The Art of Making a Cabochon

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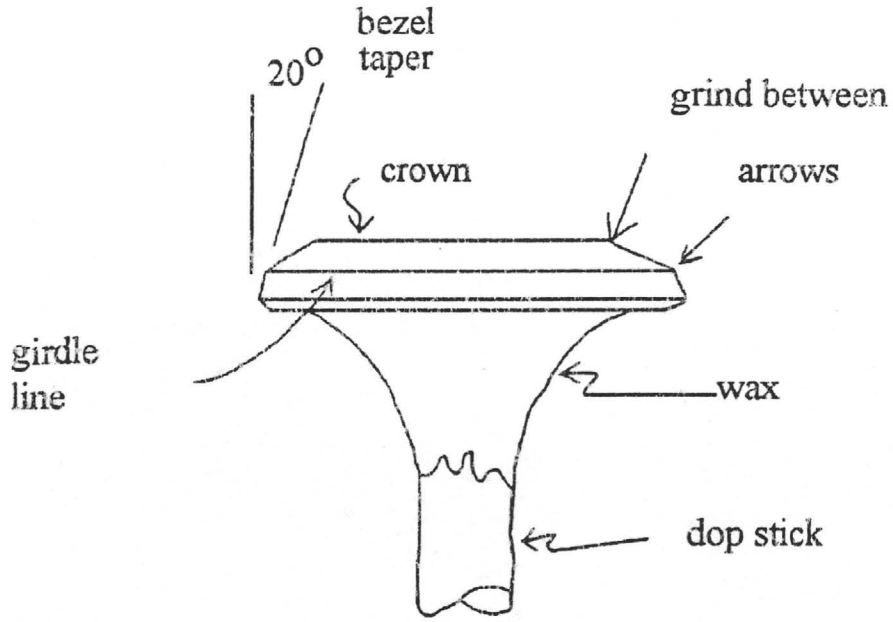
by Walter Peck
Revised by Doug Duffy and Shirley Cote



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THE ART OF MAKING A CABOCHON

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This publication was produced to serve as a textbook for lapidary classes taught at the Arizona Mining and Mineral Museum, but should also be useful for anyone wishing to learn about the lapidary arts.

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THE ART OF MAKING A CABOCHON

A. SELECTION OF MATERIAL

We are very fortunate to be living in Arizona where cutting materials of many varieties and colors are plentiful.

In selecting any material, remember that it is easier to work a good quality stone than one with undesirable features. What is good quality? It is a material that is fracture free, even in hardness (which means no soft spots) and of a color pleasing to you. Materials with more than one mineral varying in hardness can be successfully worked with more experience. In this class we will work mostly with agates that are sufficiently hard and best suited for beginning lapidary. As the course progresses, students may select one of the softer materials such as travertine (sometimes called onyx), serpentine, etc. In selecting a material, the color or pattern should be of prime importance. Just because the material may be jade or agate doesn't mean it is worth cutting. If the color is pleasing to you and it is of a good fracture-free material, it is worth cutting.

Looking at the outside of rough material does not tell you what is inside. In the field, sometimes a corner or chip is broken off to expose the color and pattern. The broken portion can be moistened to duplicate the appearance when polished. Occasionally a soft material such as manganese, which is black, will occur in the cutting material. These areas can be detected with water and should be avoided as they will pit or undercut.

So, select a material that looks solid and has a pleasing color or pattern and you are ready for the next operation.

B. USING THE SLAB SAW

Care must be exercised in following instructions for this equipment.

1. Always make sure the saw blade is immersed at least 1/4" in the coolant. The blade must **never** be used dry or damage will occur immediately.

2. Clamp the rough rock securely in the vise. After tightening the clamp, tap the back end of the vise jaw with the hammer provided and re-tighten the clamp. **A loose rock can ruin the expensive diamond blade.**

3. Make sure the clamp handle is all the way down.

4. Move the carriage up to within approximately 1/16" of the blade and lift the clamp handle.

5. Move the carriage to the position you want to cut by turning the crank. To avoid waste, if possible, start the first cut so the heel can also be used for a cab, usually 3/16" or 1/4". This, of course, depends on the type of material used.

