Faceting Machine Instructions

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Chapter One

Components
Your new Shaw faceter is a precision machine which has been aligned and checked for accuracy at the factory. Never adjust the screws and bolts at the base of the platform support at any time since this will cause a misalignment of the platform, and the unit will have to be returned to the factory for realignment.

Your faceter can be used as either a right hand or left hand machine, depending on how it is set up. The picture above shows the faceter set up for right hand operation. The machine can be set up for a left hand person simply by turning the base around, and installing the water pot post in the other available threaded hole.

You will notice on the faceting head a notched plastic disc covering the 96 tooth gear. This Facet Finder (pat. no. 3940888) has four inner holes imprinted with the letters M, S, G and G. Detailed instructions for the use of the facet finder are given in Chapter Four.

Your faceter is designed to accept "keyed" dops. If you will look at a dop, you will see a pin protruding a short distance from the end of the shah. Examining the head, you will notice a groove in the dop holder. The dop should be positioned in the holder so the pin is seated in the groove then secured in place with the dop locknut located just above the index wheel nut (see Fig. 2). This "keying" insures that the dop always returns to the same position no matter how open it is removed from the head.

The dops supplied with your unit are precision made to prevent chatter and offer a selection of shapes and sizes for variation in size and cut of stone. Choose a dop about 1/2 smaller than the stone to start cutting, then the next size smaller when transferring from pavilion to crown.

The transfer jig utilizes the keyed dops described above to transfer your stone from pavilion to crown without any loss of alignment. Complete instructions on use of the fixture are given in Chapter Four.

Two cutting laps are supplied with your machine. The 360 grit Dimafast F is an electrobonded diamond lap for preforming and cutting in large facets. The channeled construction provides exceptionally fast cutting action while improving coolant flow and swarf removal. The 600 grit Nubond has a higher concentration of friable self-sharpening diamond bonded directly to a solid aluminum backer. This lap is used for cutting small facets and prepolishing all facets. Also supplied with your faceter are two polishing laps. The phenolic is a general purpose lap, used with either diamond or oxide polishes. The tin lap is popular for a wide range of stones using oxide polishes.

The operation of your Shaw faceter is very simple. To begin, make sure your splash pan is seated firmly in place.
Run your discharge hose down to a container to catch the water. Never reuse this water! Always fill water pot with fresh tap water to avoid possible contamination of your lap.

Check the face of the flange and the mating surface of the lap to be sure there are no particles which will cause the lap to tilt, then place your lap on the flange, fitting over the center pilot (see Figure 4).

The threaded rod in the center of the shaft should be tightened with the Allen wrench provided. This rod is removable so the lap may be mounted flush if desired. The rubber-covered nut is used to secure the lap in place. When you are mounting only one lap, use the B side of the nut as shown in Fig. 4. When more than one lap is used, for example, a polish lap with a master lap, the A side should be used to secure and center the laps. The splash pan can now be adjusted to catch the water spinoff.

To turn the machine on, turn the motor speed control slowly in a clockwise direction stopping at the desired speed (usually between 400 RPM and 700 RPM for cutting and between 150 RPM and 400 RPM for polishing.) The direction of rotation of the lap is controlled by the reversing switch (see No. 4, Figure 5.) For right hand use, the switch is normally used in a forward position. Occasionally, on difficult to polish stones, reversing the direction of rotation will be beneficial. Never change direction of lap while motor is running. Always let motor stop, then reverse. Should you need to replace a fuse, unplug the line cord, then push in and turn the fuse holder cap counterclockwise. Change the fuse (3AG-3A) and replace cap. If the machine does not operate, or blows the new fuse again, contact your dealer, or the factory for advice.

The head is placed on the platform with all three feet firmly seated. Before cutting begins, be sure the two black cheater knobs register zero when turned clockwise. These knobs are used for minute adjustments of the facet angle to compensate for variations in lap surfaces and for fine adjustments of index settings on complicated cuts (See Chapter Four). The front rest point should also be turned clockwise until tight.

The head should be held so the palm rests on the rear edge of the frame. The index finger and thumb should be laid on either side of narrow portion of the casting.

The rotation of the lap is controlled by the reversing switch (see No. 4, Figure 5). This enables the machine to be used by a right or left handed operator. As the faceter comes out of the packing carton, it is setup for right handed operation. To change to left handed operation, unscrew the...
water pot support and reposition in front of the lamp (see No. 11, figure 1). The unit is now ready for left handed operation.

To set the protractor angle on faceter head to any full degree setting, simply line up the “O” mark on the vernier with the desired degree line on the protractor (Figure 6A shows the angle set at 42°). It is open desirable to accurately set an angle to \( \frac{1}{4} \) or \( \frac{1}{2} \). To set the angle to 42-\( \frac{3}{4} \) for example, move the tilt head so that the “O” line on the vernier is about \( \frac{1}{4} \) of the way between the 42° and 43° marks on the protractor. Then look at the \( \frac{1}{4} \) mark on the vernier, and line it up exactly with the nearest degree line on the protractor (see figure 6B). Use the same procedure to set the angle to 42° (or 42-\( \frac{3}{4} \)) except to move the tilt head so that the vernier “O” line is about \( \frac{1}{4} \) way (or \( \frac{1}{2} \) of the way) between 42° and 43°, then line up the \( \frac{1}{4} \) (or \( \frac{1}{2} \)) mark with the nearest line on the protractor (see figure 6C).

The same basic procedure is used for setting the angle on the 1/10° vernier model. Again, the “O” line on the vernier is moved to the approximate position (38.3 for example). Then line up the .3 line on the vernier to the nearest degree line on the protractor to fine tune the adjustment.

To lockout the index latch on the faceter head, simply push down the latch and swing the lockout to the sightsee (figure 7). This allows the index wheel, along with the dopped stone, to turn freely for preforming round shapes.

Chapter Two

How facets are formed and names of each part of a faceted stone

The term “cut” refers to the general shape of a stone and the number, angles, and location of its various facets, see Fig. 8. The line of largest diameter in any cut stone is known as the girdle. All that part of the stone above the girdle is called the “crown” and all that below the girdle, the “pavilion”. The large facet on the top of the “crown” is called the “table”.

The crown in a standard brilliant cut has 33 facets (including the “table”) while the pavilion has 24, giving a total of 57. The table is surrounded by 8 triangular facets called “stars”, a row of eight kite shaped “mains” and sixteen elongated triangular “girdles”. The pavilion has eight diamond-shaped “mains” and sixteen “girdles” but no stars; in some cases, a tiny facet called the “culet” is added at the point.

