

Professional Jewelry Repair Series

# SETTING REPAIR

*Alan Revere*

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San Francisco

Photography by Barry Blau

Illustrations by George McLean, Emiko Oye, and Christine Dhein



Setting Repair by Alan Revere  
Professional Jewelry Repair Series  
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Book designed by Alan Revere and Barry Blau

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Warning: The procedures described in this book can be harmful if not executed properly. Learn about the hazards of all techniques and materials before using them. Wear protective goggles and use proper safety measures. When in doubt, consult an expert.

Every effort has been made to ensure that all of the information in this book is accurate and represents procedures commonly used by bench jewelers at this time. Neither the author nor the publisher is responsible for any injuries, losses, or other damages that may result from the use of information in this book.

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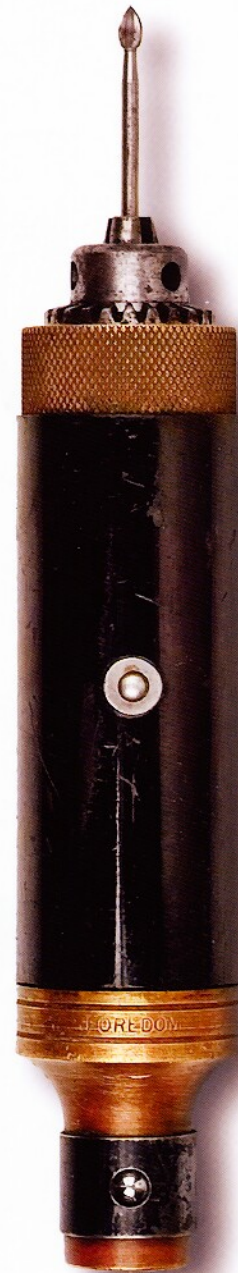
A few key people worked with me to make this book possible. Barry Blau, my photographer and friend, displayed both understanding and humor throughout the project. His technical ability to capture every detail, along with his artistic eye for composition, contributes substantially to making this book unique.

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Thank you all.

Alan Revere  
San Francisco  
January, 2008

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# *Getting Started*

Part 1



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# Introduction

We live in a throwaway society, one in which nearly everything is eventually discarded. Makers and consumers both understand and agree that today's products are designed to be tomorrow's trash. Nearly all of today's consumer goods are destined to be worn out, used up, outdated, out of fashion and rejected along with yesterday's newspaper.

But not so jewelry. In a class by itself, precious metal jewelry is never knowingly thrown away. And because it is one of our most important possessions, we include fine jewelry in our wills, to be carefully passed down to loved ones. In fact, jewelry is so highly valued in our society that when it is damaged or worn out, jewelry is taken to a specialist to be repaired.

Many of the items brought to jewelers contain gemstones. It is often the settings for these gems that need repair. Whether it is a worn prong, a damaged bezel, or a lost stone to be replaced, repairing stone settings requires specialized skill and knowledge.

Stone setting itself is really the art of compromise between two opposing goals: to hold the gem as securely as possible; and to show it off as much as possible. This means that most gemstones are held by small bits of metal that can easily become worn and damaged.

The harsh reality with jewelry is that rings, pendants and even earrings may be worn by the owner for days, months, or longer without being removed. For this reason, it is essential that jewelry bench technicians understand how to repair stone settings. While there is no substitute for hands-on experience, this book provides the next best thing. Through it, the reader can lean over a master goldsmith's shoulder and watch every detail as he explains each step in each procedure.

In the following pages you will find the most frequent stone setting repairs. Begin with the Procedures and Tools sections and then follow each



of the chapters documenting repair operations. No book can completely cover any subject. However, every effort has been made to include the most important, most up-to-date, and safest techniques on setting repair. Read and understand all procedures first and then do your best to replicate or modify them as appropriate.

The end result, which is more priceless than jewelry, is the appreciation shown by those people whose jewelry you have brought back to life.



## Warning

Some of the procedures described in this book can be harmful, or even fatal, if not executed properly.

These days, even lying in bed can be hazardous to your health, although you won't find any safety warnings under your pillow—at least not yet. Everything we do has some inherent risk, from crossing the street to slicing cheese to repairing jewelry. Some things are best learned by trial and error, but not safety precautions.

