents firescale. Not necessary with silver.
- Silver, after it has been overheated, gives off a gas every time it is reheated. This may be the cause of bubbles in enamel even when properly applied.
- Always use water and liquid yellow soap when using a brass brush on metal or you will get an alloy. Also, use soap and water or spit when glass brushing enamels. The yellow soap has more ammonia in it and helps etch the glass.
- Tear your sandpaper and "break" the backing so there are no sharp edges to scratch the metal.
- When using diamond drills to drill out imperfections in enamel, don't touch the silver with the point or you will grind grey into the enamel that you can't get rid of. The metal clogs the diamond grit and comes off in the enamel.

- If your glass brush is beginning to unravel, use electrical tape to make a new handle. Bind from the bottom upwards.

- Use a watercolour marker on the enamel to see if trying one colour will work next to or over another colour.

-Phil Barnes, The Enamellist, the Canadian Enamellist Association Newsletter

- Underfire the first two layers of red and only fire to maturity on the third layer to retain maximum colour.

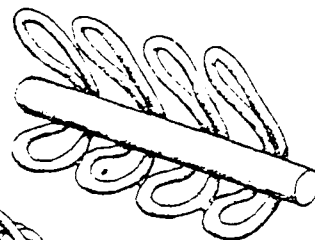
-Linda Gebert, Midwest Enamelist Guild Newsletter

- Want to enamel on a piece of cast sterling? You can do it if you don't disturb the surface. The fine white film is the fine silver brought to the surface by the casting process. Enamel the surface that you wish, then buff the non-enamelled surfaces at the end.

-Coburg Art Society Newsletter

- Stencils made from newspaper or crepe paper leave a clean outline. If you wet the stencil, it will also fit a curved surface snugly. You can add a bit of glue to the water to help it stick. Sift the enamel over the stencil before it dries.

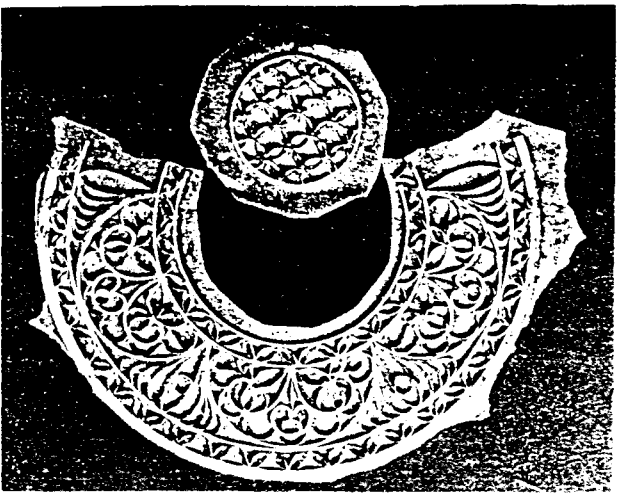
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3.



VALERI TIMOFEEV



PLIQUE A JOUR - HISTORY AND TECHNIQUE

The following is an excerpt from the brochure of Valeri Timofeev's plique-a-jour exhibition, written by Nancy Levine, a member of the Palm Beach Enamel Guild.

"Ancient examples of this demanding technique are few but it would seem that it evolved in Flanders or Burgundy at the same time as did the Limoges technique of painted enamels, both dating back to the fourteenth and early fifteenth centuries. Its practitioners were few, possibly because of the rigorous requirements it posed. Not until the late nineteenth century did plique-a-jour really come into it's own. It was an ideal medium for carrying out the sinuous designs of the Art Nouveau movement and was employed by enamellists in many countries, principally France, Norway, Russia and Spain. At the same time, Japan too evolved its own approach to the method. Designs reflected the traditions of each country but the methodology was much the same in all places.