To illustrate how the various shapes result automatically from the cutting of one row of facets at a certain angle and spacing, then a second row at another angle and spacing and so on, take any ordinary chalk crayon and smooth one end flat. Next hold it at about the
angle shown on figure 9 and draw it slowly and firmly across a sheet of rough wrapping paper laid on a table or other hard surface.

By wearing away the chalk, you form a flat surface of "facet". The end of the crayon will now appear as in Fig. 10A. Now, turn the crayon half way around in your fingers and cut a second facet opposite the first, giving the effect shown in Fig. 10B. Follow this by a third one between the first two as shown at 10C, then a fourth opposite as shown at 10D.

In the case of a real stone, the cutting would be continued until there were eight facets instead of only four surrounding the "table", and the table itself would then be in the shape of an octagon as shown in Fig. 11A.

After the eight mains have been finished, the next step would be the cutting of the eight triangular stars, these being spaced halfway between the mains as in Fig. 11 B. and finally the sixteen girdles after which the crown of the stone would appear as in Figure 11C.

Fig. 12 shows the pavilion. Fig. 12 A shows the eight "mains" which meet at the point or culet. Fig. 12B shows the pavilion after the addition of sixteen girdle facets. The pavilion of a brilliant would be cut in the same manner as the crown except that it would have only main and girdle facets, no stars and no table.

When using a mechanical tacker, the spacing of the facets in each row is governed by a "slotted disc" or "index wheel" with numbered slots. Index wheels are available with 64, 72, 80, 96 and 120 teeth. The larger number of teeth, the more complex a stone can be cut. Your Shaw faceter features a 96 tooth index in combination with the exclusive Facet Finder with 8 teeth for simplifying the indexing operation. 64, 72, 80 and 120 tooth indexes along with 10, 12 and 16 tooth Facet Finders.

In a later chapter, step-by-step directions will be given for cutting a modified brilliant. This is recommended for a first attempt at faceting. It will have but 25 facets in stead of the 57 of the standard cutout will be enough to give you the "feel" of faceting. Cutting a simple stone like that will give you confidence and help you to realize that there is really nothing mysterious or difficult about the work. Then you will be ready to tackle the standard brilliant with its full complement of facets. Surprisingly, you will be able to cut it in less time than it took you to cut your first stone with less than half the number of facets.

Chapter Three

Selecting stones for faceting, how to dop a stone, and perform on a grinding wheel

In preparation for the cutting of your first stone, select a few pieces of clear quartz material as nearly spherical as you can find them and weighing four or five grams. They will probably be broken crystals and look something like those sketched in Figure 13.

Examine them carefully for seams, cracks and surface flaws. At the dealer's shop, you can give them only a superficial examination, but at home, you can immerse them in an oil sold for this purpose and check for bubbles, feathers, inclusions of foreign matter, irregularity of color, etc. Common household
liquids like olive oil, mineral oil and glycerin can be used for this with many stones. Immerse each stone by itself, holding it with a pair of tweezers and study it carefully from all sides as you look at it through the light.

Once the flaws have been identified, a flat spot should be ground where the table is to be. The flat should be a little larger that the dop that will be used. (see Figure 14).

In order to hold a stone securely in place while it is being faceted, it must be attached to a metal rod called a "dop". The operation is known as "dopping" and is performed with a material that is hard at room temperature but softens when heated like ordinary sealing wax. There are various ways of handling it. Some cutters melt the wax in a shallow tin and dip the ends of the dops in it, picking up a blob on the end of each dop (see Fig. 15A) which is then rolled on a cold metal surface to the form of a cone (15B) and then flattened to receive the stone as at 15C. Flat ended dops are used first to provide solid support for the flat surface of the stone prepared earlier. Some people prefer to hold the wax (it comes in sticks or cakes) well above the flame of an alcohol lamp to soften it somewhat without causing it to drip while heating the end of the dop in the flame itself finally using the dop to dig the desired quantity out of the cake.

Only metal dops should be used with mechanical faceters, and they should be long enough (at least 3") so one end can be held in the fingers while the other is being heated. They should be provided with means (such as a side pin that fits into a notch) to insure their going back into the faceter in the exact position no matter how many times or at what intervals they are removed.

After the dop has been prepared in the manner outlined above, clean the stone with alcohol to remove any oils, then hold the stone in a pair of large tweezers about 2" above the flame of an alcohol lamp keeping it constantly turning to insure it's being evenly heated and at the same time passing the waxed end of the dop back and forth through the flame until the wax softens. As soon as the wax is about to drip, hold the stone down on a bare tabletop or small block of wood with the flattened spot up, and push the dop down against it, hard. Holding it in this position, drop the tweezers, moisten the thumb and first finger of your free hand and quickly push the wax into contact with both the stone and the dop. It is usually necessary to reheat the stone and dop together once or twice to insure a complete bond has been made.

Some stones are heat sensitive artful may fracture when exposed to direct heat. An alternative method uses a large size fruit juice can that has had one side cut partially away. This allows the alcohol lamp to be positioned inside, the flame heating the end of the can. Your rough gem can then be placed on the end of the can allowing a more controlled temperature rise. If necessary, a piece of cardboard can be placed under the stone to slow heating rate even further. When a small piece of dop wax placed on the stone melts, the stone has reached the proper dopping temperature and dopping can proceed as outlined above. A "Hot Dop" unit will melt the wax and heat the stone safely.

NOTE: Caution should be taken that the dop wax is not allowed to burn as this destroys its adhesion. Also, a clean flame is important, as any deposit of carbon or soot on the stone or dop will cause incomplete bonding.

A new technique just developed allows what is called "cold dopping". Cold dopping utilizes one of the many fast-setting epoxy cements on the market to attach the stone to the dop. After cutting is completed, the cement is dissolved by a chemical solvent that has been designed for
Cut 8 mains at 43°, indexing 12, 24, 36, 48, 60, 72, 84, 96.

If the stone is painted with shellac and left to dry just a few minutes before being heated for dopping, the dop wax will "hold" onto the stone with a very firm grip. Useable shellac can be made by dissolving scraps of wax in a little alcohol.

With the rough stone mounted on the dop, work with the grinding wheel to remove some of the excess material. This could be done on the cutting lap or while cutting the main facets, but the wheel will do it in a quarter of the time. If the grinder is equip'ed with a tool rest, set the rest as close as possible to the face of the wheel with the dop held horizontally and parallel to the wheel face. Hold the stone so only the high spots can touch the wheel and turn it slowly around, wearing the high spots down gradually until the stone approaches the form of a cylinder. DO NOT PRESS THE STONE HARD AGAINST THE WHEEL OR ALLOW THE STONE TO CHATTER AGAINST AN UNDRESSED WHEEL.

