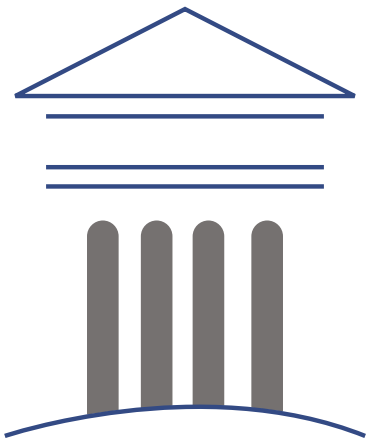
Metal Engraving and Jeweling Lesson: 2195

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Objectives

After completing this lesson, you should

1. Be familiar with the tools used to perform metal engraving.
2. Understand for what a liner is used.
3. Be able to describe florentining.
4. Know the simplest and most widely used engraving design.

Introduction

Why do gun collectors and authorities hold engraved guns in such high esteem? Does not a plain gun shoot just as well? Some trap and skeet shooters who compete with engraved guns (which are worth, in some cases, thousands of dollars), feel that the personal pride that goes with using a finely engraved gun promotes a positive mental attitude that's important to winning.

As for the serious collectors and gun experts, they know that engraving often separates the garden variety piece from the highly prized collector item, especially on American-made guns where engraving is less common than on European guns. Engraving not only increases the value of a gun, but also shows appreciation for craftsmanship and artistic ability, or in a word, *quality*. European engraving schools are four-year courses. Then, if the graduates are talented, they may reach the status of "Master Engraver" in 10 or 15 years of hard work. So, do not expect to become a gun engraver overnight, or know all there is to know in one lesson.

The main purpose of this lesson is to introduce you to metal engraving as applied to firearms — pointing you in the right direction should you desire to pursue the venture further. More importantly, you will be able to discuss the various types of engraving with your customers and be able to recognize the quality of workmanship on firearms that cross your counter.

Essential of Gun Engraving

Metal engraving may not be the oldest profession known to mankind, but every engraver can trace the ancestry of the trade back 5,000-6,000 years. Examples of the engraver's skill, in the form of seals or signets, have been credited to the Babylonian civilization as far back as 3800 B.C. The arms engravers' branch of the art began with various decorative symbols engraved upon the earliest metallic weapons, such as knives, swords, and spears.

One of the earliest examples of engraved weapons is a bronze dagger on display in a museum in Athens, Greece. This weapon, decorated with gold and silver inlays of spears and bowmen fighting lions, has been dated to about 1500 B.C.

The earliest firearms were also the subject of the engraver's art, with examples dating back to the fifteenth century. Though long obsolete as practical weapons, early engraved firearms are prized possessions for individuals as well as museums who display their embellished matchlocks and wheellocks as forms of high art.

Today, many modern guns can stand beside the early arms as works of art because of the knowledge, skill, and dedication of contemporary firearm engravers (Figure 1). Gun engraving is not a dying art. It is alive, well, and flourishing through the efforts of men and women whose work can justly stand beside that of the old masters of the art.

METHODS AND TOOLS

The methods and tools used by the gun engraver are fairly simple in concept and have changed very little over the centuries. In fact, if any of the great gun engravers of the last century —Louis D. Nimschke or Gustave Young, for example — were to step out of a time machine and into a modern engraver's shop, they could probably pick up a tool and start engraving with little change in procedure. The tools of the gun engraver are the most simple things that can be imagined; like drawing, where the only tool needed is a pencil, the work is done mostly relying on skill and talent rather than sophisticated equipment.

In addition to engraving ability, a metal engraver finds it useful to have certain other supplementary qualifications. One of these is a basic knowledge of metallurgy.

Different makes and models of guns are made of different types and variations of metal. Since a metal engraver is not limited to just guns, it is important to know about metals used for bottles, flasks, and knives, as shown in Figure 2. Another valuable asset is a knowledge of tool and die making. Most gun engravers make or shape to their own specifications at least half of their own tools. So a basic knowledge in this area is extremely useful. A third skill is a good basic knowledge of general gunsmithing because the engraver is going to have to disassemble and later reassemble the guns being engraved.

The basic tool of engraving is usually called a chisel, a small piece of tool steel specially sharpened for the desired cut and sometimes having a wooden handle. The chisel engraves by



***Figure 1**: Beautiful example of engraving by Jeff Knodle, member of the Firearms Engravers Guild of America.*



Figure 2: *The gunsmith who does metal engraving is not limited to just guns; knives, metal powder flasks, and other items like this hand tool can also be engraved. Engraving done by Catharine C. Kennedy, member of the Firearms Engravers Guild of America.*

tapping it with a small hammer called a chasing hammer. Engraving is also done with a tool called a *hand graver, burin,* or *bulino*, depending upon the engraver's background.

