Professional Jewelry Making

A Contemporary Guide to Traditional Jewelry Techniques

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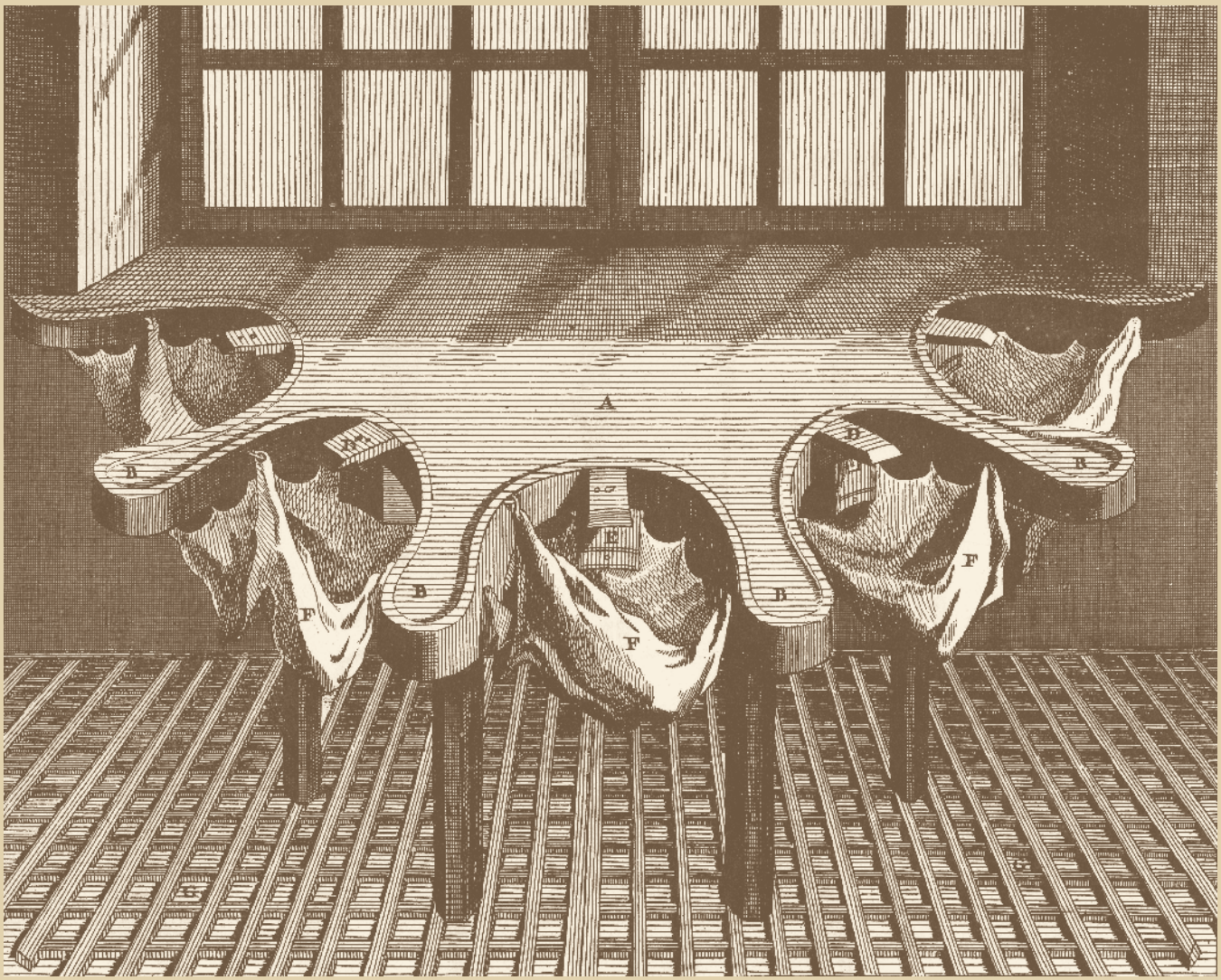
Tools



Setting up a jewelry workshop is not difficult; many of the essential tools are fairly common. This chapter will describe most of these. Because it would be impossible to list all of the tools used by all bench jewelers for every conceivable type of job, some goldsmiths will find that their favorite tools have not been included here, which goes to show how personal the choice of tool can be.

For many procedures, a variety of tools can be used. It often does not matter, for instance, whether you choose the flat side of a half-round file or the flat side of a barrette file. For many tasks, however, there is no substitute for the correct tool. In fact, often the job may be impossible without precisely the correct tool. Remember the old goldsmith's adage, "The right tool is half the job." Be prepared to add tools to your workshop as you discover what is needed. When purchasing tools, keep in mind that most quality tools last a long time. Many commercial tools also need modification or "dressing" before they are suitable for use. For example, the jaws of pliers should be sanded to remove sharp corners, and gravers and hammers require grinding and polishing to achieve the correct shape for use.

THE JEWELERS BENCH

Most jewelry handwork is done at the bench, and so working at a jewelers bench should be comfortable and convenient, with all necessary hand tools within reach. Watching a master goldsmith at work is like watching a concert organist who, in a frenzy of seemingly blind activity, reaches for just the right note at just the right moment, orchestrating the complexities of his or her art without impediment.