If the grinder has no tool rest, the dop may be held by hand only. Use both hands, holding the dop firmly, not tensely, as shown in Fig. 16. Take your time, and remember you are only trying to get rid of most of the unwanted material, not all of it. With this faceter there is no need for preforming a perfect cylinder. When the pavilion main facets are cut and the girdle line is established, as shown in Chapter Four, a perfectly centered stone will result.

Now, grind the end of the stone to a conical shape as shown in Fig. 17. The pavilion main facets will be cut on this preformed. Be sure to leave enough material for the crown. If you are unaccustomed to work of this sort, you may find it helpful to have a support for your hands, especially the one nearest the grinding wheel. A block of wood or a small box placed on the bench will do very well.

The Preformer

Attaches to the faceter, and helps you make accurate preforms very easily and quickly. As you get into more advanced cuts such as ovals, marquise and pear shapes, the preformer will save time and eliminate the tedious hand shaping operation.

Chapter Four

A complete step-by-step description of how to cut and polish a simplified brilliant

Now that you have selected a stone to cut and dopped and preformed it as instructed in the last chapter, you are ready to start to cut your first brilliant stone. This procedure describes cutting the pavilion first though some faceters prefer to cut the crown first.

As you have seen, a standard brilliant cut has 57 facets with all but the table arranged in rows of 8 or multiples of 8. Thus, on the pavilion, you would cut 8 main facets at a certain angle then at another angle, 16 girdle facets. The same procedure is followed on the crown but for the addition of a row of eight star facets and the table. If you were to look up the cut in one of the faceting manuals on the market, you would be given instructions similar to those below for cutting a pavilion.

Cut 8 mains at 43°, indexing 12, 24, 36, 48, 60, 72, 84, 96.

Cut 16 girdle facets at 45° indexing 3, 9, 15, 21, 27, 33, 39, 45, 51, 57, 63, 69, 75, 81, 87, 93.
This can be confusing to a novice, and the best of cutters has no doubt at one time set the index for 11 or 13 instead of 12 and had to recut the stone. Your Shaw faceter offers a solution to the confusion in its exclusive facet finder (Pat. No. 3940888).

The facet finder sits on top of the 96 tooth index wheel. When the hole labeled “M” is seated on the aluminum pin, the eight notches on the outside of the plastic disc automatically index the trigger to your eight main facets: 12, 24, 36, 48, 60, 72, 84, 96. If you gently raise the facet finder off the pin and turn to the left to the first “G” position, the eight notches will be set for the eight right girdle facets -3, 15, 27, 39, 51, 63, 75 & 87. The second “G” position will give the other eight led girdle facets, and the “S” will set the eight crown star facets.

Place the dopped stone in the faceter head, being sure that the dop pin is in the notch of the holder and pulled tight by the knurled nut. Set the facet finder in the “M” position and be sure that latch rests firmly in one of the notches of the index wheel. Set the protractor at 43°, the facet angle required for optimum brilliance for members of the quartz family (see chart on page 27.) To do this, loosen the facet angle adjustment (figure 2), and move the tilt head until the “O” point on the vernier lines up with the 43rd division on the protractor, then tighten the knob. Install the coarse diamond lap (360 grit Dimafast Flap) on the arbor and tighten the rubber covered nut by hand. Start faceter running in clockwise direction (counter clockwise if left handed) and adjust speed to medium or fast. Adjust the water flow to about one drop per second. The drops should fall on the lap close to the center and on the side away from you.

Make sure each of the rest point cheater knobs register zero when turned clockwise, then place the faceter head on the platform with its three rest points inside the guard rail and with its forward end extending out over the lap.

Hold the faceter down on the platform by resting one hand on it as shown in Figure 19. With the other hand, turn the handwheel in a clockwise direction lowering the platform until the stone touches the lap. Listen to the sound it makes. It will cease almost immediately, indicating that the cutting has stopped. When you started cutting, the middle rest point was raised off the platform. As material is cut away, the rest point is lowered until it retouches the platform, then cutting stops. Lift the faceter head and turn it upside down with the stone away from you and pointed directly toward the light. You will see a tiny flat spot on the stone - the beginning of a facet.

The handwheel has depressions in its rim on the upper and lower sides. The space between each depression raises or lowers the platform about twice the thickness of this paper. Now, lower the
platform about one space on the handwheel, and rest the faceter on the platform holding it
down as before by resting one hand on it. Swing the stone back and forth across the lap until the
cutting has again stopped. The flat spot will be larger.

Note: When lifting the faceter head from the platform, lift the front end of the faceter head before the
two rear rest points. This will prevent accidentally hitting the lap and spoiling the facets you have just
cut.

Without changing the height of the platform, release the latch and turn the facet finder
clockwise until the latch drops into the next slot. Place the two rear rest points on the
platform and lower the stone gently into contact with the lap. Cut the second facet and
repeat in this manner for each facet in turn until the facet finder is back in its first
position and all eight facets have been cut. They will vary in size, and it is quite possible
that no cutting whatsoever will have taken place at some of the positions. Pay no
attention to this, but continue to lower the platform one space at a time and cut the
facets around the stone repeating as many times as necessary to bring them to a sharp
point as shown in Figure 20A.

This may seem ridiculously slow, but remember, this is just to give you the “feel” of
faceting with a machine that is wholly unfamiliar to you. Later you will find yourself
lowering the platform several spaces at a time and completely cutting eight facets in as
many minutes or less.

While the eight facets you have just cut will vary in length, if you have followed the directions
carefully, they will all be cut to the same depth which is essential if they are to meet at the exact
center of the stone. It is now an easy matter to establish the girdle line by setting the angle to 80°
and lowering the platform until cutting begins. Cut one or more times around until the girdle line
is straight and unbroken all around the stone as shown in Figure 20B. This completes the rough
cutting of the pavilion facets, and you are ready to prepolish them.

Remove the coarse lap and replace it with the 600 grit NuBond lap used for fine cutting and
prepolishing. Now go back over each facet, cutting just deep enough to remove the lines and
scratches made during rough cutting. The more care and precision you use here to get all eight
facets in each set the same depth and perfectly smooth, the less difficulty you will have in
polishing.

You are now ready to start the polish operation. Remove the fine cutting lap and install the
polishing lap. (Many faceters take the precaution of cleaning out the splash pan before installing
the polishing lap to prevent contamination.) Close water feed and reduce speed to around 400
RPM. Provide two dishes, one for polishing powder, the other for water. Glass ashtrays or almost
any sort of flat dish will do. Put a little water in one and about 1/2 teaspoon of cerium oxide in the
other at the far side of the dish.

For applying the powder to the lap, cut a piece of ordinary cellulose sponge to a 1/2"X1"X2" size.
It can be cut easily from a perfectly dry sponge by means of a knife or razor blade. Small plastic
sponge brushes, sold in hardware stores for painting trim, are also ideal for this purpose.