Gravers are made of hardened tool steel — hard enough to cut all but ultra-hard alloys and case-hardened steel. These simple tools can be compared to the paintbrushes of an artist. Like painters' brushes, gravers come in different sizes and shapes, and have different names. There are square, flat, round, and knife gravers, among others, all designed to do specialized jobs (Figure 3). Most metal engravers shape their tools to fit their own special needs. Also, by having this knowledge, engravers are qualified to sharpen their tools when they become dull — a continuing necessity.

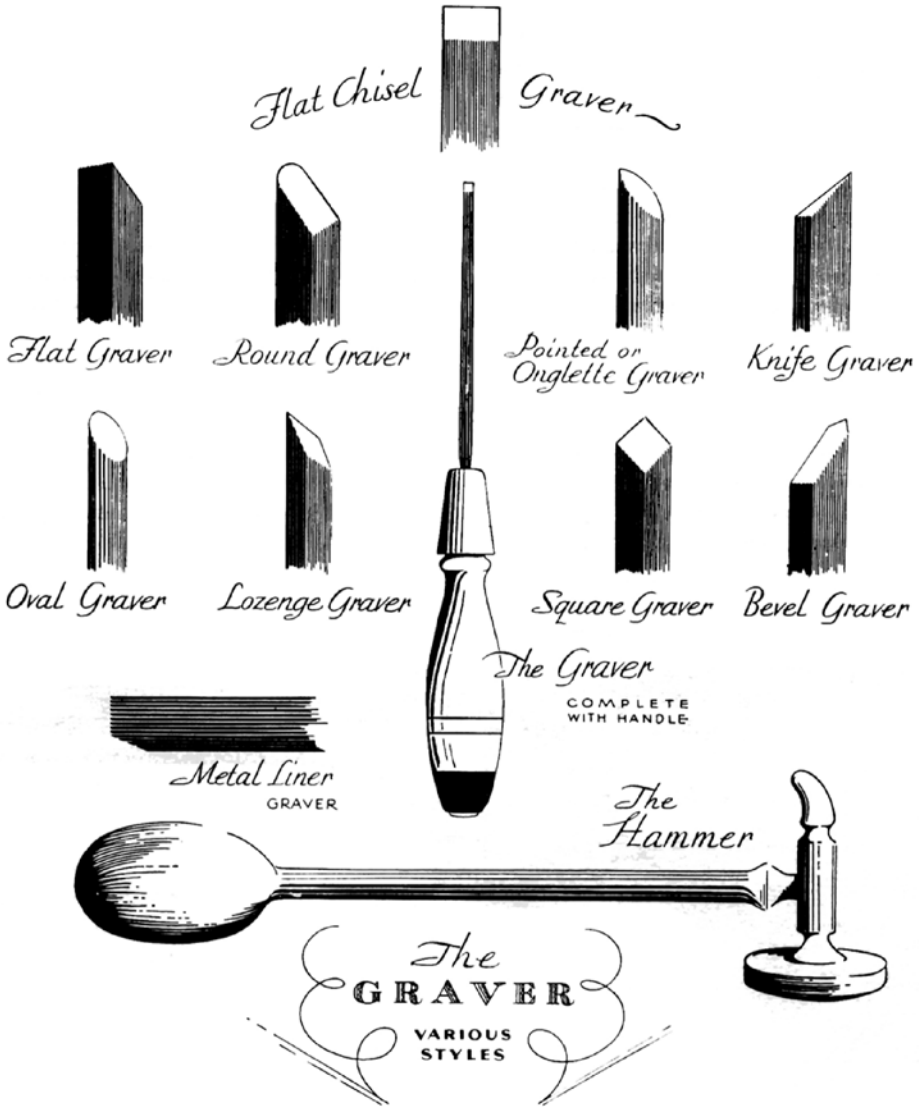


Figure 3: *The basic tools of the gun engraver are simple. However, final success depends on the vision and skill of the most important tool of all the - gun engraver.*

One of the most used cutters is the *square graver*. Its end is square, as the name implies. One corner is used to make triangular grooves. The basic outlining you see in gun metal scrollwork is done mostly with this instrument. The square graver is also the primary tool used to cut cross-hatching for shading and shadow effects. The square graver can be either pushed across the metal by hand or with a small chasing hammer. The more need there is for precision, the more likely the hand will be used instead of the hammer.