6. Close the lid and turn on the switch. The power feed will take over. **Never, is the lid to be opened when the saw is running.**

7. When the saw cut is finished (you can tell by the sound) turn off the switch and **wait** about 15 seconds so the oil can drain from the lid back into the tank. Open the lid, push the clamp handle all the way down and retrieve the carriage.

8. If another cut is to be made, turn the crank to the new position so the slab will measure 3/16". This is the most desired thickness. Where high domes are wanted, make the slab 1/4". For cabs there is no need to go any thicker. Proceed by following steps 4, 5, 6, and 7.

9. Before proceeding to the next operation, the slabs should be cleaned. Cover them with kitty litter and let stand 15 minutes, brush off excess kitty litter, and wash in soapy solution or cleanser.

10. Leave the slab saw as clean as you found it, especially the vise. Keep the lid closed when saw is not in use.

C. ORIENTING AND MARKING THE SLAB

The marking tool is either an aluminum or brass rod filed to a point or a laundry marking pen. Either should be sharp.

Templates are used for orienting patterns and marking an outline on the stone. The commercial templates have sizes cut out to match the standard findings. As an example, a large brooch, bola tie, or pendant is usually 30 x 40 millimeters. Without a template an accurate outline would be difficult to make.

When a slab of scenic material is used, try many positions and find the most pleasing. Again try to stay away from fractured or pitted areas. If you find the best looking area right in the middle of the slab, that is where you make the outline. Don't worry about the waste.

Mark the stone on the side that is to be the back. If you have a certain pattern in the stone which you want to appear on the face of the stone, mark it temporarily on the front side. Saw it out on the trim saw, leaving at least 1/16" margin all around. With it thus reformed, turn it over and mark the back side, which can be marked with ease as you can now see the approximate shape your finished stone will be. The reason the stone is marked on the back is that the bottom must fit accurately in a bezel or prong setting and this is the only way of controlling the required shape. The top, not having to fit anything, has some degree of freedom in shaping.

D. USING THE TRIM OR DROP SAWS

As mentioned for the use of the slab saw, the same care must be exercised in using the trim or drop saw. These types of saws are used for cutting out the pattern you previously marked. They can also be used with a vise for slabbing smaller pieces of rough material.

NOTE: A diamond blade must **never** be used dry. The coolant does three things:

a. Keeps blade cool.
b. Cleanses cut of abrasive particles.
c. Provides lubrication.

Trim Saw

1. **Always** make sure the diamond blade is immersed in the coolant. Since the coolant cannot be seen, rotate the blade and watch for oil to drip from the splash guard.

2. **Always** saw in a straight line. By making a series of straight cuts you can reduce any slab to an almost perfect oval, round or any other curved shape.

3. Feed the slab easily. Keep pressure light and uniform. Pressure should always be exerted directly from in front of the blade.

Drop Saw

1. **Be sure** the coolant is being pumped to the blade before starting to cut.

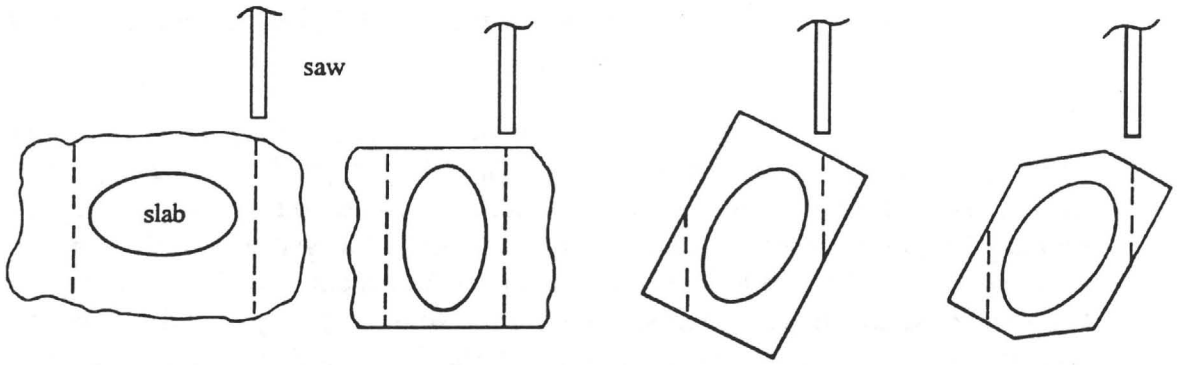
2. Keep the pressure of the blade light and uniform.