Now the technique: First one must know the material requirements. in the method used by Timofeev, a metal frame must first be constructed to support the individual panels of the enamel. This must be able to withstand the heat of the kiln at the temperature and time required to melt the enamel which will be applied to the finished frame in a powder form mixed with a soluble glue. Next, the metal must be one to which the enamel will easily adhere. Fine silver, 99.9% pure, or a high karat gold is normally selected. Whatever metal is chosen must be formed to the design and the work soldered to create the structural background for the enamel. Thus, the solder must also be capable of withstanding the kiln heat. The design would normally be worked out before these steps and would focus on certain requirements. Every design element must connect with another or others in several places to provide a rigid frame for the enamels. Additionally, no wire may be left "dangling" within the framework or the frame will be weakened and the enamel will, after a few firings, cause the frame to

distort unacceptably. Also, the cells created by the metal wire must be of a size and shape which permits surface tension to form the enamel skin between the metal elements. Not only is this difficult to create fluid designs within these limitations but the difficulty is compounded by often having to adapt the design to a three dimensional form.

Having designed and made the frame, suitable enamel colours must be carefully chosen and inserted into the cloisons (the metal-bordered cell) and the piece in its entirety must then be put into a kiln, normally held at 1400 degrees until the enamels fuse. Not only should the combination of colours be aesthetically pleasing but the enamel should fuse at roughly the same temperature. A number of fillings and firings are normal, and with good fortune the piece, all cloisons satisfactorily filled, is complete. Since the metal chosen shall be one to which enamel readily adheres, any out of place enamel must next be removed from the frame. After this is meticulously done, the piece is given one last firing to insure that the gloss of the enamel, which may have been lost in the polishing, is restored.

With this knowledge, one must look with new respect at the enamels on view. They are stunning, vibrant - and the fruit of an incredibly demanding process. These unique treasures are the work of a single individual, a master of the technique of plique-a jour, Valeri Timofeev."



NEW CHALLENGE FOR AN ANCIENT CRAFT

- by AUDREY KOMRAD

This article is reprinted from the Enamel Guild South newsletter, Vol XIV, No 1, Oct 1997.

Most of us as enamellists, go out of our way to view the work of other enamellists, to admire and critique it. The range of craftsmanship among enamellists varies considerably from the naive to the exotic. It is rare to see the work of any one artist that is so exquisite in concept, design, craftsmanship and presentation, that it literally causes one to gasp. Such was the reaction when I had the privilege of viewing 42 pieces of plique-a-jour by Valeri Timofeev recently at the Museum Of Arts & Sciences in Daytona Beach, Florida.

While I had the experience of an all too brief workshop with Valeri and have viewed several examples of his work, the impact of these multiple pieces, effectively displayed as an ensemble, was almost staggering. Valeri is a contemporary enamellist who had not only mastered the plique-a-jour designs and techniques of old Russia, but through his own innovation, had matured and improved many aspects of the classical themes of Russian Plique-a-jour. The display made it possible to observe most of the pieces in trans-illumination which is probably the only way to truly appreciate this technique since it really animated the vividness and transparency of the enamel colours. Even after being in a workshop with this outstanding craftsman, I continue to be impressed by his ability to suspend enamel so freely between the cloisonne wires, in a variety of forms. Many of the pieces included filigree which served to intensify the appearance of open-ness and the airi-ness within the enclosed structure, such as a variety of bowls, 3 of which had irregular "fluted" rims and a lot of filigree. I was fascinated by his wine goblets, each retaining their uniqueness of design through exquisite craftsmanship of the metal stems and bases, several of which contained gold foil and semi-precious stones such as pearls, onyx, agate, turquoise, haematite, malachite and garnet set into the base.

In addition, several goblets with decanters were in combined in a unique construction of aluminum or copper and silver base. The most outstanding was a conical shaped decanter with 3 coned shaped goblets, all fitting together in a single constructed base, which together become a beautiful plique-a-jour sculpture, beyond its functional use. A similar ensemble was created to hold a vodka decanter and glasses, containing obsidian and lapis with a brushed aluminum base.