An equally used tool is the *flat graver*. It is shaped somewhat like a common chisel except that its cutting edge may be only $^1/_{32}$" wide. This graver is used to cut away material around miniature figures of animals, leaves, etc., and for molding and modeling these forms to a fine finish.

A chisel graver is also often used. It is similar to the flat graver but with a wider cutting edge. It is used for gross removal of metal so as to lower the background away from foreground elements.

The other gravers are used less often, but they have specialized functions. The *knife graver* is used to cut a special type of line. *Oval* and *round gravers* often come into use on curved surfaces, like the top of the receiver on the Colt Woodsman shown in Figure 4. There are other gravers used for such jobs as matting and inlay work.

An important complementary tool is the engraving block, or vise. This is a heavy, spherical vise for holding the piece of metal being engraved. It usually rests on a doughnut-shaped pad of leather. By using such a vise, the engraver can move the piece to almost any desired angle. More important, it can be moved during the engraving process. Thus, when carving sharp bends in a scrollwork pattern, the engraver does not have to make large and potentially inaccurate movements of his body. The workpiece, held in the rotating vise, is merely moved to the desired position, leaving the graver almost stationary. This is a great aid when making precise cuts.

There are also a number of other tools that are useful to have around. One of these has to do with eye saving. Obviously, when engraving outdoor scenes on surfaces as small as an action sideplate, or even engraving a screw head, the eyes are going to get a considerable workout. When putting in cross-hatching lines for shadow effects, the line spacing may be only a few thousandths of an inch. An engraver normally uses a jeweler's loupe with a single magnifying lens — usually only 2x or 3x in strength. It is not true that the greater the magnification the better the engraving quality. More important is how the elements in a scrollwork design or an outdoor scene relate to each other — maintaining the correct perspective. This is easily lost if the engraver gets too close to the work.

An equally important eye aid is correct lighting. High intensity is not necessarily the key in this case since the metal reflecting light may cause eyestrain. Instead, ample diffused light placed close to the work is the answer.

All metal engravers will also have a sketchpad close at hand. Most of the basic ideas for scrollwork and outdoor scenes come from the elements existing in nature. Thus, the gun engraver must record in some way these various scenes as he sees them in the woods or field - or perhaps at a local zoo. A camera is often used for this purpose. The engraving scene as it finally shows up on the gun may consist of several different images from several different trips into the field. Photographs can serve well to trigger the imagination and pull these images together.



Figure 4: *Very few tools were used for the scrollwork on this Colt Woodsman semi-automatic rimfire pistol. The work was done by Scott Plinkington of Dunlap, Tennessee.*

Another commonplace, but sometimes important addition, is a *mechanical grinder*. Since the engraver makes many of his own tools, and must also sharpen them periodically, this tool is almost a necessity.

If you are starting from scratch, you will save a lot of time and confusion by buying one of the engraver's tool kits available from various retailers. These kits are designed for the beginning engravers who are still in the process of finding out which tools they are most comfortable with.

James Meek's Beginner's Kit. This kit contains point, numbers 0 and 4; square; two Momax Cobalt Blanks; flat, numbers 36 and 39; knife, number 2; and round, numbers 50 and 59, for a total of nine gravers in all. The point graver No. 4 will cut most scrolls if sharpened correctly. Fine detail is cut with 0 and 00 points, and the No. 2 knife. The square is perhaps the most widely used, for it can be sharpened as a point or a chisel. Flat and round gravers are needed for lettering on high relief work.

There are also a couple of machines for use in gun engraving that are suited for the beginner or for the quality-oriented master engraver who is production minded. One is called the Gravermeister (Figure 5A) and the other is the NgraveR Electric Engraving Tool.

Gravermeister. The Gravermeister is manufactured by GRS Tools, 900 Overlander Rd., Emporia, Kansas, 66801; 1-800-835-3519; www.grstools.com. Its power is regulated through a foot pedal which serves the same function as the foot throttle in an automobile. Control is so precise that with the proper tool chucked into the handpiece the operator can vary the power in ranges from stipple engraving on delicate crystal to the task of hogging out metal from a steel die.

Delicate speed and power control make this machine ideal for gun engraving. It moves gravers, liners, beading tools, files, and stones effortlessly whether cutting steel dies or carving and finishing delicate gold and silver inlays on quality custom guns. The alternating vacuum and pressure system does not permit the handpiece to heat as happens if operated by air pressure alone. Therefore, bright, smooth cuts can be obtained on both ferrous and precious metals.