Adjust the angle on the protractor to that at which the facets were cut (in this case, 43°), rest the
faceter head on the platform, and adjust the height until the stone just touches the lap. Then
remove the faceter head and start the motor. Next, wet the applicator, give it one quick, hard
squeeze, and use it to drag a little of the powder down into the bottom of the dish in the form of
a paste, applying it immediately to the revolving lap. Repeat several times until the surface is
evenly, but thinly coated and then before the powder has time to dry out, replace the faceter
head on the platform.
Lower the platform until the stone makes contact with the slowly rotating polish lap. Lift the front of the head and unscrew the front rest point at least one full turn. This will allow the facet face to be aligned with the lap as the platform is raised or lowered. Note: Return the front rest point to zero before cutting any more facets.

If the stone shows signs of polishing only at the culet end of the facet, lower the platform a little - if at the girdle end, raise. If it is polished only on one side, unscrew the rest point on the opposite side a half turn or so. Cheater adjustments should only be made if the conditions persist after ten or fifteen seconds of polishing. Don’t get discouraged, it may require three or four trials to get the adjustment just right on the first facet, but it should be correct for the others in that row. The polishing must now be continued until every facet reflects light as brilliantly as a mirror and there are no unpolished areas and no scratches that can be seen without using a high power magnifying glass. To polish in this way, the lap must be coated with a thin but complete layer of moist, not wet, polishing powder. Touch it frequently with the damp applicator, and when you find the applicator itself becoming dry, barely touch one small corner of it to the water in order not to pick up more than one or two drops at a time. When a little more powder is needed, touch the applicator to the paste in the bottom of the dish. Most beginners use much more powder than they should.

There is nothing more to be said on the subject at this time except that we urge you to experiment as you work. Try different pressures of the stone against the lap. Swing the stone back and forth slowly and rapidly. Count the swings per facet. Place the stone in different positions on the lap in order to try polishing in different directions. Polish the pavilion facets with cerium oxide, but try Raybrite or some other polish on the crown or on the next stone.

Some operators find lining the stone off of the lap every five seconds for about a second will improve polish and prevent the stone getting hot enough to move out of alignment in the dop wax. The pavilion is finished when you have completed this polishing, and it is now time to transfer the stone to another dop so the crown can be faceted. The easiest and most accurate way to do this is by means of your transfer jig. (See Figure 3).

First, select a dop somewhat smaller in diameter than the diameter of the stone at its girdle line, heat the end and fill the conical depression with doping wax. Fill it solidly, right to the edge. Insert this dop in the lower section of the fixture and tighten the clamp.

From a paper towel, tear strips about 8" wide by 8" long. Hipbone of them in cold water and wind it about the wax that holds the stone to the dop. Cover the wax completely, right up to the stone. The cloth will stay in place if tightly wound. Clamp this dop in the upper section of the fixture with the stone pointed down. The side pin should lie against the edge of the groove in which the dop fits just in front of the slide bar. Clean the stone with alcohol to remove oil if you have touched it.

Now play hot flame on metal end of lower dop (or hold over alcohol lamp flame.) When wax starts to flow and stone is warm, press upper dop down with slide bar as far as it will go. Do this quickly and without twisting the dop. Some of the wax will squeeze out in the form of a ring. Direct the flame toward it until it flows into contact with the stone. You can assist this by picking the fixture up and turning it this way or that, but DO NOT TOUCH THE STONE, or the wax or the dops with anything except the flame while you are doing this.

You now have two dops attached to one stone, before removing this dop assembly from the fixture, double check to make sure the alignment is O.K. Make sure the dops
have cooled, then loosen the lower dop clamp and slide dops up until the pin of the upper dop rests on the edge of the groove as before. Now, push the dop to the lower position using the slide bar; the pin of the lower dop should rest on the lower groove edge. If it does not, the dops are not in alignment; they should be separated and the doping operation repeated until they are properly aligned. (See Dop Rotational Adjustment).

Now you are ready to remove the dops from the jig. Release the lower dop clamp, raise the upper spring clip and remove the connected dops from the fixture. Unwrap the cloth strip from the dop, wet it again and wrap it around the wax on the other dop, then hold the two dops horizontally above the flame, heating only the unwrapped dop near the wax until it can be pulled away from the stone.

After cooling thoroughly, most of the wax clinging to the stone can be snapped off with a fingernail, a sharp knife blade or the point of a darning needle. Small bits of wax left on the stone may be removed with a cloth dipped in alcohol or even left on as they will be ground off.

Examine the crown of the stone. Any excess material can be ground off at an angle with the face of the grinding wheel as shown in Figure 17. Be sure, however, to grind only to within about 1/mm or 1/16 of an inch of the girdle line.

Now, remove the polishing lap, put the rough cutting lap in its place. If the girdle line is covered with wax all the way around, chip off enough to expose at least one girdle facet. When this has been done, place facet finder on "M", set the angle to 42° and cut the eight main facets of the crown (starting at the facet where the girdle is exposed) almost down to the girdle line. Leave a space of about 1 mm or ½ of an inch. See Figure 22A.

The next operation will be the cutting of the table. With the protractor angle at zero, cut carefully a little at a time until the diameter of the table is about ¼ the diameter of the girdle.

Change to the fine cutting lap and go back over the mains and table as you did on the pavilion. Always use the slower cutting rate of the fine cutting-lap to cut star and girdle facets preventing overcutting. Change facet finder to "S" position, set the angle to 27° and cut the eight stars with care. Cut the stars until their corners just meet the level of the table as shown in Fig. 22B. Remove the cutting lap and replace it with the polishing lap.

Polish table first at 0° (with the facet finder in the same notch as during the fine cutting operation), then stars at 27° and finally mains at 42°.

Warm the stone over the flame until it can be pulled away from the wax (with tweezers), scrape most of the wax from its surface, and drop it into denatured alcohol for four or five minutes. Then wipe it with a cloth or facial tissue, pick it up by the girdle (preferably with tweezers to avoid finger marks), stand where the light will come over your shoulder onto the stone and feel your lips break into a smile as you observe the result of your first venture in faceting.

NOTE: It is recommended that those not familiar with doping first practice transferring a plain stone from one dop to another several times. After going through the doping operations as described on Pages 8, 9, 14 and 15 a few times, you will acquire the knack of handling the transfer jig and torch or alcohol lamp so as to keep the dop wax and stone at proper temperature to get the best adhesion. Some may find that placing the receiving dop in upper section of figure works best for them. Use fresh wax each time, and remember that grease from fingers, smoke from flame and overheated wax will prevent or reduce adhesion.
Dop Rotational Adjustment

On the side of the tilt head opposite the protractor is a graduated knob. This knob is a rotational adjustment of the dop. This should be used instead of the rear cheaters when a transfer error causes a slight rotation of the stone. Before cutting the second half of the stone, adjust for any rotational error by aligning the main facets on the crown with those on the pavilion. Once in alignment, the adjusting knob is not changed until the stone is finished. It is very important to "zero out" this adjustment after the stone is finished. See explanation below.