Unchanged for over hundreds of years, *jewelry benches* are still made of wood. The work surface, normally 92–94 cm (36–37 inches) above the floor, is customarily made of 5 cm (2 inch) thick hardwood maple or oak. European-style benches feature a 50 cm (18 inch) semicircular cutout that allows a goldsmith to be surrounded by tools. Traditionally a leather skin hangs below the cutout area to catch filings and items that drop. Contemporary bench makers have substituted a sliding drawer that pulls out below the bench pin. In addition to catching metal, the drawer is also used to store tools.

Illustration 3.1 The jewelers bench.

A *wooden bench pin* is centrally located in the cutout area of a jewelers bench and is the focus of the working area where most of the handwork is done. The pin can be sawed or filed to support different objects as the need arises. The bench pin usually has a V-shaped notch in the front over which sheet is held during piercing.

An adjustable chair should be selected that allows the artisan to sit and work comfortably. To determine the correct height, sit in the chair with your back straight and put your elbows on the bench top. Now adjust the height of the chair so that your upper arms are parallel to the floor. This arrangement will provide maximum comfort with minimum fatigue. If the bench surface is too low or the chair is too high, you will be forced to lean over your work, a position that leads to neck and shoulder strain.

Most craftspeople select a flexible bent-arm light with either fluorescent or incandescent bulbs. The best lights have a combination of both.

Most craftspeople wear some sort of apron or shop coat to protect their clothes. The most popular is a wraparound half-sleeve apron, available from uniform suppliers.

A *bench brush* is needed to brush dust from the work and hands and to sweep up lemel (filings) from the bench and the catch drawer. A clean paintbrush or shaving brush can be used for this purpose.

EYE WEAR

Jewelry is built upon details, and therefore goldsmithing requires good corrected vision. To a large extent, the quality of craftsmanship is a reflection of how well the artisan can see his or her work. Jewelers must be able to see fine details without guessing. Also, when using rotary tools such as flex shafts, grinders, and polishers, eye protection must be worn; when working with acids, a full face shield is mandatory; and when using torches at high temperatures, dark goggles are essential. Eye wear should fit comfortably. Don't scrimp when buying protection for your eyes.

Optivisors are binocular magnifiers. Most craftspeople find that magnification #3 is sufficient; some prefer the stronger magnification of a #5 or #7; while many with perfect vision do not use optical aids of any sort. For fine work such as diamond setting, use higher magnification.

A *loupe* is a small single-lens magnifier used to inspect solder seams, mechanisms, settings, gemstones, and so forth. Most bench workers use an inexpensive bench loupe ranging from 3 to 7 power for this purpose.

Clear *protective goggles* are essential for use with all spinning tools such as flex shafts, drill presses, polishing lathes, etc. Find a comfortable pair and use them regularly (Illustration 3.2c). In addition, the high temperatures required for working platinum and melting gold produce hazardously intense light, requiring the use of welding goggles with protective dark lenses. Use at least #5 for soldering platinum.

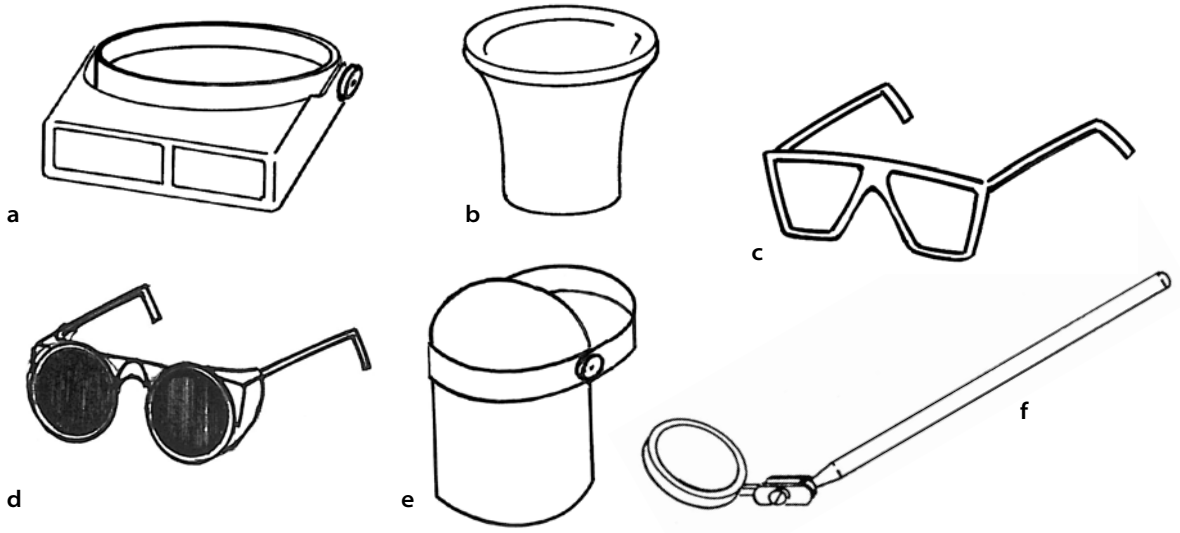


Illustration 3.2 Eyewear: a. Optivisor; b. loupe; c. protective goggles; d. welding goggles; e. face shield; f. dental mirror.