Here are a few important things to keep in mind as you read through this book and work at your own bench:

- Most important: Your health and safety are your primary responsibility, and yours alone.
- If you are unfamiliar with a process, chemical, or tool, learn about it before using it.
- Understand the risks and safety measures for all procedures before undertaking them.
- Think before you act. Imagine what could happen if things go wrong and what hazards may arise. Do your best to plan for the worst.

### In the workshop

- Maintain a completely stocked first aid kit within sight.
- Check your fire extinguisher. It should be in plain sight, easy to reach, and properly charged.
- Be sure that your facility complies with local, state, and federal regulations regarding fire, safety, and health.
- Remember: One careless second can change your life forever.



**Bodily protection**

- Tie back long hair, loose sleeves, and anything else that could possibly get caught in machinery such as polishing motors, grinders, and rolling mills.
- Keep your fingers out of harm's way when using polishing equipment, hammers, burs, drill bits, torches, gravers, and so on.
- Wear protective goggles when using spinning tools such as polishing motors, flexible shaft machines, and drill presses, as well as when using chemicals and solutions.
- Wear the appropriate dust mask or respirator when doing procedures that produce dust, such as polishing and sanding.
- When heating platinum, wear protective lenses specifically rated for the light emitted under the temperatures that are required. These should be at least #5 or darker.

**Chemicals**

- Collect and archive the necessary Manufacturers' Safety Data Sheets (MSDS), available from suppliers, for all chemicals and solutions.
- Do not throw hot metal into pickle solution. It can splatter, dispersing toxic and corrosive particles into the air. These are very dangerous and can harm your skin, lungs, eyes, and clothing. Throwing in hot metal also forces pickle into the deepest cracks, pores, and crevices of the metal, making it difficult to remove.
- Keep baking soda on hand for acid spills.
- Rinse recently pickled metal in a solution of baking soda and water.

---

# Procedures

The repair of stone settings combines jewelry repair techniques with those of setting stones. You need both sets of skills. But no matter how much skill and patience you possess as a repair technician, if the initial job was not properly executed, you'll find it difficult to repair properly. And it will be nearly impossible to improve on it without major reworking.

As you follow the projects documented within these pages, remember that each setting repair is a unique task with its own set of factors to consider. Always keep this in mind: Every time you accept a repair job, you are entrusted with a precious heirloom. Treat each piece with the respect and care you would give the item if it belonged to a member of your own family. Examine and evaluate your work as objectively as possible, and constantly strive to improve.

## Setting Theory

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There are many methods, but the goals are always the same: to reveal as much of the gem as possible; and to hold it as securely as possible. These opposing goals are reconciled by compromise and skill. Settings for gemstones can be divided into the following three general categories: bezels, prongs, bead.

You'll also come across channel settings, which resemble very wide prong settings, and a few other styles that combine aspects of the three main categories.



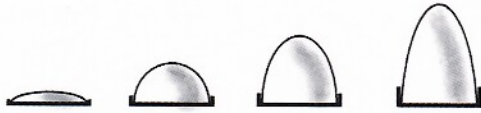


Figure P.1. Bezel heights

### BEZEL SETTINGS

A bezel is a metal collar that holds a gemstone securely in place. Bezels are the most common way to hold cabochons and are also used for faceted gems. Tube settings are a type of bezel. Most bezels are round, but they can also be square, rectangular, or any shape at all. The height of a bezel depends on the slope of the gem's sides (Figure P.1). Stone setters use hammers, punches, pushers, rollers, and burnishers to close and tighten bezels.

### PRONG SETTINGS

Prongs are posts into which seats are cut to match a stone's shape. Because prongs have far less contact with a stone than a bezel, it is especially important that they have proper seats and shapes to hold the stone securely (Figure P.2).

Setters use burs, files, pushers, and sometimes gravers to set stones in prongs. The most common repairs to prongs include tightening, replacement, rebuilding, retipping, and realignment.



Figure P.2. Prong setting

Unlike bezels and channel settings, most prong settings can be modified to accommodate a range of stone sizes. Merely moving the prongs symmetrically in or out is usually all that's required to make small changes in the size. As they are moved, the prongs' angle will change.