Both Trim and Drop Saws

1. Cut out the marked stone leaving approximately 1/16" around the edge for grinding.

2. Clean the saw table and remove all pieces of stone.

3. Clean the cab before proceeding to the next operation. Cover the stone with kitty litter and let stand 15 minutes; brush off excess kitty litter; and wash the stone in soapy solution or cleanser.

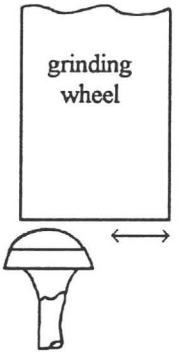


E. ROUGH AND FINE GRIND SHAPING ON GRINDER

Grinding is the shaping of a stone to a desired configuration. This will be accomplished in two steps. The rough grind is done on a 100-grit diamond wheel that removes material quickly. The fine grind finishes the operation on a 180-grit wheel and takes significantly longer than the rough grind.

It is well to note here that **HASTE** is responsible for most errors and that **PATIENCE** is the only remedy. If you haven't the time to do it right, when will you find the time to do it over?

NEVER use heavy pressure. Heavy pressure will cause the wheel to become worn and possibly ruined.



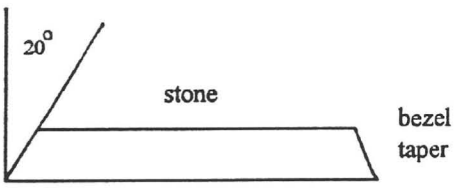
When grinding, work the whole width of the wheel.

If a spot is worn in a diamond wheel, the wheel is ruined. A new 8" diamond wheel costs around $200.

USING THE GRINDER

1. Turn on the grinder.

2. **Be sure water is flowing on the wheel before starting the grinding operation.**



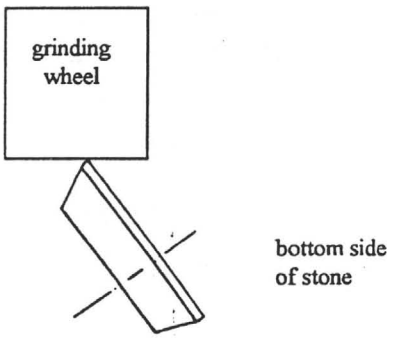
3. The 80 and 100-grit wheel is for shaping. Grind off excess material and bring the stone to the desired shape, but do not grind to the line. Leave about 1/32" of material outside the line. Hold the stone at a 20° angle to the wheel. This will put the required bezel taper on your stone. You are actually doing two operations in one at this point -- grinding to shape and placing the bezel taper on the edge of the stone.

4. Move to the fine grinding wheel. This wheel is for preparing the stone for the sanding operation. The 180-grit grinding wheel grinds much slower than the 80 or 100; consequently it gives more control to your finish grinding operation. Correct any irregularities you might have from the 80 or 100-grit wheel. Be sure you do not grind away your line - be sure to leave the line intact. When checking the bezel taper to see if you have removed all the grind marks, dry the edge with a rag as you will not be able to tell whether you have removed all of the grind marks if it is wet. Everything looks good wet. Occasionally, check the stone size by trying to fit it through the opening in the template. When it just barely goes through, you have completed this operation.

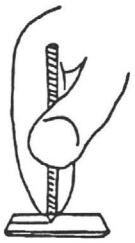
5. Bevel the bottom sharp edge of the stone to smooth it. This will prevent chipping in later operations.

6. Turn the off water, but let the wheels turn for a few minutes as this allows the wheels to dry out evenly.

7. Turn off the grinder.



F. MARKING THE GIRDLE LINE



1. Place the cabochon (bottom down) on a flat surface. Take an aluminum marking pencil or laundry marking pen and, holding the cabochon, run a line around the bezel, half the thickness of the stone. This is called the girdle line. No more grinding will be done on the lower side of the line. You are now ready to round the top half.

2. Wash hands and stone before dopping.

G. DOPPING

There are several methods used for applying dop wax. In this class, we will use the commercial dop pot method.