Florentine and matte are the most common types of gun engraving finishes. Such finishes are applied with a Gravermeister tool called a liner which is essentially a flat graver with V-shaped grooves cut into the bottom to produce parallel lines. Liners are categorized by width and number of lines per tool. The lower the width number, the narrower the tool; therefore, a #14-6 and a #18-6 would both cut six lines, but the #14 would be closer spaced because of its narrower width. Many different width and line combinations are available, but the liner generally favored by gun engravers for florentining is the #18-10.

Florentining consists of cutting crossed sets of lines. First, all of the lines in one direction are cut. Then, cross lines are applied at the preferred angle — just like checkering a gunstock. A somewhat similar effect can be obtained by dragging the tip of the liner across the desired area. This action produces lines with no material removal. The stroke-speed setting and the speed with which the Gravermeister is pulled determine the spacing effect. If you drag the tool at a constant speed, increasing the stroke speed results in closer spaced lines.

The liner is sharpened the same as a flat graver: the face of the tool is held at about a 45° angle and like most gravers, should



Figure 5A: *This Gravesmith engraving system gives each handpiece excellent range of power with perfect control throughout an expanded range of impact speeds*



Figure 5: *Many modern, custom-engraved guns are used for presentation purposes, like this over/under shotgun engraved by Jerome Glimm of Conrad, Montana.*

be polished after sharpening. In addition, the tip of the liner should be gently wiped on a sheet of crocus cloth to remove burrs, thus permitting polished cuts.

Using the machine is like playing an instrument — it requires practice to develop skill. Those people who show an interest in the instrument and practice faithfully start producing faster. Those who are not willing to practice do not seem to do very well. Therefore, if you decide to do any type of gun engraving — whether with hand tools or a machine — you would be wise to purchase several engraver's practice plates from Brownells. They sell inexpensively in lots of five plates, so you can practice, practice, practice for very little money.

In general, the Gravermeister is used in place of the chisel and hammer. It operates by locking the steel part of an engraver's chisel into a handpiece which is connected to a length of tubing. The tubing is connected to a motor that provides an alternating pulse of air, which activates a hammer within the handpiece. Though the Gravermeister is a mechanical device, work done with it is properly considered hand engraving because the pneumatic hammer only takes the place of the chasing hammer, freeing one hand to turn the vise.

NgraveR Electric Engraving Tool. This machine is meant to replace the hammer and chisel in the hands of the engraver, and is somewhat less expensive than the Gravermeister. Working on a unique patented mechanical power transfer system, this electric engraving tool is actually a tiny jackhammer run by a standard flexible shaft power tool using the 3:1 gear head accessory.

The flexible shaft from any flex shaft machine attaches to the engraving tool with standard quick-detachable couplings. When the flex shaft turns, it rotates a drive shaft inside the tool which in turn compresses a spring, forcing the striker against the tool holder. The rate of impact is completely controlled by the foot rheostat, and is variable from 300-1500 impacts per minute. The system is so well-designed that there is no noticeable vibration.

For the beginner, this electric engraving tool will start him or her cutting clean, bright lines effortlessly without the ever-present worry of accidentally skidding across the work. For the professional, the tool makes engraving easier, allowing more work to be done in a given period of time — without compromising the quality of the work.

Ray Phillips, President of NgraveR Company, put together a Beginner's Kit to be used with the NgraveR Electric Engraving Tool. Detailed instructions are included along with four gravers: No. 1 diamond, No. 2 narrow chisel, No. 12 Liner, and a 1.8" round blank to be shaped as needed.

Either the Gravermeister or the NgraveR is of little use without certain other tools. First of all, you will need an engraving block. One such block is offered by GRS and was designed by a master engraver who was tired of block movement when making precision cuts. This massive 28½ lb. engraving block is a stable work-holder for all engraving, including heavy cutting and chipping. This block can be used to engrave everything from the shotgun in Figure 5, on the previous page, to the knife in Figure 6. This block is available from Brownells.