The rotational adjustment knob is calibrated into 16 equal divisions. These calibrations are for reference only since in most cases this adjustment is trial and error. For advanced cutters who wish to use the rotational adjustment for special cuts, the following information is supplied for reference;

One complete turn of the dial moves the index gear 1.75° (1.45°).

One graduation on the dial moves the index gear .109° (0° 6’ 33")

To "zero out" the rotational adjustment, first turn the knob until the edge of the latch (as seen from above) lines up with the scribed line on the aluminum block (figure 23). Then look at the dial and set the heavy line exactly on the scribed line (figure 24). Double check to confirm that the edge of trigger still matches the scribed line. This is important because the knob can be turned more than one revolution in either direction.

Chapter Five

Cutting and polishing the 57 facet round brilliant

A standard 57 facet round brilliant (like most diamonds are cut) is the same as the modified brilliant you have just been cutting except 16 girdle facets are cut in the pavilion main facets and 16 girdle facets are cut in the crown main facets. These girdle facets are cut at the wide end of the main facets adjoining the girdle line. See Figs. 25 & 26

Start by preparing a stone and setting it up in the faceter the same as in Chapter Four. Rough cut the eight pavilion mains at 43° as before, then lock out the latch, change the angle to 80° and rotate the dop to generate a round girdle. Now change your lap and continue to make prepolish cuts as usual, but do not polish. Change angle to 45° and set facet finder in the first "G" position; this will locate all the right hand girdle facets in their proper relationship to the main facets to provide maximum brilliance.

The shaded area of figure 25 represents a "left hand" girdle - so called because with the stone held up to the light for inspection, as shown in the illustration, it is on the left hand side of the main. A right hand girdle would be on the opposite side.

Girdle facets must be cut with great care, and only until the lower right hand corner "d" has reached a point on the girdle at the center of the main facet, that is, halfway between points "a" and "b".

As the cutting proceeds, you will note that, while the corner "d" creeps to the right along the girdle line, the corner "c" creeps to the left, but more slowly and not so far. Point "a" represents the original left hand boundary line of the main facet before it was obliterated by the cutting. Originally, the main facet touched the girdle line for "a" to "b" whereas, after the girdle has been
finished, the main will touch the girdle only from "d" to "b".

There are two tricks you may find helpful. First, before you start cutting the first girdle, mark the girdle by means of a sharply pointed lead pencil, halfway between the point "a" and "b" (you can do this easily by eye). Second, partially cut all the left-hand girdles, then partially cut all the right hand ones, and follow by cutting a little more in the same way until they meet in points at the girdle line. Watch the distance from the end of each girdle facet to the culet. This is helpful in getting them all alike, but if you do make a mistake and cut one of them too deep, cut them all to that same depth and then recut the mains as necessary to bring their points back to the girdle line. Now, set facet finder in second girdle position and cut the right girdle facets. Install polish lap and polish these first since the faceter head is correctly set for them.

After you have polished all the pavilion facets, and before you transfer the stone to another dop, note that the girdle line which was perfectly straight on your first stone (see Figure 20) is now a series of scallops resulting from the intersection of the girdle facets with the round girdle surface, therefore, when you cut the crown mains, instead of cutting until they nearly touch a straight line (the girdle line), you should cut them until they are about 1/10 mm from the pavilion mains. This will leave material for the crown girdle facets without forming a knife-edge girdle (which will chip easily in setting).

Before cutting the crown mains (the first operation after the stone has been transferred to another dop and the excess material ground off), you must adjust the angle to 42° and set facet finder in the (M) position. After the mains have been cut, change the angle to zero and cut the table until it is about 60% of the diameter of the girdle. Change the angle to 27° (M-15°) and put on the fine lap, set facet finder to (S) position and then cut the eight stars just as you cut them on your first stone.

The final cutting operation will be the 16 crown girdle facets. If the height of the crown has been made to an exact measurement, it would be possible to specify the correct angle for the girdles, but to do that would have been a difficult matter and it is actually much easier to find the correct angle by the following "cut and try" method. This would only be necessary for the first girdle facet. Based on past experience, we suggest 46° for the trial angle.

With this angle and with facet finder in the "G" position, make a light trial cut. Referring to Figure 26, you will see at "A", the main and star facets of the crown and at "B", a left hand girdle properly cut while at "C" and "D" are girdles that have been cut at wrong angles. A properly cut girdle will extend from the point of a star facet to the center of the adjacent main at the girdle line.

When the first (or perhaps the second) trial cut has been made, it is easy to judge whether or not the angle is correct. If it looks as though the girdle facet will reach the point of the star before it reaches the center line, at "C", increase the angle a little, say 1° and make a trial cut on the next facet. Conversely, if you see that it will reach the centerline before it touches the point of the star, reduce the angle.

On the first occasion, you may have to make three or even four trials before finding the correct angle. Make each trial on a different facet, and when you are satisfied, cut all the girdles (including those used for trial cuts) at that angle.

The cutting of girdle facets is about the fussiest job you will find in connection with faceting, especially on the pavilion where the difference between the angles of the mains and girdles is smallest. Because of this slight difference in angle, a variation of a thousandth of an inch in depth may make a difference of thirty thousandths of an inch in the length of the girdle facets. See Figure 27.

Now, a thousandth of an inch isn't much. It is only 1/4 the thickness of human hair or of the
paper on which this is printed. But thirty thousandths of an inch is practically 1/32, and that is a lot on the length of a small facet.

Still other variables are the size of the facets, the hardness of the stone, the weight of the operator’s hand, and the amount of water and sludge present on the lap. With all these variables in mind, it is easy to understand why, in the case of the pavilion girdle facets, the progress of the cutting should be checked every few seconds.

After the crown girdle facets and stars have been cut, proceed to polish in the order of table, stars, mains and lastly girdle facets.

**Note:** The more care you use in having all the main facets on the pavilion or crown cut to exactly the same depth during prepolish, the less trouble you will have in cutting and polishing the girdle facets. Here is a quick, easy way to achieve the high degree of precision that is obtainable with this parallel platform and three rest point features of your Shaw faceter: When the front rest point of the faceter head contacts the platform, normal cutting stops but small amount of material is still being removed for the next few seconds due to the closeness of the stone to the revolving lap. By placing pressure on the front rest point with one hand and moving the stone back and forth sideways with the other hand, you can feel the friction of the nearest points decrease to zero when this slight cutting stops. By lining the stone off the lap at zero friction or just prior to that point on the main facets, precise uniformity can be obtained.