1. Heat the dop wax in the dop pot until it is melted. Do not let the wax vaporize (shown by smoking).

2. Select a dop stick approximately 1/4" smaller than the narrowest part of the stone for large stones. You may not be able to keep this much margin for smaller stones. Use a nail for very small stones.

3. Place the stone over the holes in the dop pot and let the stone heat until all moisture is removed and the stone is hot to the touch.

CAUTION: Some stones will fracture when heated. Opal, with its water content, is a good example.

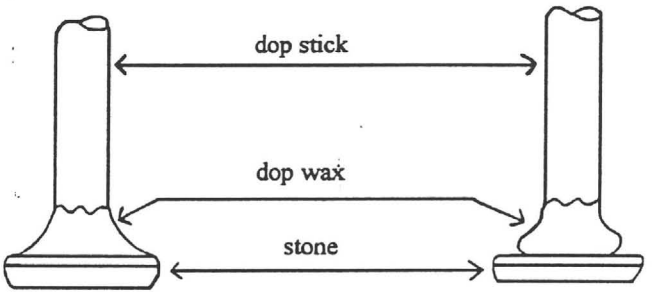
4. Dip the dop stick in the hot wax, covering about 1/4" of the end of the stick. Center it on the back of the stone while it is still hot. The heat from the stone will help to flow the wax into a natural fillet.

If you have a cold joint, the stone will probably come off while grinding. Do not press down hard on the dop stick. You may press out all the wax between the stone and the dop stick. This may weaken your bond. Light pressure is sufficient.

5. Now, wet one hand with water. Grasp the dop stick with your dry hand and while holding the stone with the wet hand, center the dop stick on the stone. Keep the wax well away from the edges of the stone. (Dop wax on the edges can get on the grinding, sanding, and polishing wheels. This clogs the open spaces on the wheels and reduces their efficiency.) Slowly spin the stick and stone between your fingers at eye level to see if the stone is centered and is perpendicular. If not, reheat the stone and try again.

6. Set the stone down on a flat surface and let the wax harden.

If it looks like this, you have a good joint



If the wax turns under where it meets the stone, you have a cold joint.

H. ROUGH AND FINE CONTOUR GRIND

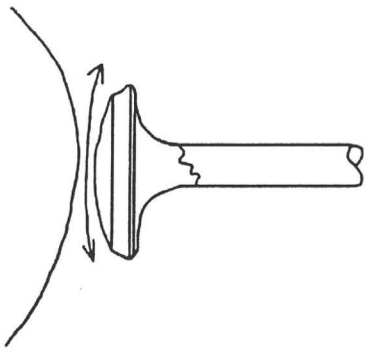
Many of the steps discussed in grinding the outline also apply to contour grinding. If you are not familiar with these steps, refer back to them now and from time to time when needed.

1. Using the 100-grit wheel, grind around and around, knocking off the corners to the girdle line. The narrow ends of an oval stone vary in area compared with the sides. Consequently, the ends will grind away faster. Therefore, a person must be cautious when grinding this area.

2. Grind crosswise and lengthwise to completely remove the flat spot in the center. Be careful not to over grind the edge and destroy sections of your girdle line.

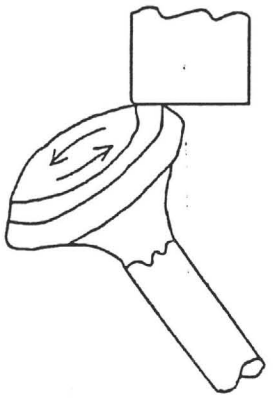
3. Finish on the 180-grit wheel. The 180 wheel removes the small white scratches seen when the stone is dry and will give a smooth appearance to the stone and a proper surface for the sanding operation. **Do not hurry**. A little time spent on this wheel will make sanding easier and give better results.