A *face shield* offers the protection of a large clear plastic shield, and it is essential when working with acids, hazardous chemicals, and machinery.

When setting up a soldering job, inaccessible areas of the work can be inspected by using a small ***dental mirror*** on a swivel handle.

MEASURING

The most critical step in making jewelry is layout. A craftsperson needs to have the tools required for measuring, laying out, and marking. First, a steel or plastic *metric ruler* is necessary to precision craftsmanship (Illustration 3.3a), and a *slide caliper* enables the craftsperson to measure and analyze work precisely. Standard stainless steel models that read to the nearest twentieth of a millimeter are fine, and inexpensive plastic models are also acceptable. The latest electronic models offer the convenience and accuracy of a digital LCD readout, indicating measurements to a tolerance of 0.01 mm. Just make sure that the caliper you select has a metric scale.

A *spring gauge* is a handheld measuring tool that usually reads to the nearest 0.1 mm. It is ideal for measuring the thickness of an object, especially if an obstruction makes normal caliper measurement impossible.

Most *micrometers* have a dial that shows the thickness of wire and sheet to the nearest 0.01 mm or finer.

A *small machinists square* is very useful for precision work. By butting one leg against a straight edge, you can establish a right angle for sighting and scribing perpendicular lines.

Not normally found on a goldsmith's bench, *protractors* are nonetheless useful for measuring and laying out angles. The most useful model butts up against the work and has an adjustable leg that swivels around a calibrated 180 degree semicircle.

MARKING

Although most people think that *dividers* are limited to laying out arcs and circles, they are ideal for laying out straight lines as well. Dividers can also be used to transfer precise measurements from ruler to work. To do this, rest one leg of preset dividers along the straight edge of a piece of metal, and drag the other leg along as you scribe a fine line. Keep the dividers' tips sharp by occasionally filing them to a point.

Really just a glorified nail, a *scribe* is used to scratch light layout lines onto the work. To transfer patterns, it can be dragged along a straight edge or machinists square or around a template.

A *center punch* is simply a pointed steel rod that is tapped with a chasing hammer to mark holes for drilling. Automatic center punches are spring-loaded and require no hammer. When pushed into metal, this tool's tip recoils and then pops out, driving the tip into the work.

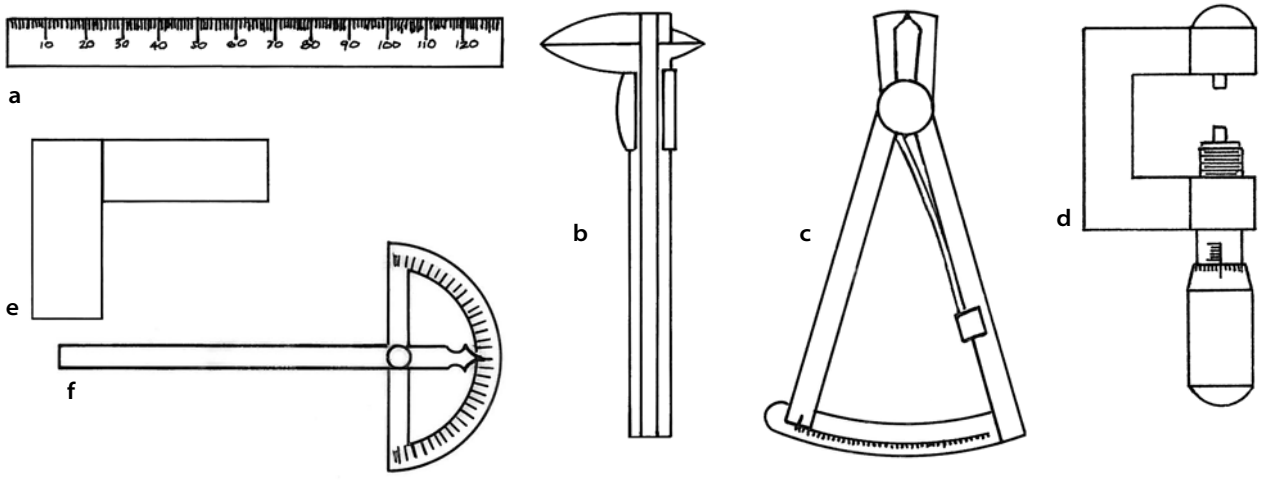


Illustration 3.3 Measuring tools: a. metric ruler; b. slide caliper; c. spring gauge; d. micrometer; e. small machinists square; f. protractor

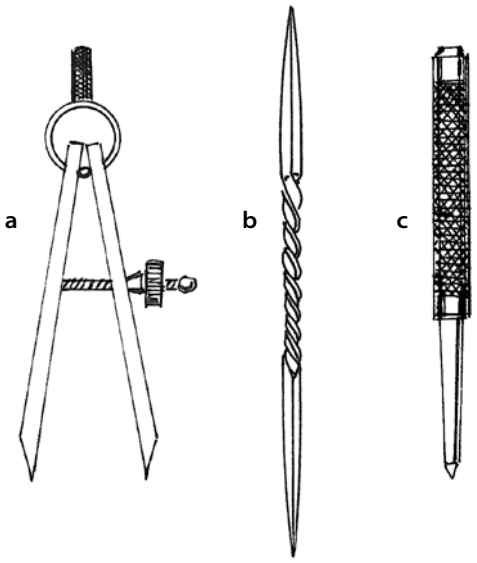


Illustration 3.4 Marking tools: a. dividers; b. scribe; c. center punch.