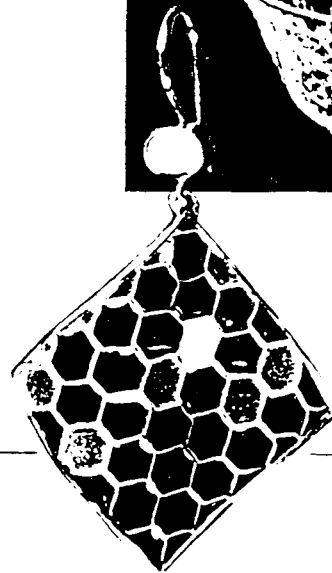
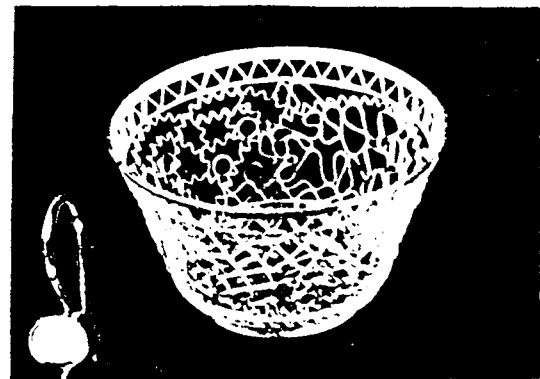
Not satisfied with merely presenting lovely plique-a-jour plates, the design of the cloisons in these plates were arranged in a series of interesting spirals and several

bowls had "fluted" edges to add to inner vibrancy to a static object.



Valeri Timofeev is an inspirational artist for all of us because, in his own plique-a-jour enamel medium, he has accomplished what many of us strive to do - to utilize the old, respected, established techniques and by conceptualizing new presentations and developing new techniques and methods to support these presentations, he has faced the challenge of bringing this medium into the 21st century.

My only disappointment in this wonderful exhibition was there was no catalogue of the show. I would have loved to have pictures of these splendid pieces to enjoy forever.



FAY ROOKE

This is an extract from The Enamellist, the Canadian Enamellist Association newsletter, Summer 1997.

Summer 1997 Workshop Report - by Elizabeth den Hartog.

"This year it was one of our own members, Faye Rooke, who shared her enamelling expertise with the group. At the workshop, having set out a problem for us, Fay then promptly advised us to 'design the problem away'. The project was to complete a piece with cloisonne and multiple enamelling techniques on a concave - convex shape. From a flat 3" copper piece, shape the metal with positive and negative curves. Using wet inlay, enamel the piece creating light and dark areas around the highest and lowest points in the metal to achieve a greater sense of depth. The design will include various gauges of silver and copper wire plus any combination of firescale, foils, impasto, basse taille or other surface treatments.

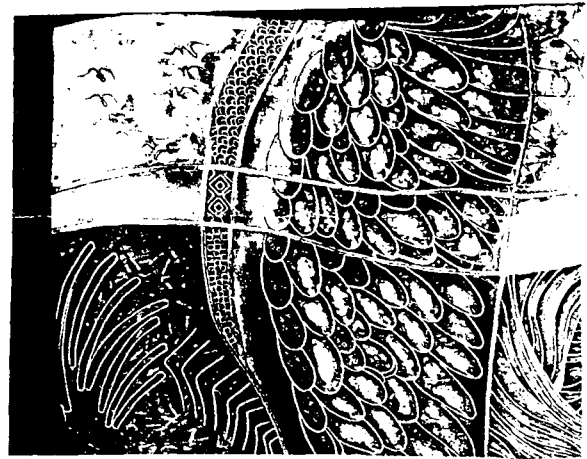
Following are some of the highlights and tips from the process Fay took us through, however you really had to be there.



"And after all of the above, the group had some small skirmishes when discussion of our favourite subject, 'enamelling' was carried on at a nearby restaurant. There is nothing like a good day's learning topped off with an evening of more learning.

What the Workshop brings home is a real appreciation for the skilful rendering of all the enamel techniques integrated into one of Fay Rooke's outstanding enamels."