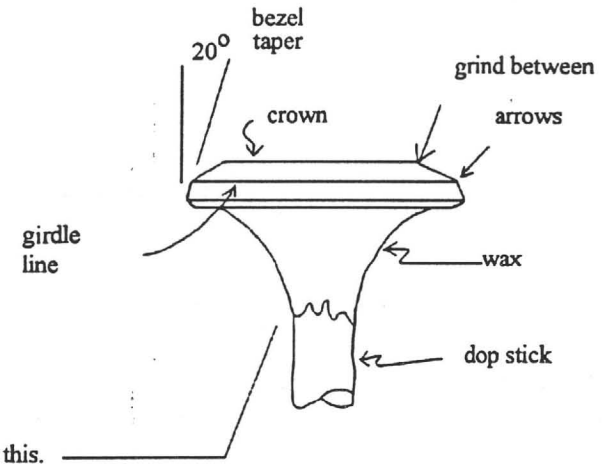
grinding wheel



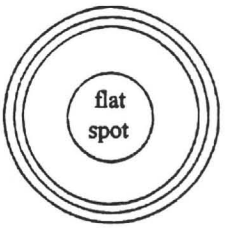
The grinding of the cabochon is finished when no flat spot remains. Do not attempt to take out a flat spot on the sander.

Rough and Fine Contour Grind

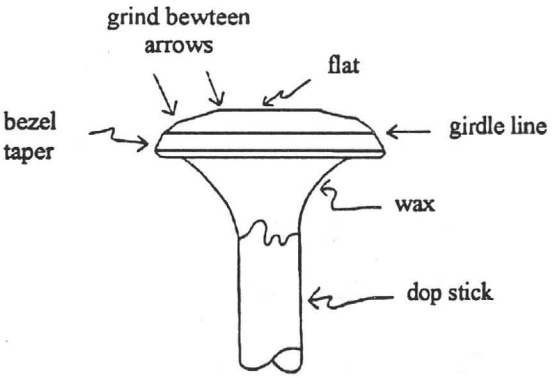




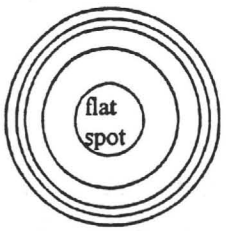
Your first grind step should look like this.



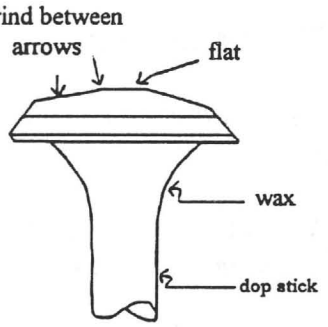
top view



Move up and work towards center.

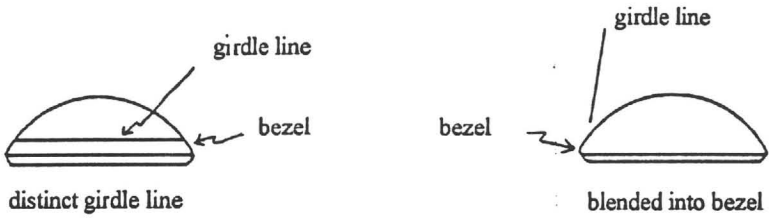


top view



Continue grinding towards center until only a small flat spot remains.

NOTE: Whether or not a girdle line remains on the finished cabochon is a matter of preference. When grinding on the fine wheel this can be blended into the bezel as shown below.



ROUGH AND FINE SANDING

REMINDER: **Always wash your hands, stone, and dop stick between grinding and/or sanding operations. Otherwise, contamination can be transfered from operation to operation.**

Sanding is one of the most important parts of the lapidary operation. The perfection of your final polish is largely dependent on the quality of the surface developed in the sanding process. A properly sanded stone will have a semi-bright luster that can be brought to a high polish within a few minutes on the polisher.

The sanders, having a backing of sponge rubber, have quite a bit of resilience (give). This allows the cutting grits of the cloth to conform to the curved surface of the stone more readily. Consequently, this gives an evenly curved contour after proper sanding.

USING THE SANDERS

1. Turn on the sander unit.

2. Turn on the water.

3. Sand in the same manner as you did in grinding. If you choose to keep your girdle line, caution should be used not to destroy it.

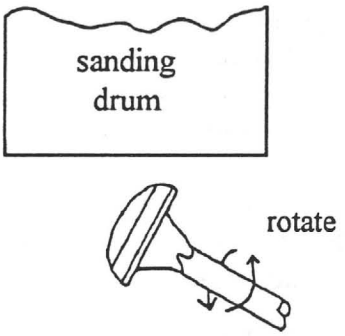
4. When the stone appears to have an even, satin-looking finish, **clean it off with soap and water along with the dop stick and your hands.** Go to steps 9 and 10 and return to Step 5.