Permanent markers are very helpful when working with metal. They can be used for drawing shapes to be sawed or filed, for indicating areas that need further work, and for writing down measurements when comparing different areas.

HOLDING

Jewelry is composed of small, odd-sized pieces that must be held securely during filing, sawing, drilling, and setting.

Holding tools should be selected to avoid damaging or marking the work.

Traditionally made of wood, *ring clamps* are double-ended, lever-action vises that are tightened by driving a wooden wedge into one end. They are used for holding rings and other objects during filing, sanding, engraving, and setting without marking the work. To achieve greater stability, some jewelers carve a groove around the cylindrical jaws of the ring clamp about 10 mm from the end and then push the groove in the V of a bench pin for support.

A *pin vise* is used to hold wire while filing, to hold drill bits while resharpening them, and for similar tasks. Pin vises have jaws called collets on one or both ends. Most pin vises have interchangeable or adjustable collets and an open shaft down the middle for holding long pieces of wire or rod.

A *tube holder* is similar to a pin vise but larger. It comes with a set of interchangeable collets of different sizes for holding tubes or rods while setting or filing without damaging the surface.

A *hand vise* is made of steel with an adjustable screw clamp and is used to hold larger and less delicate items during filing, bending, sanding, and the like. By clamping two pieces together in a hand vise, they may be filed to exactly the same shape.

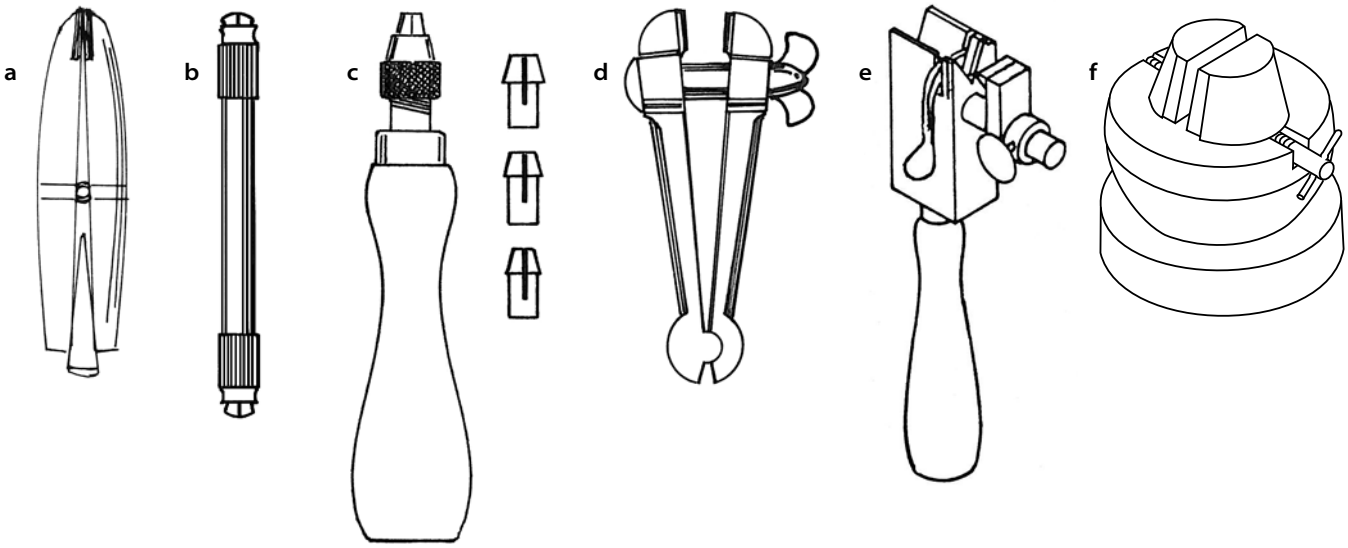
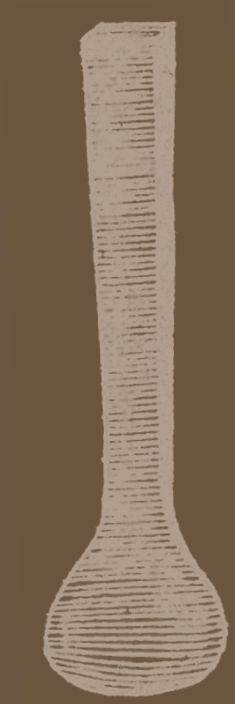


Illustration 3.5 Holding tools: a. ring clamp; b. pin vise; c. tube holder and collets; d. hand vise; e. tube-cutting jig; f. engraving block.