1. *Inspiration and Design* were illustrated by a Slide Show - Look around you. Fay showed us that inspiration is everywhere. Nature, architecture, the world is at your feet. The slides ranged from delicate petals to sturdy lattice windows. Look for the pattern, texture, the drama of light and shadow, the subtly of colour. And on your design sketches, don't forget to use a brush, and watercolours as well as the pen and pencil. The diversity of what happens to enamel in each artist's hand, was reflected in the slide examples we saw of other enamellists' work.



2. *Forming the Metal* When sinking the metal, use leather for instance. Always anneal as the metal work hardens. Stakes can be used for raising. Use a planishing hammer. Create your positive and negative curves. Surface texturing can be added by engraving, etching and hammering. Or sawing out a design for an enchanting plique a jour motif. Drill all necessary holes at this stage. 20 gauge metal was recommended for jewellery pieces.

3. *Cleaning the piece* Dish soap, a plastic scrubber and water.

4. *Preparing the enamels* Presift the enamels using the set of large sifters available from Thompsons. Remember coins to help the enamel go through the screens. Flux should be well sifted and used sparingly as it tends to cloud. For gradation of mesh, sift the enamel onto sheets of white paper (for clarity). Use 60, 80, 100 mesh for maximum brilliance. The fines could for instance be used for impasto. Fine sand can be added and then build your mountain in very gradual stages. For curved surfaces it is more advantageous to have mixed grains. For steep curves use 140 grain. Washing the enamels, use a plastic spoon, pour water over the enamel, stir, pour water off using the front lip of the spoon. Then you will have very wet to semi-wet areas from which to select your grains. Label the spoons, then you'll be sure not to confuse the colours, one from another. Looking for the absence of cloudiness is your gauge when washing the enamels. Colour samples are a must. Make a grid by firing the first three background colours first, then add the other colours to be used. With colour, firescale is usually your darkest dark. To achieve depth, opaques should appear at the highest point. Silver and cold (or gold and warm) colours go well together.

5. *Inlaying the enamel* Underpainting is where you create the drama of light and dark. Always inlay as thin as possible. After wet inlaying a surface and especially if it's partially dry, redampen the whole piece to avoid blurred edges from water marks.

6. *Preparing and firing the wires* Begin with the difficult wires. The heavy wires should go on first and fire them until attached - it may take several firings. Spot inlay with the matching underlying colour on curved surfaces. Put a notch in the wire when you want to bend it, sometimes slightly touching the wire with a saw blade is enough. Mitre the cut. Emphasize the wire design by varying the gauges as well as the materials such as silver, copper and why not even gold.

7. *Firing* Remember every firing is costing you colour. Fire immature, gradually maturing the piece. Immature firing can be described as orange peel or the shiny bumpy stage. Fire at the same temperature every time, but increase each time by a few seconds. On silver particularly, stay immature, otherwise you may encounter bubbles - from the gas produced by silver. To correct these tiresome bubbles, you can create glass, silver or gold balls to fill in the holes. Try to fire upside down every other firing to get an even surface. Introduce soft enamels at the end of your firing. Or chose to fire a hard enamel at the end to achieve a pebbled effect. The suggestion to leave a piece in the turned off kiln or annealing kiln as long as 24 hours after the final firing is well taken.

8. *The In Between Steps* Burr the edges at the beginning and between each firing. This is a very useful method for preventing the thinning slope which occurs at the edges of an enamel. Using file, burr the edges of the piece toward the side you are going to be working on (top and bottom in the case of flat pieces) this creates a rough ridge which holds the enamel in place. Burr between layers. Also use a glass brush, working in circles between firings. And any burnishing of foil will work better if the piece is still warm.

9. *Surface Treatments* If you are firing foils onto an immature surface, remember that the foils will float sideways and upwards. Use a diamond burr to lay a trench into the enamel then inlay more enamel to create a pattern. Maybe you'd like to see what would happen by putting a hard enamel into cold water to let it fracture and then enamel over with a soft enamel. To work with opalescent (opal) enamels, fire the opal over with transparent, then opal again, finishing with another transparent. Endless combinations are waiting to be explored using firescale, foils, impasto, basse taille, underglazes, overglazes, sgraffito, lustering, etc, etc, etc. Don't forget to put your name on the piece too, inscribed into the metal itself or even in cloisonne!