5. The next step is to sand your stone on the 400-grit sander. Repeat steps 1 and 2 and sand in the same manner as you did on the 220-grit.

6. Again, when the stone appears to have an even, satin-looking finish, clean it off with soap and water along with the dop stick and your hands. Go to steps 9 and 10 and return to Step 7.

7. The 600-grit sanding is a most critical step and should never be hurried. This step results in a semi-polish with no scratches left to the naked eye. Scratches simply can not be removed by polishing. Proper time spent on this operation will give you a base for a perfect polish. (If scratches are still present, **wash your stone, dop stick, and hands** before returning to the 400-grit sander to remove them. Then, repeat steps 6 and 7).

A good rule to follow is this: When you feel the stone is ready for polishing, go over it one more time.



8. Do not neglect to sand the bezel.

Be sure to sand the bezel at the same angle as your bezel taper.

9. Turn off the water, but let the wheels turn for a few minutes as this allows the wheels to dry out evenly.

10. Turn off the sander.

REMINDER: Wash your hands, stone, and dop stick before moving on to the next step.

J. POLISHING

This is the final and perhaps the most fascinating step in the 'art of making a cabochon' and only takes a few minutes on a properly ground and sanded stone.

Some of the intangibles of polishing are the amount of pressure needed, the number of times to buff the stone, the degree of dryness of the buff needed for best results, and the amount of polishing compound on the buff. Experience is the best guide in these matters.

Wash the stone, dop stick, and your hands in soap and water so that no grit will be carried from the sander to the polishing buff. This is very important as any grit will contaminate the buff so that it is impossible to polish without leaving scratches.

In a small container, mix only enough polishing agent and water to form a thick slurry.

Using a squirt bottle filled with water, wet the leather buff thoroughly, then with a brush apply a thin coat of the polishing slurry. You should be able to see the buff through the polishing compound when you have the proper amount on the wheel. Both operations, applying water and the compound, must be done while the wheel is not running.

NEVER mix different polishing compounds on the leather. This will ruin the entire set-up.

ALWAYS wash your hands and the items you are polishing with soap and water to remove all polish before proceeding to the next polish.

ALWAYS use the white, tin oxide polish first; then the green, chrome oxide if you are going to use both.

Now turn on the polisher. If the surface of the stone was properly prepared, it will take no time at all on the buff to bring it to a high polish. Prolonged polishing should be avoided. A quick polish diminishes the chances of excessive heat and minimizes orange peeling, which is actually a flow of the stone material.

Use somewhat heavier pressure in polishing than you did in grinding and sanding. You will soon feel a pull on the buff as the leather begins to dry out. Check the stone for overheating. If a polish still does not appear, apply more water and proceed.

Polish in all directions and keep the stone moving at all times.

If a polish still does not appear after two minutes, stop the wheel and inspect the surface of the stone with a hand lens.

A poor polish can generally be attributed to poor preparation or poor material. Poor preparation includes scratches that were not sanded out, flat spots, uneven girdles, etc. Correct the problem by going back to a sanding operation, or it may even be necessary to go back to a grinding operation. If grinding or sanding does not correct the problem, then the quality of material must be considered. The quality of the stone generally will determine the degree of polish you will receive.

Even though we cannot improve the materials with which we work, we can improve our cutting and polishing skills to the point that will enable us to get the best out of a certain stone.

NOTE: As was stated previously, **HASTE** is responsible for most errors, and **PATIENCE** is the only remedy.

K. REMOVING STONE FROM DOP STICK

There are many methods used to remove a finished stone from a dop stick. Care should be used here as a lot of work went into the cutting and polishing up to this point. The following is the quickest and easiest way and is recommended in class.

1. Place the stone and dop stick **on its side** in the freezer compartment of your refrigerator for 10-15 minutes. Remove and apply slight pressure against the stone and it will break loose.

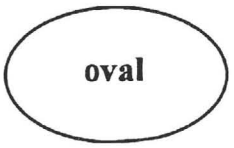
2. Scrape off excess wax on the back of the stone with a razor blade or knife. Any wax remaining may be wiped off with a cloth dipped in nail polish remover or alcohol.