Project 19

Locket



TOOLS

anvil or steel block
ball punch – wood
bench knife
charcoal block
dapping block – wood
dividers
drill bit
file – 2 mm round
file – cylinder
file – flat
flux brush
goggles
hammer – riveting
inside ring sanding cone
jewelers saw
needle file – cylinder
needle file – flat
needle file – round
pliers – chain-nose
pliers – flat
pliers – half-round
pliers – round
pin vise
polishing buffs and wheels
polishing lathe
reaming broach
ring mandrel
ruler – flexible
saw blades
scribe
shears
solder pick
soldering board
third-hand
torch
tweezers – 2 pairs, mounted

MATERIALS

binding wire
clear plastic sheet
double face tape
epoxy
fire coat
flux
permanent marker
pickle
polishing compounds
sheet – 0.6 mm x 6 mm x 22 mm
sheet – 3 pieces: 0.6 mm x 30 mm x 60 mm
sheet – 2 pieces: 0.6 mm x 2.5mm x 66 mm
silver solder
tubing – 0.5 mm wall x 2.5 mm O.D. x 12 mm
wire - round: 1.5 mm ø x 35 mm

Among all of the jewelry items and objects that can be made by hand, the locket is one of the most complex and practical. Unlike nearly all other jewelry, lockets serve a function. Like wearing a small safe, a locket can protect and conceal valuables, pictures, human hair, mementoes, and even medication.

1 This basic locket is composed of two domed halves with removable bezels so that a photo can be inserted on each side. The halves are hinged together and held closed with a friction catch. A bail is added so that the locket can be worn on a chain. Modifications to this basic pattern can include making the locket oval or heart-shaped, adding knuckles, adding pages inside, hinging it from the top, etc. The project is made almost entirely of 0.6 mm sterling silver sheet. Note that fire coat (boric acid and alcohol) is used whenever possible to protect the silver surfaces from firescale.

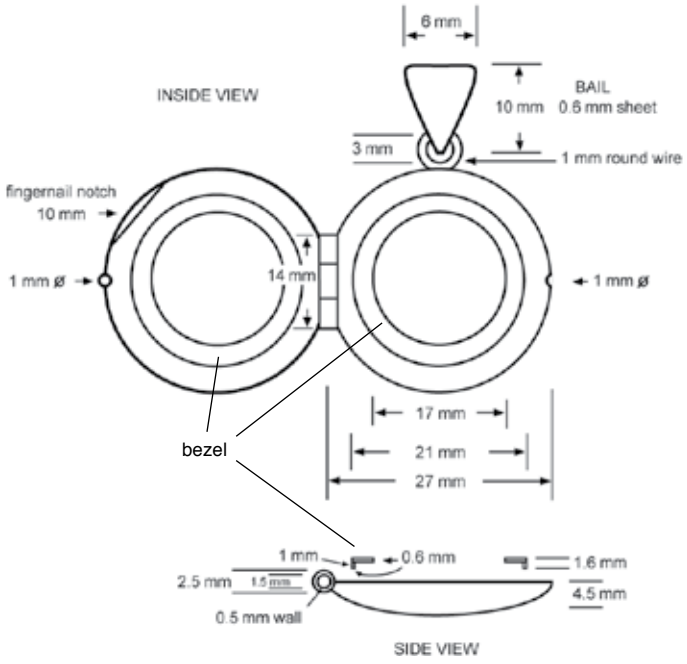


Figure 19.1 Diagram of the locket halves.

2 Mark and saw out two 27 mm disks from 0.6 mm sheet. There is no need to trim or file to the marks at this point.

Figure 19.2 Piercing two disks for the domed halves.

3 Apply firecoat and anneal the disks if they are not already soft. Use a dapping (also called doming) block as the die and use a punch to shape the metal. Most steel dapping blocks are deep and half-round. This wooden one is intended for watch cases and has shallow domed depressions. The matching wooden punch also has a low dome on the front end. Gently tap the punch to push the metal all around, rather than slamming it in one spot. Alternate working on both domes, so they match. Measure the heights of the domes to compare them. Stop when the two pieces are 4.5 mm tall.

Figure 19.3 Doming the locket halves.

4 Use a large flat file to establish a flat surface around the base of each dome (i.e., where they meet when held together). Alternate filing on both pieces until they have large, uniform flat rims.

Figure 19.4 Filing the rims flat.

5 On another piece of 0.6 mm sheet, lay out two 21 mm holes for the bezels. When the domes are placed over the holes and soldered, each side will have a frame for the bezel, 3 mm wide. Using dividers, layout two 21 mm circles on the sheet of metal, with a border of at least 4 mm all around.

Figure 19.5 Piercing the bezel holes.

6 After piercing the 21 mm holes, correct the shape with a half-round file. Finish the holes by using an inside ring sanding cone with coarse paper (220-grit or lower). These wooden tapered mandrels are intended for use at low speed on a polishing lathe, although they are also effective by hand. An alternate method is to wrap a ring mandrel with coarse paper. Twist the sand paper into the hole until the surface is uniform and round. Measure the holes and make sure they are round and identical in size (21 mm). Set these pieces aside.