Besides an assortment of gravers, you will need some means of sharpening them — especially if you use the power machines. A power honing tool — also offered by GRS — is ideal for this use. It is faster and easier for the beginner to learn and saves valuable time for the experienced engraver. The fully shrouded motor is carefully balanced and trued to turn the 4" silicon carbide stone or the long-lasting, fast-cutting 600-grit diamond lap smoothly and without wobble. The motor rotates



Figure 6: *This presentation-grade knife features a tiger-eye insert and metal engraving by Jerome Glimm.*

the stone at a smooth 200 rpm for fast, no-heat tool sharpening. The high position of the stone gives clearance to sharpen all graver points and tip angles. The flat-top surface provides an ideal platform for combined use with the GRS sharpening fixture to maintain consistent angles.

The Graver Sharpening Fixture provides accuracy for sharpening the tools. It enables gravers to be located exactly every time, assuring that your tool will cut the same after sharpening.

SELF-TEST QUESTIONS

Please check your answers on page 21.

1. *True or False.* **A metal engraver automatically reaches the status of "Master Engraver" after completing four years of school.**
2. **Which graver will probably be used the most in firearm engraving?**
3. *True or False.* **A gun engraver should stick to engraving guns only.**
4. **What is the name of the electric engraving tool that operates like a miniature jackhammer?**

Engraving — The First Step

Most serious gun engravers agree that design is the most important factor in a good engraving job. Professional engraving schools in Liege, Belgium; Ferlach, Austria; and Gardone, Italy, all put great emphasis on being able to draw proper designs. If both the master engravers and the engraving schools attach so much importance to design drawing, there must be something to it.

Figure 7 shows one of the drawings required at the engraving school in Liege, Belgium. This school believes that the ability to draw a design precedes any attempt at actual engraving. Since a good engraving job is only as good as its design, it would therefore follow that the first order of business for the beginning engraver is to be able to draw. If you cannot draw a good design, you cannot possibly expect to cut one. There are some engravers who might disagree with this statement, but those that do usually are trying to sell engraving tools, patterns, or an instructional dvds.



Figure 7: *A Belgium engraving student's drawing prior to cutting the design on metal.*