### PRONG ANGLES

The main goal of cutting seats in prongs is to hold the stone securely. This means that at the point where the prong captures the girdle of the stone, you'll remove less than half of the metal in the prong, leaving plenty to hold the stone (Figure P.3).

To prepare for burring the seats, adjust the prong angles (the openings for the stone) so that they will properly meet the stone and you can cut the seats accurately. Prior to setting, look at the prongs from

the top and sides to determine how much they should be opened or closed. If the prongs are designed to be vertical, then the stone should cover nearly half the prongs when viewed from above prior to setting. As the angle of the prongs increases and they flare out, the stone should cover a smaller portion. Use chain nose pliers or a pusher, working each prong individually, to adjust a setting for the correct opening. To raise a stone in a setting, close the prongs; to lower a stone, open them.

A general rule for selecting a setting is: When the prongs are angled slightly outward, the stone should rest just on their inside corners.

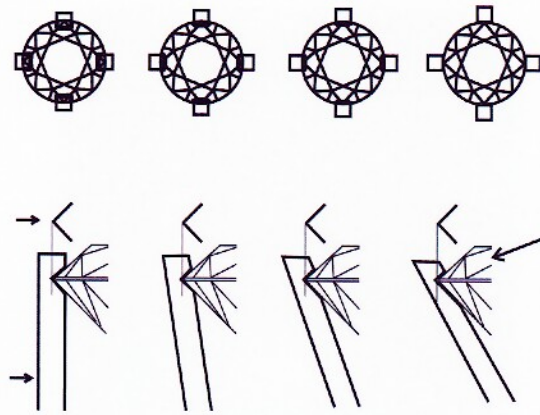


Figure P.3. Prong angles

### PRONG PROPORTIONS

Because prongs are so small and must cover as little of the stone as possible, they must work efficiently. Where prongs do cover a stone, they must be thick enough to withstand daily wear. For stones larger than 4 mm, the prongs generally need not be taller than the stone; they should rise to about 60 to 80 percent of the crown height and cover about 33 to 50 percent of the crown angle. For smaller stones, prongs can in some cases be even taller than the stone. At right are the guidelines for prong settings according to Jewelers of America's Jewelry Quality Assurance Guide (Figure P.4).

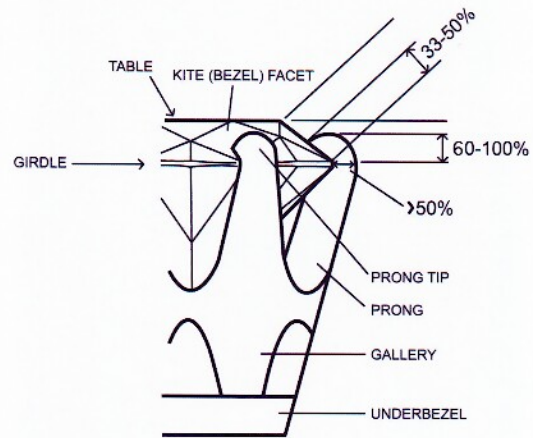


Figure P.4. Prong proportions

### TIPS FOR PRONG SETTING

- When setting a brilliant-cut gem greater than 3 mm in a 4-prong setting, rotate the stone so that a kite facet lines up with each prong.
- Before locking a stone into the setting, make sure it is level.
- To shift a crooked stone, lift the prong on the low side of the stone. Straighten the stone and push down the prong on the high side.
- After setting, you should not see any light between the prongs and the stone. Hold the work up to a bright light to check the silhouette view (Figure P.5).



Figure P.5. Silhouette view

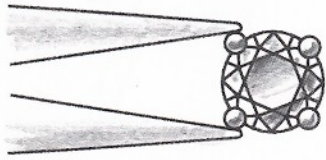


Figure P.6. Tightening prongs

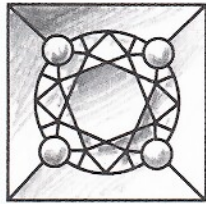


Figure P.7. Bead and bright-cut setting

- Always lubricate a bur with wax or by dipping it (when it's not spinning) into a tin containing a cotton ball soaked in a lubricant such as wintergreen oil, soap, or kerosene.