Figure 19.6 Rounding the holes.

7 Make two bezels that will fit into the half domes to hold photos. The bezels should be perfectly round and fit exactly into the 21 mm holes. To calculate the length of the blanks for the bezel strips use this equation:

$$\pi \times (\text{O.D.} - \text{thickness}) - 0.5 \text{ mm} = \text{bezel length}$$

$$3.14\ (21 - 0.6) - 0.5 = 63.5 \text{ mm}$$

Note: O.D. refers to the outside of the bezel

Because it is easy to stretch a bezel, lay out the blank 0.5 mm too short as indicated, so that it can be stretched up later.

Cut two strips of 0.6 mm sheet, 2.5 mm wide and 63.5 mm long. Flatten the ends with a file and make sure there are no burs. Use half-round pliers to bring the ends together for soldering.

Figure 19.7 Forming the bezels.

8 Clean and flux the seams, then solder the bezels closed with hard solder. Use two mounted tweezers to set up both bezels for soldering at the same time. Quench, pickle, rinse, and dry.

Figure 19.8 Soldering the bezels closed.

9 Round the bezels on a ring mandrel. At first they should be too small to fit into the holes, because of the 0.5 mm taken away from the blank. This makes it easy to stretch them to fit tightly into the holes. Anneal the bezels, check again and make sure they are round. Finally, file one side of each bezel flat and remove the burs by sanding.

To prepare the base plates for the bezels, cut two 27 mm squares from 0.6 mm sheet. Bend each corner down using flat-nose pliers, taking care to keep the center of the sheet flat. Fire coat and place on a white reflective soldering pad. Flux the flat side of each annealed bezel and place it onto the center of the sheet. Use binding wire to gently hold the two assemblies in position. Place snippets of hard solder on the inside of each bezel where it meets the sheet. Aim a neutral flame at the soldering pad toward the front of the base plate, holding it at a 45-degree angle; this will bounce heat up underneath the bezel. Continue to heat and move the flame around the bezel until the solder flows. Quench, pickle, rinse, and dry.

Figure 19.9 Soldering bezels to sheet (note that fire coat has been omitted from the photo for clarity).

10 Use a saw to remove the excess around the bezels.

Figure 19.10 Sawing off the excess.

11 Use a flat file to trim the excess sheet flush with each bezel. Use long strokes with the file rolling away from you, at the same time, pivoting the work toward you on your bench pin. Correct the surfaces on the outside of both bezels being very careful not to remove too much metal. These two bezels must still fit tightly into the pierced holes in the sheet after filing, sanding, and polishing, so go lightly with the file.

Figure 19.11 Filing the bezel assembly.

12 Now prepare the two pieces of sheet with the 21 mm holes to be soldered to the two domed halves. In order to position them correctly, inscribe two guide circles around the holes on one side of each sheet. Do this by setting the dividers at about 4 mm. Rest one leg inside the hole as the other inscribes a circle around it on the surface. Clean, fire coat, and flux. On a charcoal block, position the dome, centered within the guide circle. Use binding wire to hold the parts in place and position snippets of hard solder generously around the dome, resting on the base plate.

Figure 19.12 Dome setup with solder.

13 Use a large neutral flame to join each domed half to the base sheet. Add solder as needed and test for complete flow by dragging a solder pick along the seams, as the solder is liquid. Quench, pickle, rinse, and dry.

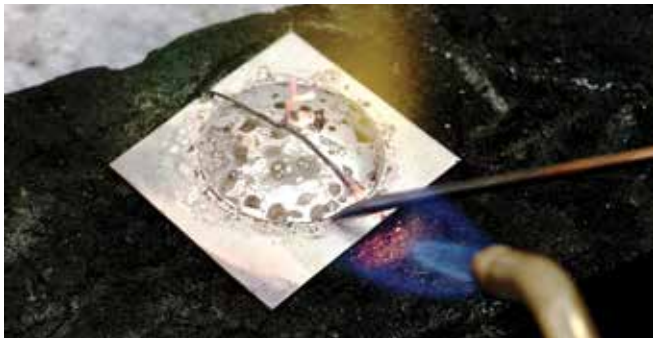


Figure 19.13 Soldering dome to base.

14 Trim the excess with a saw and then file the two halves until they are round.

Figure 19.14 Filing the domed halves.

15 After the bezels have been soldered to the bases and trimmed (Steps 8, 9 and 10), use dividers to lay out a circle 2 mm within the exterior. Pierce and remove the centers. File the interiors round using a half-round file.

Figure 19.15 Filing to round the interior of a bezel.

16 At this point the two bezels should fit inside the two locket halves. To adjust the height of the bezels, flip them over and insert them with the flat face first and the open bezel sticking out. Use a flat file to trim the excess flush with the frames. File slowly so that you do not catch and distort the thin metal edge. Repeat for the other side.

Figure 19.16 Trimming bezel heights.

17 The final step in completing the bezels is to sand the entire interior surfaces, bezels, and frames, flat. With the bezels inserted properly, sand the assemblies flat in preparation for polishing. Rub each half over a flat sheet of 400- and 600-grit paper in turn. Remove the bezels, mark which parts go together, then set them aside.