10. *Hand Polishing* Level the enamel by stoning the surface under running water. Always use a panel to support the piece when hand polishing. Glass brush thoroughly and then wet and dry emery papers 400, 600. Use Renaissance wax for the final polishing of the surface of the enamel.

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ACIDS

I have noticed some responses in various newsletters to the ACIDS article from the Canadian Enamellist Association newsletter. All are to raise concerns about the use of Hydrofluoric Acid. This is definitely one of the worst chemicals you might use but it also is a useful one. Great care must always be taken, first aid always at hand, and I try set up any acid work on a table outside where there is plenty of ventilation. This is fine as long as the area is pet, child and people free. Acids should be stored correctly and locked safely away when not in use.

Jill Parnell has sent me an information sheet on a product called etchall -etching cream. From the information sheet - "Etchall Etching Creme is a thick creamy textured product that when applied to glass, mirror, porcelain or ceramics will change the surface to a matte frosted finish. Etchall etching creme is reusable. The active ingredient is ammonium bi-fluoride which reacts with the exposed areas of glass, mirror, porcelain or ceramic glaze and changes the surface permanently. Although Etchall etching creme does not contain any dangerous Hydrofluoric Acid it should be treated as you would any other household chemical." For an information sheet: freecall 1800 635137

I think this product may be similar to the Armour Etch available from Anna-Margot Originals. Both etching agents should handled with care - Editor.



MORE HAZARDOUS ACID HANDLING TIPS: by David Hustler.

Reprinted from the summer 1997 issue of The Enamellist, Canada.

Since penning the article on hazardous acids for our winter newsletter, a couple of additional tips have come to light on the safe handling of these substances.

- From Mary Hellier comes a handy tip. Mary dusts baking soda (bi-carb) into her rubber gloves and between the double glove layer to add an extra bit of protection in case her gloves develop a leak.
- After scaring myself researching the effects of Hydrofluoric acid on the human body, I've developed a practice of tying a bit of fishing line to the piece to be immersed in acid. This greatly facilitates removal of the article as all you have to do is carefully haul in the fishing line and the article follows. This means you don't have to open the lid of the acid container completely and try and fish the piece out, so you aren't exposed to the Hydrofluoric Acid more than you have to be.



SAFETY

These extracts of information are from Fordel Jewellers Supplies newsletter.

"With health and safety issues becoming more prominent, we decided to have the majority of our chemical products analysed. Some of the results were very surprising. If your work area is not well ventilated or dust/fume extraction is not provided, then over prolonged periods of exposure you are probably at risk of contracting lung disease! Some of the most popular solder flux can contribute to Fluorosis! Be aware of the products you are using and at least invest in some safety equipment."

Fordels sells a couple of respirator masks. One type most would have seen is the soft silicon half face respirator that replaceable filters. Different filters are available to deal with different situations and substances. They also have a lightweight mask (soft white fibre ones that you might use in house renovation) with some improved features. "This respirator has a twin strap design, foam nose seal, and nose clip, to ensure a good face seal over a wide range of face sizes. It has a unique valve which allows your breath to be exhaled. This means the mask stays cool. The mask meets Australian Standard AS1716 and has received government approval. This low cost respirator (\$5.10) will give you excellent protection against, most polishing compound dust, some of which contain silica, some soldering fumes and plating solutions etc."

(It would be wise to discuss your specific needs when purchasing a mask.)

Also ..."HELPFUL HINTSRolling Problems

- Sheet uneven, wavy, distorted - Remove from mill, anneal, planish sections where less stretching has taken place, insert in mill and use less pressure on rollers.
- Buckling - Caused by changing direction during rolling without first annealing. Remove metal, anneal, proceed.
- Cracks along edge - The ingot rolled is not of uniform shape, metal rolled too much without annealing. To correct: saw out sections which contain cracks or holes. Anneal, forge out material around the cavities so they align with the edge. Anneal, proceed to roll."