- The shape of the bur should closely match the stone's girdle. The bur should be slightly smaller than the stone, but make sure that it is not so small that it can slip between the prongs, where it will do severe damage.

- Tighten prongs by using chain nose pliers to squeeze adjacent prongs together around the stone (Figure P.6).

---

### BEAD SETTINGS

Also known as bright cut, plate, and pavé, the bead style is common for setting small diamonds into gold or platinum surfaces. Setters primarily use burs and gravers to cut seats and move metal. Because stones set in this manner are low and the beads that hold them are recessed, bead settings usually wear well over time. Diamonds are frequently bead set into nickel white gold, which is more durable than yellow gold. You may have to replace worn beads and occasionally replace a bead-set stone (Figure P.7).

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## Inspecting an Item Prior to Repair

When jewelry is brought in for repair, the person accepting the work inspects it and writes up a job envelope. This person is responsible for correctly filling in the blanks, but the repair technician is equally responsible for checking every detail for accuracy.

Before you begin any repair, carefully inspect the piece. Note anything that may affect repair operations, and answer these questions: What is it made of (what are the metals and gems)? What damage is there to the gems and metals? How was the item made? Where are the solder seams, if any? Ask the customer or make your own determination about whether this piece has been repaired before. Were previous repairs well executed? Will the current repair require solder? If so, will you need to remove the

gems? And perhaps most important: What can go wrong?

When you are handed a job envelope, make sure that the item matches the description. If the person who took the job missed anything, bring it to the attention of management before you even clean the piece. Now, rather than later, is the time to document flaws such as small abrasions on the stone. After you accept the job, any prior damage that has not been recorded becomes your responsibility.

Remember that all promises and guarantees must be in writing. Oral agreements that are not noted on the envelope do not count.

### *WRITING UP A JOB ENVELOPE*

Write up the repair order on the appropriate form or envelope, (Figure P.8) making sure the information is accurate. Do not guess and do not take the customer's word for anything. The person in front of you may say that her round blue gem is a sapphire, but that does not make it so. **Write only what you know with certainty.** If you are not a gemologist, write only a description such as "blue, round, faceted gem." Get assistance from a pro to avoid making a costly mistake: If you write "sapphire," you are responsible for delivering a sapphire, regardless of what you were handed.

### *OPENING THE JOB ENVELOPE*

The cautions above apply. When you receive a job envelope, carefully read and verify all the information. Once you accept the envelope, any problems you did not bring up immediately become yours.

### *CLEANING PRIOR TO REPAIR*

Cleaning is essential before repairing jewelry—especially any item that will require heating. When a piece of worn jewelry is heated, built-up dirt and other impurities carbonize and can turn into a tenacious black residue on metal and gems.