Figure 19.17 Sanding the interiors.

18 In preparation for filing the cradle, use epoxy to glue the halves together. When the glue sets, file the outer shape to be perfectly round and trim the contour as desired. The edge view of the locket can range from rounded to almost a sharp point. What matters most is that the shape and contour are uniform all over. With the assembly filed to perfection, use a large flat file to establish a flat spot on the seam, where the hinge will go. Continue to file, noting the shape of the flat area as it changes and becomes more elliptical with each stroke. Keep the file flat, level and centered as the hinge area stretches out to 12 mm long. It is important that the final surface be one flat plane: level and centered.

Figure 19.18 With halves glued together, file a flat spot for the hinge.

19 Select tubing with a 2.5 mm outside diameter and a wall thickness of 0.5 mm. The two halves each need a bearing (also called a *cradle*) to match the shape of the hinge. This means that you need a matching 2.5 mm round file, the same size and shape as the tubing. Most round files are tapered and will not work well for this because the size of the groove will not be uniform and the knuckles will not fit tightly.

Special files called cylinder files are available from suppliers in small incremental sizes. Best mounted in a handle or pin vise for gripping, these files do the job just right, matching the shape and allowing you to cut to any depth. Another type of file, which is also intended for this purpose, is a round-edge joint file, also available from suppliers in a range of sizes.

Use a cylinder file to cut a groove down the center of the long, elliptical flat spot where the halves meet. The groove must be centered, straight, and of even depth about 12 mm long. File until a third to half of the tubing is buried in the cradle. The tubing should sit evenly in the cradle, making contact everywhere. If the seat is not flat, the knuckles will be out of alignment. With the groove filed to perfection, soak the halves in hot water to loosen the glue and separate them with a knife.

Figure 19.19 Filing a cradle for the hinge.

20 Prepare a section of tubing to be soldered to one side of the locket. Each of the three knuckles will be 4 mm long, so the total tube section will be 12 mm. Use the bridge method for creating the knuckles (see *Project 25, Hinged Bracelet*), cutting out a 4 mm section, halfway deep, centered in the 12 mm section of tubing. Use binding wire to position and hold the tube section in place. If the tubing has a seam, place it downward, facing the cradle. Do not tighten the wire, or the bridge will be crushed. Fire coat the locket and hold in a third-hand to solder. Flux and place two small snippets of medium solder in contact with both tube and cradle.

Figure 19.20 Set up for soldering the outer knuckles.

21 Use a large neutral flame to heat the entire assembly. When everything is hot, pay a little extra attention to the hinge area until the solder flows onto the first side of the tubing. After cooling, pickling, rinsing, and drying, use a saw to remove the bridge. Saw from the inside out, right against the flat ends, leaving the two outer knuckles in perfect alignment. Trimming with a file is limited.

Now cut a new piece of tubing to fit the opening left by the bridge. This middle knuckle should fit perfectly with both ends filed flat. It should slide into place with a little pressure. Since the hinge will loosen through use, make it tight now. Ideally, the middle knuckle should fit so tightly that it can be pushed into place but not shaken free.

Figure 19.21 Soldering first side.

22 Fire coat the other locket half and hold in a third-hand with very light pressure. Position the center knuckle in the groove. Rotate the tube so the seam (if there is one) is down. Flux and place small snippets of medium solder along the seam and solder the tubing in place. After soldering, cooling, pickling, rinsing, cleaning and drying, check the alignment and make sure the knuckles fit together. Trim the end knuckles, and use a reaming broach to line up the interiors. Pull a piece of wire for the hinge pin, leaving it as large as possible so that a little force is required to insert it all the way.

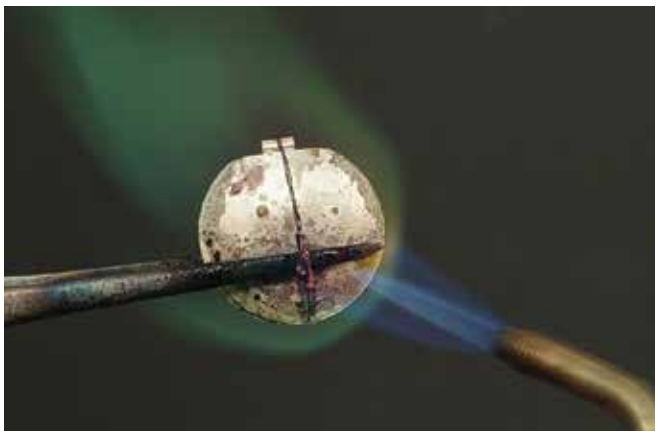


Figure 19.22 Soldering the center knuckle into second side.

23 A simple catch for this locket is placed opposite the hinge. Use a marking pen with a straight edge to lay out a cross on each side of the locket, to determine the correct locations of the catch and the bail jump ring. With the two halves held together, use the tip of a round needle file to file a small notch on the edge, opposite the center knuckle of the hinge. File a neat groove about 1 mm in diameter and 0.5 mm deep. File across the seam between the two halves, leaving identical aligned notches in each.