**Shaw Faceting Procedure**

These eight basic steps in faceting serves as a working procedure and also show how the Shaw "facet finder" eliminates hunting out 152 or more index numbers when faceting the average stone.

1. Dop stone and grind excess material from pavilion. Insert dop in faceting head, set facet finder in "M" position and protractor angle at 43°.
2. Install coarse lap. Cut the 8 main facets, change angle to 90° lock out the latch and generate a round girdle, or cut 8 facets deep enough to form a straight girdle line.
3. Install fine lap. Prepolish the 8 main facets, set the facet finder in "G" position and angle at 45°. Cut 8 girdle facets and move facet finder to second "G" position and cut other 8 girdle facets.
4. Install polish lap. Polish all pavilion facets starting with the last girdle facets. Reset the facet finder and angle degrees to previous settings for each round of 8 facets.
5. Transfer dop to expose crown. Grind off excess material, insert dop in faceting head, set facet finder in "M" position and protractor at 42°.
6. Install coarse lap. Rough cut mains, set protractor to 0° and cut until table size is ⅛ diameter of the stone.
7. Install fine lap. Prepolish 8 mains and table. Set facet finder in "S" position and angle at 25° to cut the 8 stays. Set facet finder in "G" position and at 47° and cut 8 girdle facets. Set facet finder in second "G" position and cut remaining 8 girdle facets.
8. Install polish lap. Polish in the order of table, stars, mains and, lastly, girdle facets.

For Quartz

See Appendix I for facet angles of other gemstones.

**How to cut rectangular stones such as French Start & Emerald Cut**

Many materials such as tourmaline and emerald are not well suited to the brilliant cut because of their natural shape and the
direction of best color so they are cut with rectangular girdles. The "French Star" is a square stone having a step-cut pavilion and a crown that is unique. It has 21 facets, but despite its simplicity, it is most attractive. See Figure 28. It is suggested that you make this stone 10 mm square which will be easy to work on and a good size for a ring stone.

First, saw or grind a piece of rough material to a truly square shape 12mm x 12mm x 10mm thick. Cement it to a dop so the dop is approximately centered on one of the 12 X 12 faces and the side pin perpendicular to one side. If you have a grinding wheel, rough out the pavilion as shown in Figure 29. Stand back as you grind so you can look down along the dop and see the position of the stone in relation to the wheel face and grind only a little at a time.

Note: If you don't have a grinding wheel, the pavilion can be roughly out on the coarse side of your cutting lap after the dop is mounted in the faceting head.

For square and rectangular stones, the facet finder should be set in (M) position and only every other notch is used. Set the angle at 80° and cut all four sides to establish the girdle. Now, set the angle to 43° and cut the four sides until they meet in a point forming the culet as shown in Figure 30-d.

Change the angle to 51° and cut until these facets meet those of the first step halfway as shown at 30-e, then change the angle to 47° and cut until these facets are the same width as the other two at 30-f. When cutting each row of facets, be sure that their junctions on each side of the stone line up with the junctions on the adjacent sides as shown in 30-g.

All sixteen facets should now be polished, commencing with the culet step at 43° then the second step at 47°, the third step at 51° and the girdle at 80°.

Transfer to another dop and grind some of the excess material from the four sides of the crown (being careful not to overgrind), then replace the dopped stone in the faceter, set the angle to 40° and cut the four sides nearly to the girdle line, leaving a girdle about 1mm wide. The crown will then appear as in Figure 31A.

Change the angle to 22° and cut the four diagonal facets until their points match the depth of the side facets as shown at 31B. There may or may not be a small square spot left uncut at the center of the crown depending on the amount of material left above the girdle line. Pay no attention to this, but set the angle to zero and cut the table until it assumes the form of a square with its
four corners just touching the tips of the side facets shown (31C). Polish all the crown facets and the girdle and your stone will be finished.

The French Star you just cut was a square stone having a step-cut pavilion and a cardinal-type crown. Step-cut stones are made in many shapes with varying numbers of steps and/or facets in the crown and pavilion.

Making the following step-cut rectangular (Cushion Cut) will give you the remaining knowledge and experience needed to understand how the various shapes and types are formed and cut.

Unlike the brilliant cut, in which the depth of the pavilion is less than half the diameter of the girdle, the pavilions of step-cut stones should be given a depth of 50%–70% of the girdle diameter (or girdle width), and this can present a problem in mounting them. For this reason, most of the step-cut stones we see are too shallow “so shallow, in fact, that they appear to have a window in the center through which one can sometimes see with such clarity as to be able to read newsprint through them. Such stones, of course, are virtually devoid of “life”, hence they have no beauty other than that which comes from their color. This is not necessary and should be avoided whenever possible.

Caution: Never cut a pavilion facet at less than the critical angle (see Appendix I).

Rectangular step-cut stones, both sharp-corner and cut-corner types

To minimize the depth of the pavilion and to maximize the amount of light returned, it is important to keep pavilion facet angles as low as possible, however, it is difficult to cut facets accurately if the change in the angle is less than 4° for each step.

The following diagrams show some good proportions and slope angles for both two-step crown and three-step crown cuts on 11 different gemstone materials using 4° steps. In each case, the width of the girdle is 1.000 and that of the table is .500.

In each of the proceeding diagrams (figure 33-36), the width of the stone at the girdle is taken as “unity” and all dimensions are expressed as percentages. For example, if you are cutting a stone of the quartz family, you would use the proportions shown in figure 33. If the width is 10mm, the depth of the pavilion would equal 10 X 0.54 or 5.4mm, and the crown height 10 X 0.16 or 1.6mm.

It is important to realize that there are no “best” angles and proportions. Values shown in various books are the results of experiments by different people and seldom agree with each other. There are many “bad” angle and proportion combinations, however, so it is advisable not to stray too far from recommended values. The values shown here work well and are different from many books. The minimum pavilion angle should not be changed more than one degree. Other pavilion angles and crown angles can be changed as much as five degrees.

The secret to cutting step-type cuts, without guesswork or measuring, is to cut the minimum slope first until a point is formed, then the maximum slope until two facets of equal width are formed. For a three-step pavilion or crown, the intermediate angle is then cut until three facets of equal width result. For a four-step pavilion, cut the two intermediate angles until they reduce each of the previous facets to half of its width “the result will be four facets of identical width. The proportion shown in Figs. 3v-xv6 are for facets of identical width.
The length of a rectangular stone in relation to its width may vary considerably, but the most pleasing proportion lies between 1.4 to 1 as a maximum and 1.2 to 1 as a minimum. The cutting of the steps on the crown makes the stone appear narrower than it really is in relation to its length. Depths are maintained in proportion to the narrower girdle dimension, and the angles on the ends are the same as the sides.