NO GOODS DELIVERED WITHOUT THIS CHECK

No. 0618

WE WILL NOT BE RESPONSIBLE FOR GOODS LEFT OVER 60 DAYS

DATE RECEIVED \_\_\_\_\_

DATE PROMISED \_\_\_\_\_

No. 0618

ARTICLE \_\_\_\_\_

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

REMARKS: \_\_\_\_\_

REPAIRED BY \_\_\_\_\_

TOTAL CHARGES \_\_\_\_\_

No. 0618

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

PHONE \_\_\_\_\_

ARTICLE \_\_\_\_\_

DATE REC'D \_\_\_\_\_ PROMISED \_\_\_\_\_

INSTRUCTIONS: \_\_\_\_\_

REC'D BY \_\_\_\_\_

CASH  WEEKLY  SEMI-MO.  
 MONTH  WILL CALL  MAIL

CHARGES		
FEDERAL TAX		
STATE TAX		
TOTAL CHARGES		
DEPOSIT		
BALANCE ON DELIVERY		

Figure P.8. Job envelope

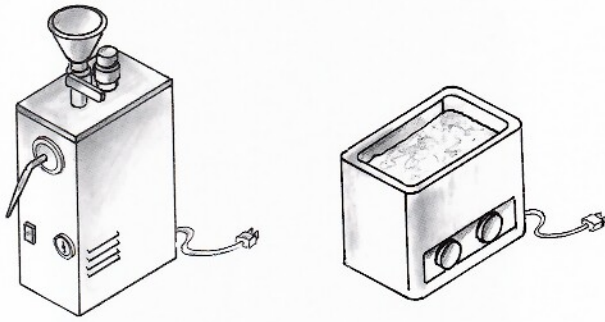


Figure P.9. Steamer and ultrasonic

For most jewelry, cleaning means putting the item in an ultrasonic bath to loosen the dirt and then using a steamer to blow it away (Figure P.9). Not all gems can withstand this type of cleaning, however. Refer to the chart in Appendix I to learn which stones can. If an item contains very small stones that could be loose and fall out during cleaning, put it in a closed mesh basket before placing it in the ultrasonic bath.

---

### EXECUTING A REPAIR

- Take time to examine items before beginning.
- Inspect for chipped stones.
- Compare the item to notes on the job envelope.
- Plan your work.
- Protect the gemstones.
- Conserve the metal's dimensions.
- Work accurately and efficiently.
- Maintain quality marks and engraving.
- Disturb as little as possible.
- Deliver the item repaired and rouge-free.

Put simply: Except for your repair, the item should remain unchanged.

---

## Soldering and Heating

### FIRECOAT

After cleaning and prior to soldering, apply a firecoat to the surface. You can make this solution by mixing powdered boric acid with denatured alcohol at a ratio of about 50-50 by volume (Figure P.10). Either dip the piece or paint it with solution. Ignite the mixture with a fuel-only flame to burn off the alcohol, leaving a powdery white coat. When heated, this coating forms a kind of glass that seals the metal and protects it from oxidation. It protects a polished finish as well as gems that you will heat during soldering. Do not apply firecoat to platinum.

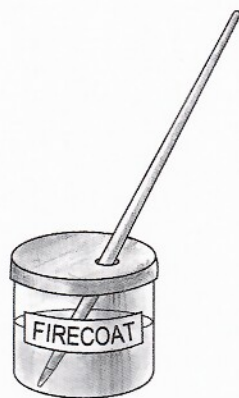
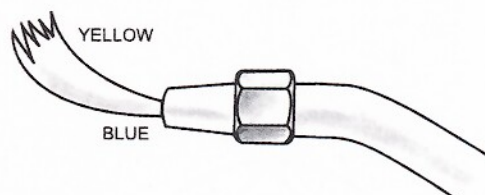


Figure P.10. Firecoat



### *FUEL-ONLY FLAME*

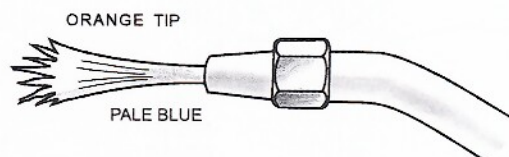
As indicated by the name, this is a yellow flame that has no oxygen—it consists only of gas and the small amount of oxygen it can pull from the air nearby (Figure P.11). It is a relatively cool flame and is used for tasks such as warming dop or shellac and igniting firecoat.



*Figure P.11. Fuel-only flame*

### *REDUCING FLAME*

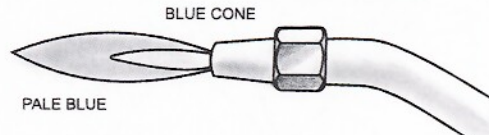
This flame has just enough oxygen added to the fuel to produce a long, bushy, light blue cone with a bit of orange at the tip (Figure P.12). This flame consumes oxygen from the air around it, and is suitable for heating and soldering. Use it to anneal metal and to heat a piece slowly to dry flux before soldering.



*Figure P.12. Reducing flame*

### *NEUTRAL FLAME*

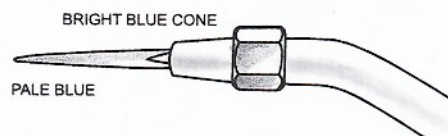
This is often the best flame for general heating and for soldering silver and gold. A neutral flame has a slightly bushy, light-blue cone at its center (Figure P.13). The hottest part is just beyond the tip of this inner blue cone.



*Figure P.13. Neutral flame*

### *OXIDIZING FLAME*

When you add more oxygen, the flame changes color, shape, sound, and function (Figure P.14). Characterized by a bright blue cone and a faint hissing sound, this flame can be used for localized heating. It will not heat large areas well unless you move it around a lot.