3. Finish by washing the stone in soap and water. If for some reason, you have a fracture in the stone or a pit that is filled with polish, use a regular tooth brush and tap the brush on the stone under running water. The bristles will usually remove the polish. (If you followed all the instructions, you should not have a fracture or pit).

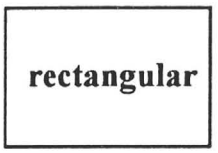
NOTE: The methods described above will work for the average stone. There is a cold dopping compound that is used for heat-sensitive stones, like opal, which can be purchased from most lapidary shops.

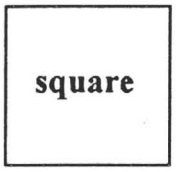
L. STONE SHAPES

The following shapes are arranged in their approximate degree of difficulty.

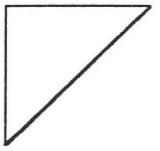
1. 

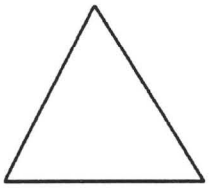
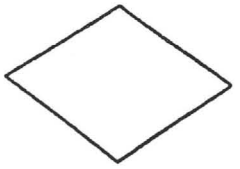
Proceed as directed in instructions.

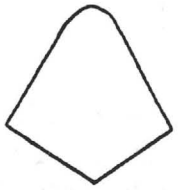
2. 



Same as above except do not rotate stone while grinding and sanding.

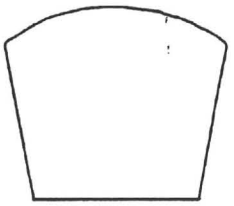
3. 
modifcation of square

Same as #2.

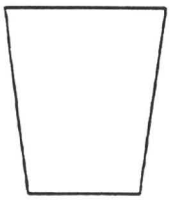
4. 
triangular

diamond
Same as #2.

5. 
modification of diamond

Same as #2 except rotate where curved surfaces appear.

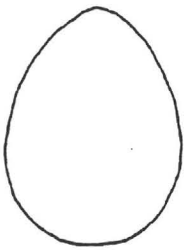
6. **keystone**

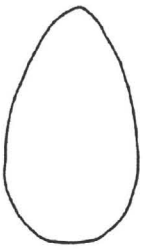




Same as #5.

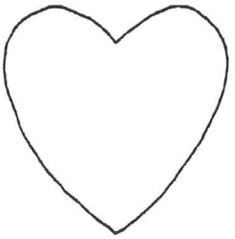
7. **teardrop**

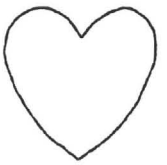




Same as #1 except use caution to keep bezel line even if finished one one side only. See note #1.

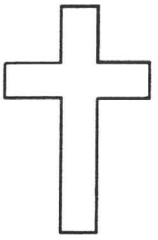
8. **heart**

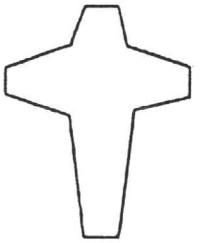




Same as #7, see note #1.

9. **cross**





Same as #2 except leave top and bottom surfaces flat. Polish edges.

10. **star**

Same as #7 or #9.

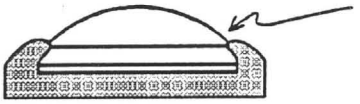
NOTE: The teardrop and heart designs are sometimes finished on both sides. Omit the 20° bezel. Grind to shape with straight sides. Mark the girdle line half the thickness of the stone and proceed to finish one side completely down to the girdle line. Remove from dop stick and redop on finished side and completely finish the other side.

L. MOUNTING STONES IN FINDINGS

After a stone is worked to a fine polish, it would be most discouraging to have it fall out of its finding and chip, crack, or break. Therefore, all stones should be mounted securely in their findings. To prevent a loose stone, it is suggested that a very small amount of an instant glue* or equivalent be used. Place the instant glue on the back of the stone or on the ledge where the stone lays.
(* "Hot Stuff" Super "T" instant glue)

For bola tie tips, place some instant glue on the ends of the cord and with a twisting motion, push the bola tip onto the cord as far as possible then let dry. (Be sure any seams on tips are oriented in the same direction.)