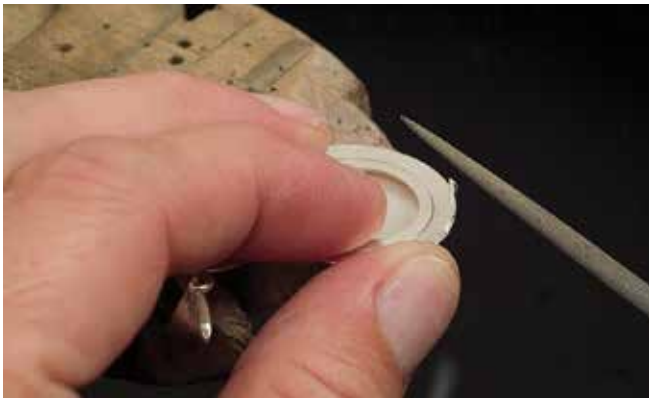


Figure 19.23 Filing a groove for the catch.

24 Draw a section of 1 mm round wire for the catch and prepare a jump ring for the bail by winding it around a 3 mm rod. File the jump ring flat on the seam and prepare to solder it at the top of the locket. Coat the locket halves with fire coat to protect the surfaces. Place both halves on a charcoal block. Stick the catch wire into the charcoal and position the front locket half with the single knuckle facing up to meet it. Place the jump ring on the charcoal and push it partially into the surface so that it rests at the desired height and place the other locket half in position next to it. Flux the seams, then use medium solder to join the catch and jump ring to the two different halves. Quench, pickle, rinse and dry.

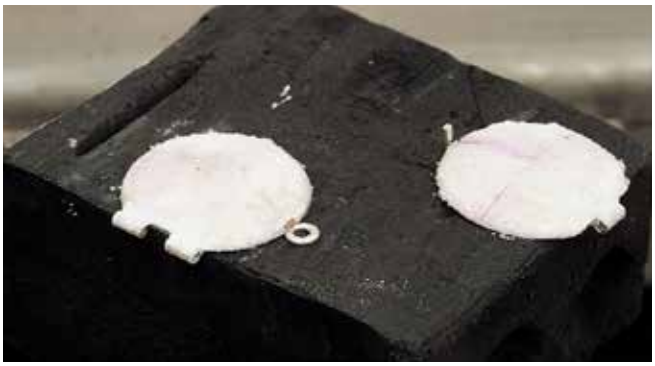


Figure 19.24 Setup to solder the catch and jump ring.

25 Cut a rectangle 6 mm wide and 22 mm long from 0.6 mm sheet for the bail. Shear both ends to a taper from the middle of the rectangle, leaving a lozenge shape. Use round-nose pliers to form the metal into a teardrop shape. Hold the pliers against a wooden surface for leverage. The ends should meet with an interior opening of 6 mm at the top.

Figure 19.25 Forming the bail.

26 Feed one side of the bail through the jump ring, flux the seam and solder the ends closed. Quench, pickle, rinse, and dry.

Figure 19.26 Soldering the bail in place.

27 On the front, trim the catch to a small nub and remove any sharp corners. Trim the end facing the back to about 2 mm. Use a section of 1.5 mm round wire for the hinge pin, adjusting as needed. Insert the pin, holding the halves together, and use a pair of chain-nose pliers to adjust the catch to allow the two halves snap together. Fine tuning the catch includes filing the edge that meets the back, adjusting the angle of the catch and polishing all moving parts. When the catch is adjusted properly, the two halves snap together with an audible "click."

Figure 19.27 Adjusting the catch.

28 Add an inscribed radial line texture to the front. Place some double-sided tape on a flat surface and mount the front half securely in place. Use a sharp scribe held against a flexible ruler to inscribe lines onto the metal. Select a point above the equator of the locket and to the left of center as the focal point of a radiating pattern. Pivot the ruler against this point as you inscribe lines deeply into the silver. Producing an effective texture means making so many small marks that they are seen as a group and not individually.

Figure 19.28 Adding a radial texture.

29 Insert the hinge pin and cut it off leaving about 0.5 mm sticking out from each end. With one end on an anvil or steel block, use a small riveting hammer to upset (flare) the ends, alternating working on both ends. Use a flat needle file to shape the ends of the upset rivet into equal hemispheres.

Figure 19.29 Upsetting the rivet.

30 The front half needs a small notch for your fingernail. Use a half-round needle file held at 45 degrees to carve a shallow curve about 10 mm wide into the top near the catch. Test the notch to make sure it provides a purchase to insert a fingernail for leverage.

Figure 19.30 Filing the finger notch.

31 Polish the locket carefully using small and large buffs and wheels. Buff with tripoli and polish with rouge. Cut two small circles of clear plastic for the lenses to fit inside the bezels. Cut two photos to fit in the bezels, behind the lenses.

Figure 19.31 Open locket with separate bezels, lenses, and photos.

32 After inserting the bezels, lenses, and photos, the locket functions as a private two-page photo album. The lovers in the photos forever gaze into each other's eyes.

Figure 19.32 Open locket.

33 The finished locket and its hidden memories is ready to wear.

Figure 19.33 Finished locket, closed.