*Figure P.14. Oxidizing flame*

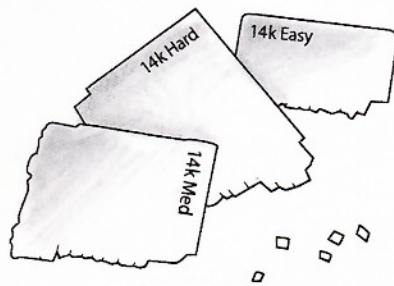


Figure P.15. Solders

### WHICH GRADE OF SOLDER TO USE

For repair purposes, jewelers can choose from a larger range of solder temperatures than for fabrication, where there are different requirements (Figure P.15). Repair technicians can use hard, medium and easy solder in the same karat as the piece plus repair solders, which are even lower in temperature and karat. In general, hard solder will match the color best and resist wear virtually the same as karat gold.

Nonplumb solders (in the past, 13.5k and 17.5k were legally acceptable), repair solders (generally 3 to 4 karats lower), and medium or easy plumb (14k or 18k) solders will be more susceptible to tarnish and corrosion than either hard solder or the plumb karat gold in the object.

Some jewelers insist on using only high-temperature plumb solders for prong repairs such as retipping, while others maintain it is safer for diamonds to use easy solder.



Figure P.16. Platinum goggles

### SOLDERING PLATINUM

To start, you *must* wear welding goggles specifically approved for platinum work (Figure P.16). They should have a #5 lens or darker. Don't take chances where your health and vision are concerned.

Platinum's popularity as a jewelry metal has grown rapidly. With its increased use comes the need for repair technicians who are skilled in working with this metal. In most ways, platinum behaves like gold and silver. It saws, files, forms, forges, and sets much like the other metals. However, the heating procedures for repairing platinum jewelry are unique because the metal requires very high temperatures for annealing, soldering, and welding. When adding new tips to platinum prongs, it is customary to use white gold solder.

## Gems

### REPAIRING DIAMOND JEWELRY

The world of diamonds has changed more in the last 50 years than it did in the preceding 20,000. Until recently, jewelers ran little risk leaving diamonds in place during soldering repairs. Soldering near and even directly on diamonds rarely caused a problem if certain precautions were taken: The item was clean, coated in boric acid, brought to temperature very gently, heated evenly overall and not directly in one spot, and allowed to cool slowly. But thanks to modern technology, bench jewelers are faced with a new set of challenges (Figure P.17).

Today, diamonds—even small ones—are often treated in a variety of ways. Diamonds can be drilled with a laser to remove dark inclusions. They can be filled with lead glass to decrease the cloudiness of a fracture. They also can be treated with high temperatures and pressure to improve color grades. All of these treatments to improve a diamond's color grade and clarity also increase a stone's beauty and therefore its value. According to the Federal Trade Commission, such treatments must be disclosed to buyers, but that doesn't always happen.

The problem is that gem treatments are not always permanent or stable. Common procedures during jewelry repair such as steam cleaning, immersion in an ultrasonic bath, pickling, contact with solvents, electroplating, and exposure to ultraviolet light may damage a fracture-filled diamond, causing it to revert to its original condition.

Jewelry repairers take note: Before undertaking potentially risky procedures, remove diamonds and gems if you suspect they have been treated. And remove all gems that you cannot afford to replace if they are damaged in your care. Simply put: **If in doubt, take it out.**

Knowledge of gems and skill in working around them are indispensable if you want to be certain to return a customer's property in the condition in