For prong mounting, proceed as shown below.



Usually the tips of the prongs are straight. If the prongs are just pressed against the bezel, a good contact may not be made.

If mounted this way, the prongs will easily catch in any cloth.

Correct way to mount.
First, form tip of prong with proper pliers, then press against the bezel.

ACKNOWLEDGMENTS

Information was used from the following sources.

1. *General Lapidary Information* -- Phoenix Arts and Crafts Center

2. *Gem Cutting Shop Helps* -- The Lapidary Journal

3. *Gem Making as a Hobby* -- Star Diamond Industries

4. *Helpful Hints For Your Hobby* -- Highland Park Mfg. Co.

5. *Gem Making* -- The Beacon Engineering Co.

The following article was taken from the June 1970 issue of the *Rocky Mountain News*, an official publication of the Rocky Mountain Federation of Mineralogical Societies.

Avoid Lapidary Mistakes

"It has been my experience in teaching lapidary that most beginners make the same mistakes, with the same results, and that these mistakes number only half a dozen or so. Actually, it takes less time to cut a stone properly and carefully than it does to hurry the job, then go back and correct the mistakes. The common errors are careless marking, inaccurate grinding, insufficient sanding, and neglecting a final inspection of the supposedly finished stone.

Careless marking with the template may result in an undersized or misshaped stone which will not fit the mounting. The marking pencil must be sharply pointed, so that the line will be as close to the template size as possible. If you have trouble seeing the line, go over it with a dull pencil, which will widen it to the inside, but leave the outside accurate. On light colored stones, a ballpoint pen may be used but may not mark closely enough. If not, make allowance for this when grinding.

The template marking on the BACK of the stone is your guide to grinding to the template line, since the back is the side which must fit the mounting. Leave a tiny margin outside the line, just enough so that you can see you haven't touched it. After the stone is ground to shape, go back and grind off this margin to the line, making any corrections needed to even the edge to the proper thickness. Before going to the fine wheel, and certainly before sanding, check the top of the stone for a flat in the center. Hold the dopped stone so you can see the cross-section against a contrasting background. If the curve over the top is broken, however slightly, by a straight line at the middle, you still have a flat which must be ground out. It is almost impossible to sand and polish such an area, and even if you should succeed, a flat in the center of an otherwise rounded stone is unsightly.

Proper dopping is more important than many people think. Wax is not only the adhesive which holds stick and stone together, but forms a support to prevent the stone popping off under the pressure of grinding and sanding. Use enough wax so that it can be tapered outward to form a brace under the edges of the stone. Wax should be hot enough to flow slightly, which will aid in the tapering and make a better bond with the WARMED stone. While it is still warm enough to work, center the stone on the stick and make sure it is level. Use the marking pencil to push the wax back from the edge of the stone, so it will not rub off on sanding cloth.

A well-sanded stone will finish into a well-polished stone, and the reverse is equally true. A good rule of thumb is to continue sanding on one grit until the surface looks the same all over under a good light. Any small flats or scratches MUST be sanded out before going to the next grit. If you don't get them out here, you won't get them out, period. Remember to sand the edge at each step, but lightly, particularly on the coarse cloth. Too much sanding of the edge may reduce the size. Since each succeeding step brings the stone to a little higher luster, a scratch or two may show up which has been overlooked, and this requires going back to the previous step until they disappear. A good piece of material will appear almost polished when it comes from the last sanding operation and will polish quickly if the previous steps have been properly done.

There is one more test before the stone may be said to be polished -- the final inspection. Take the dopped stone to a good light and watch the reflection of the light on the surface as you rotate the stone. If you can see any scratches, however slight, the stone is not finished. Go back to the last sanding step, sand thoroughly and polish again, repeating the operation if necessary until you can no longer see any scratches. No one, except an eagle-eyed judge in a competition, is going to examine your stone so critically; but you will know it is not the best work you are capable of. And each tiny scratch acts as a mirror, reflecting some of the light away from the eye of the observer, while diminishing the brilliance of the polish by that much.

I remember reading once that if you don't keep a diamond clean, you might as well wear a piece of glass instead, because dirt dulls the brilliance of the stone. If you don't polish a cab to the highest brilliance possible, you shouldn't have bothered with it at all."