It should be mentioned that all dimensions of gemstones should be expressed in millimeters. First because it is customary and mountings are made in millimeter (metric) sizes and second because it is much easier to

Proportions and angles for step-cut stones in Group A
Feldspar (orthoclase), Quartz, and Beryl

![Proportions and Angles for Step-Cut Stones in Group A](image)

Make measurements in millimeters than in inches and fractions or inches and decimals.

Let's start another stone 'a rectangular step-cut with either sharp corners or "cut corners" as you prefer. From your stock of stones, pick a piece large enough to make a blank 12 x 15 x 10 mm for a finished size of 10 x 12 x 7.0 mm as per the left hand diagram of Figure 33. Dop it, and place it in the faceter and line it up carefully with the surface of the cutting lap. Adjust the angle to 80° and cut one long side until it is cut full-length then cut to the same depth on the opposite side. Continue in this manner, first on one side and then on the other until the proper girdle width (10 mm) is obtained. Now do the same thing at each end until the proper girdle length (12 mm) is obtained.

Set the angle to 43° and cut the two long sides until they meet to form a point. Then set the angle to 51° and cut the two long sides until faces of equal width are formed. Then set the angle to 47° and cut the two long sides until three facets of equal width are formed.

The facets on the ends should then be cut to match those on the long sides. Starting with the step next to the girdle and working downward to the culet, match them as closely as you can, but if they do not match exactly, corrections can be made in polishing. These end facets will not meet at the culet; there will be a ridge which is 12-10=2 mm long. This is normal for rectangular stones.

Since the facets of the step-cut stones are long and narrow, and since laps are seldom perfectly flat over their entire surfaces but are apt to become hollowed out in the most used area, as shown in greatly exaggerated form in Figure 37, it is evident that a long, narrow facet will be somewhat curved if cut in position "A". If, however, it is cut in position "B", the curvature will be less or eliminated altogether. It is best, therefore, to cut the facets of step-cut stones with the dop pointing directly toward the center of the lap.
Faceting Machine Instructions

If you have decided on a cut-corner stone (emerald cut), set the angle to that of the second step, 47° and cut each of the corners until the points of the corner facets just touch the line between the first and second steps. Use great care because they will be small and cut quickly. The form of these facets is shown in Figure 32. Change the angle to 51° and cut the corners of the third step. These facets should just meet the others at the junction of the second and third steps. Now change the angle to 80° and cut the corners of the girdle. All will be the same depth.

After polishing the pavilion and girdle facets, transfer the stone to another dop and grind off some of the excess material above the girdle.

Set the angle to 42° and cut the facets of the first step on the crown until the desired girdle thickness is obtained. All of these facet edges should be aligned at the girdle. If this is a cut-corner gem, cut the corner facets first, at 42°, all the same depth setting; then cut the side and end facets to align with these at the girdle line.

Set the angle at 0° and cut the table to a crown height of 1.6mm above the girdle line as shown in Fig. 33. Polish the table without changing this setting unless you are sure you can duplicate it exactly to polish it later.

Set the angle at 25° and cut the facets of the second step until facets of equal width are formed. If this is a cut-corner gem, cut the corners first, at 25°, all at the same depth setting. Now polish all the crown facets.

Note: To prevent chipping and polishing problems, use a fine lap for all cuts on these stones except where much stock must first be removed.

Appendix I
Popular Gemstones
Hardness, refractive index, critical angle, and facet angles

<table>
<thead>
<tr>
<th>Group</th>
<th>Gem Name</th>
<th>Hardness</th>
<th>Nominal RI</th>
<th>Critical Angle</th>
<th>Facet Angles (Degree)</th>
<th>Polishing Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pavilion</td>
<td>Crown</td>
<td>Main</td>
</tr>
<tr>
<td>A</td>
<td>Feldspar</td>
<td>6 to 6°</td>
<td>1.52</td>
<td>41.1</td>
<td>43</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Quartz</td>
<td>7</td>
<td>1.55</td>
<td>40.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beryl</td>
<td>7° to 8</td>
<td>1.58</td>
<td>39.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Topaz</td>
<td>8</td>
<td>1.62</td>
<td>38.1</td>
<td>40</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Tourmaline</td>
<td>7 to 7°</td>
<td>1.63</td>
<td>37.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peridot</td>
<td>6° to 7</td>
<td>1.67</td>
<td>36.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spodumene</td>
<td>6 to 7</td>
<td>1.67</td>
<td>36.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Spinel</td>
<td>8</td>
<td>1.72</td>
<td>35.6</td>
<td>40</td>
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</tr>
<tr>
<td></td>
<td>Garnet</td>
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<td>1.75</td>
<td>34.9</td>
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<tr>
<td></td>
<td>Corundum</td>
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<td>1.77</td>
<td>34.4</td>
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<tr>
<td>D</td>
<td>Yag, GGG</td>
<td>8-1/4</td>
<td>1.83</td>
<td>33.1</td>
<td>42</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Zirconium</td>
<td>7°</td>
<td>1.89</td>
<td>32.0</td>
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<td></td>
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<tr>
<td>E</td>
<td>CZ</td>
<td>8-1/4</td>
<td>2.15</td>
<td>27.7</td>
<td>41</td>
<td>35</td>
</tr>
</tbody>
</table>

*Key for recommended lap
1. Raybrite Fast Lap
2. Ceramic (Usually used with 50,000 Diamond)
3. Tin
4. Zinc
5. Copper
6. Phenolic
For brilliant cuts, pavilion girdle facets are 1’ to 2’ more than mains, crown girdles 4’ to 5’ more than mains. For emerald cuts, pavilion steps increase 4’ increments from value shown (at culet).

In the above list, the species offeldspar known as orthoclase has been included because it is inexpensive, cuts and polishes easily and makes beautiful stones for pins, brooches, earrings, etc. It is a little soft to be durable as a ring stone, but it is excellent for practice.

Quartz is the family name for amethyst, citrine, smoky quartz, rose quartz and the colorless rock crystal.

Beryl includes emeralds, aquamarine, golden beryl, heliodor (yellow), morganite (pink) and goshenite, the colorless variety. These are all the same stone except for color.

Corundum, when red, is called ruby; all other colors are called sapphire.

With the knowledge and experience you have gained in cutting the three basic types of faceted stones plus the broad capability of your Raytech-Shaw faceter, there is virtually no limit to the number and variety of faceted stones you can produce. The ease and speed of your faceting will increase rapidly as you continue to gain experience.