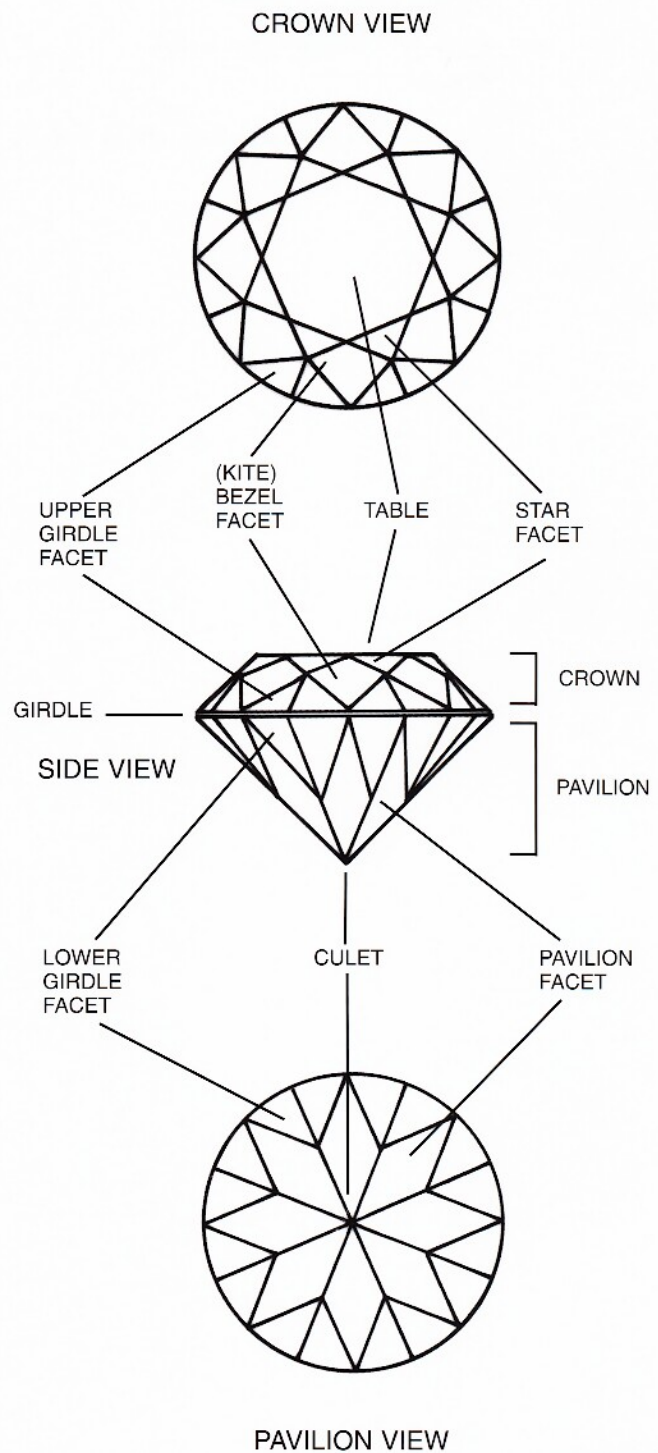


Figure P.17. Parts of a diamond

which you received it. On the bright side, you can easily learn to spot a treated diamond even if you are not a gemologist. You can get the necessary information from videos, books, trade journals, and classes. Take the time to educate yourself.

---

### *HEATING GEMSTONES*

All stones are sensitive to heat, some more than others. Most experienced bench jewelers are comfortable soldering near diamonds, rubies, and sapphires once they have determined that the stones are not treated. As stated above, if you are not certain that a stone can withstand the heat of a procedure, remove it. Consult the chart in the appendix for the suggested heat tolerances of common stones, but note that this chart is only a guide and not a guarantee.

Cracking and frosting are among the risks of overheating diamonds, and some cuts are more prone to damage. Diamonds with points, such as pears and marquises, are extremely sensitive to heat, especially when it is uneven, which results in cracks at the thin points. Frosting or “burning” a diamond is often the result of heating a dirty stone so high that the surface dirt carbonizes onto the surface, requiring that it be repolished.

And finally, if you are certain that a stone can withstand the required heat and that it is not treated, you can go ahead and carefully solder the item. That means begin to heat the entire piece very slowly using a neutral flame as you gradually bring it to the soldering temperature. At this point, you can adjust to a hotter, more oxidizing flame in the specific area of the repair. And always be sure to maintain heat over the entire gem. After soldering, allow the work to cool very slowly, placing it on a warmed charcoal block or under a glass jar to slow the cooling process.

---

### *Finishing and Polishing*

Plan ahead. Always finish the interior of a ring before the exterior and always polish a ring before setting a stone (Figure P.18)—after setting, some areas may be inaccessible. A soft-bristle brush, such as a goat-hair