Helpful Hints

Position the faceting head so lap cuts across the facet during the last stage of rough cutting and during all prepolish cutting. Position it on polish lap so it polishes lengthwise of the facet. By using this procedure, the source of any scratches appearing during polishing can be identified. Crosswise scratches would have been made during cutting, lengthwise probably from contamina’tion of the polishing lap. See Appendix 111 for more information on scratching.

Finish prepolish cutting and the cutting of all small facets by using very light pressure and by lifting stone off lap every few seconds. The smoother facet surface is the quicker and brighter it will polish.

Moving stone back and forth sideways an inch or so on lap when cutting or polishing equalizes lap wear and reduces chance of overheating dop wax.

Before each use, scrub polishing lap under running water with a stiff bristle brush and hand soap and then rinse well. Repeat during use if scratching becomes a problem.

Scrub cutting laps occasionally the same as polishing lap only use a piece of flat 600 grit waterproof silicon carbide sheet in place of brush to remove stubborn stone deposits adhering to lap. Store laps standing on edge in a clean protected area so stray grit doesn’t get ground into the working surface as it does when they are slid over each other.

600 to 800 RPM is a good speed for fast removal of large amounts of material. 400 to 600 RPM is about right for cutting small facets and for prepolishing.

Everyone eventually develops his own technique in polishing, We get excellent results by applying polish with a small damp sponge, as described in the instruction book, to the phenolic lap rotating approximately 300 RPM and applying pressure for several seconds, then lifting stone off lap for a second and repeating until satisfactory polish is obtained.

If you can see print or determine color when looking down through a faceted stone, it id not cut at its best angle for maximum brilliance. Ideally, all light entering the top of the shone should be reflected back out the top.

Notice to Beginners and Hobbyists

The polishes listed in Appendix I are now available bonded to one side of a thin plastic disc called “Ultralap”. Ultralaps are inexpensive and simple to use. When the recommended “Ultralap” is used as follows, a good quality scratch-free polish is easy to obtain.

“Ultralap” as supplied by Raytech has a ½” center hole. The smooth metal back of a polishing lap can be used as a master lap. One side of the arbor nut on the Shaw Faceter has ½” diameter boss which can be used to center the “Ultralap” on the master lap.

“Ultralap” is available now with an optional pressure sensitive adhesive coating on the back side. This adhesive coating will firmly anchor the “Ultralap” in place so that it will not wrinkle even if
considerable pressure is used during polishing.

Start laps rotating at 400 to 500 RPM. With water dropping about 1 drop per second at center of lap, place stone on lap and proceed to polish in usual manner, using light pressure and moving stone back and forth across lap. The pressure will need to be increased as laps wear smooth. With “Ultralap” the facet edges may not be quite as sharp as with a hard lap, but surface galling and contamination scratches are practically eliminated.

Appendix III

The Causes of Scratching

Lap Contamination

The appearance of unwelcome scratches on a facet while it is being polished is a problem which from time to time nags both amateur and professional alike. While it is sometimes difficult to identify and eliminate the cause of scratching, the following outline of some of the possible causes may be helpful in eliminating the problem if it should arise.

One of the most common and easiest to identify causes of scratching is the presence of an embedded particle in the polish lap. If the scratching occurs in one portion of the polish lap only, an embedded particle of abrasive grain, a metal sliver or a small particle of gemstone is probably the cause. Sometimes a careful examination of the problem area in the lap will locate the particle, and it can be picked out of the lap surface with a knifepoint or razor blade.

Scratching caused by lap contamination can be minimized by careful handling and cleanliness. Polish laps should be stored in their own individual clean plastic bags or other sealed containers. It is a good practice to thoroughly clean the surface after the cutting steps are completed and prior to polishing, so that no grit remains on the machine. The hands, fingernails, sleeves of clothing, as well as the overhead lamp, are possible sources of grit contamination.

Residual Scratching from Prepolish

It is the function of the polishing operation to remove the fine scratches remaining from the prepolish step. The scratches present on a facet may be scratches as yet unremoved from the previous step or else they may be new scratches created by the polishing step itself. If the polishing direction on the final facet is arranged so it is at right angles to the prepolish direction, then the direction of any scratches observed will reveal whether they are new scratches being formed or residual scratches as yet unremoved. If the scratches present are those remaining from the prepolish steps the cause may have been contamination of the prepolish lap. If the prepolish lap has a tendency to scratch over its entire surface, and especially if it is new, it will probably benefit from being broken in by hand grinding a rounded lump of hard material such as corundum or possibly even agate.

Loose Grit Contamination

Loose grit, coarse polish particles or polish agglomerates can also cause scratching. This cause is eliminated by simply scrubbing clean the lap and the stone. Coarse particles and agglomerates can be eliminated from the polish by suspending the polish in water and using only the portion of the polish that remains suspended and not the coarse portion which falls quickly to the bottom of the container.

Scratches Generated by the Polishing Action

Probably the most troublesome scratching and the least understood is that created by the interaction of the lap, the polish and the gem. This kind of scratching is most common in certain troublesome stones, such as the quartz gems, and is more likely to occur on large facets such as the table. The occurrence of this type of scratching is not consistent but seems to occur with some stones and not with others.

Without attempting to theorize as to the mechanism by which the scratching takes place, it does seem to be caused by a seizing and a tearing of the stone surface and seems to be aggravated by high lap speeds and high polishing pressures. Reducing the lap speed and pressure will often eliminate the problem, but of course these steps add to the time required to polish the surface. To reduce the total time required, it is often worthwhile improving the quality of the prepolish by using a NuBond 1200 grit lap, or Dimafast P3000 grit lap. The use of “Ultralaps” will often eliminate scratches when all else fails.
When scratching becomes a problem during your usually successful polishing operation, a complete and thorough cleanup is usually worthwhile. The lap can be cleaned by scrubbing it vigorously with a stiff bristle brush in all directions under running water. Place it on the arbor only after cleaning the arbor, the lamp and the splash shield. A plastic or metal lap can be cleaned by scraping it. The lap can be scraped with a sharp, stiff backed razor blade as shown in Figure 38 while lap is rotating approximately 300 RPM, first in a reverse direction opposite to that used in polishing and then in the polishing direction.

Tilt the blade slightly as shown and apply sufficient pressure to actually remove some of the lap surface. Scraping in this manner is also good practice to help keep the lap surface flat and smooth. If a clean up does not clear up scratching, the problem may be due to deep scratches incurred during rough or fine cutting. A standard operating procedure is to cut crosswise of the facet during coarse and fine operations, and lengthwise of the facet during polishing. If scratches appear crosswise of the facet, then you know they were made during cutting; if they are lengthwise of the facet, they were caused by contamination in the polishing lap.