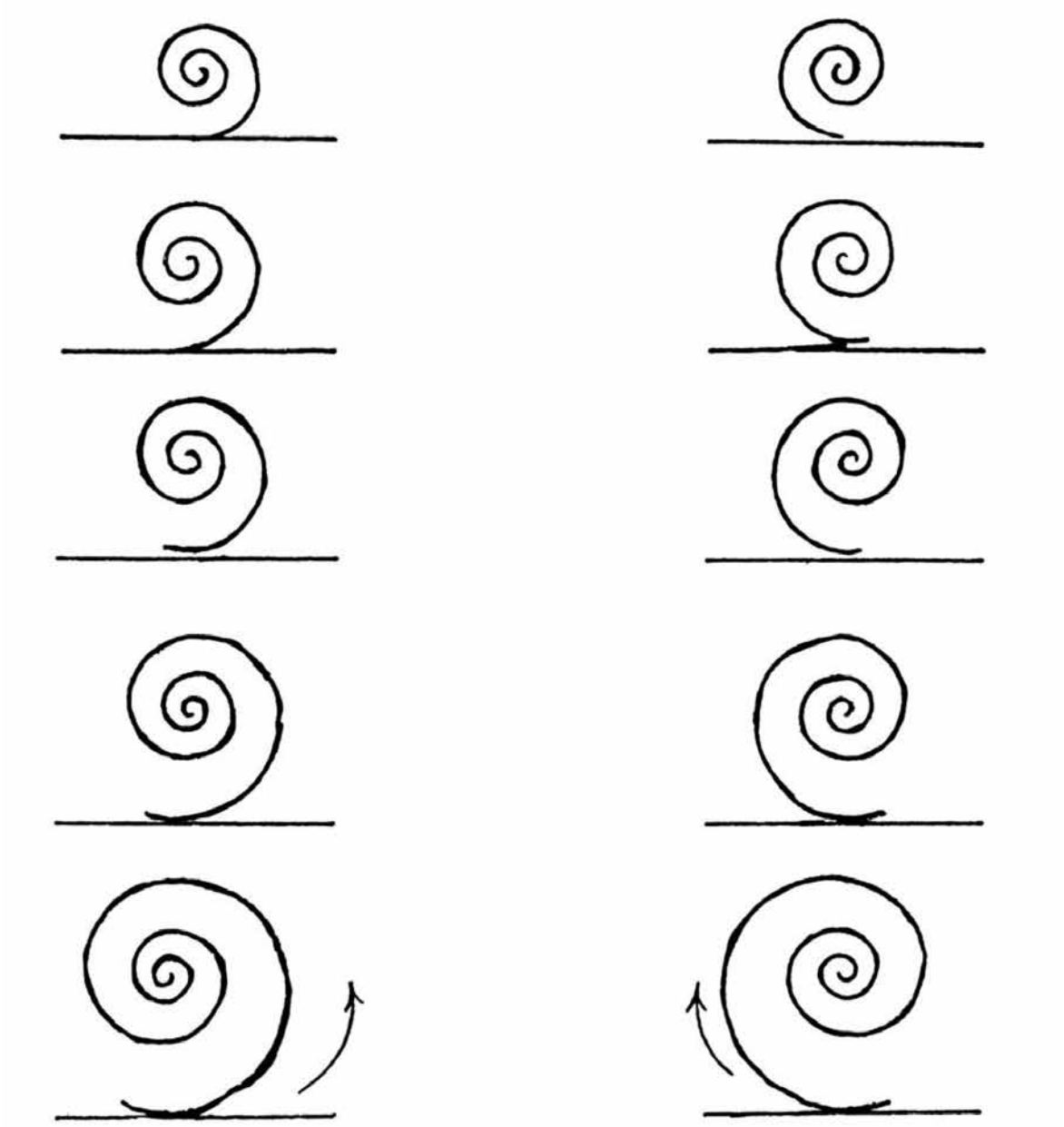


***Figure 8**: Draw single scrolls first. After drawing each scroll, turn the page sideways to each to detect any "egg shaping." Remember, the scroll is the basis for most of the designs done on guns and knives today. It is absolutely necessary to master the scroll before moving on. Keep your scrolls fairly large at first. Start from the outside and work your way inward.*

The first step towards a good design is to be able to draw scrolls, since most of the engraving styles are based on a combination of flowing scrolls, in varying sizes. Start by drawing single scrolls, both right and left hand. Larger scrolls are not only easier to draw, but also easier to cut, when one gets to that point. Practice drawing these single scrolls until they are exactly right (Figure 8).

After perfecting the drawing of single scrolls, try stacking several scrolls, one on top of the other as shown in Figure 9. As with single scrolls, practice this "stacking" until you can do it perfectly. Assuming you have mastered the foregoing drawing exercise, you are ready for the next step.

Admittedly, these bare scrolls really do not look like much and the way to correct this is by filling them in with "leaves." There are many styles of fill leaves, a few of which are shown in Figure 10, on page 12. Remember, take your time; do not skip any of the steps; there are no shortcuts to good engraving. Your progress will be in direct proportion to the effort you put into this highly specialized form of art.

By this time, if you feel that your drawings look similar to the samples shown on these pages, it is highly recommended that you purchase the book, *The Art of Engraving*, by James B. Meek. It is available from Brownells, as well as online booksellers. You will also want to check out the GRS Tools website

at www.grstools.com or call them at 1-800-835-3519. This company has just about everything an engraver will need in the way of equipment and supplies.

When you get to the point where you want to start cutting, acquire a quantity of soft steel practice plates from GRS or Brownells. Practice cutting designs on these first. Under no circumstances should you jump from the drawings directly to cutting on a good firearm or knife.

THE FIRST CUT

An engraved design on steel can be geometric — straight lines, triangles, circles, etc. — or it can be artistic — scrolls, floral or rose style, game scenes, etc. It is the latter type which is generally so much admired on guns. The cutting of such a design requires artistic ability and appreciation which must be inherent.

However, you can acquire a certain proficiency in copying and reproducing designs mechanically. If talent is later uncovered, the reward will be twice as great.

The tools advised and the method of procedure outlined earlier in this lesson are not to be taken as the only ones available. Instructors will teach different methods and recommend different basic tools. As with many artistic crafts, there is no one right way; it is the end results that count.

The tool shown in Figure 11, on page 13, is the No. 6 square graver which is slightly under 1/8"square. Graver sizes are numbered from 0, the smallest, to 10, the largest in normal use. The square graver is used with the point of the square doing the cutting as opposed to the flat or chisel graver where the whole side is used for cutting. The graver blade (3"-3½" in length) should be mounted in a mushroom-shaped handle with one side cut away. The cutting point of the edge of the square graver is called the face. The top edge as you look down on the tool is called the back. The graver blade as supplied from the manufacturer must be prepared and sharpened before it can be used. Unless the tool is sharp it will not cut. If it will not cut, you cannot hope to achieve any useful results.

The metal to be engraved must be smooth, well polished, and above all, held firmly. The best tool for holding the part to be engraved is an engraver's vise or block as discussed previously. Once the part to be cut is secured firmly, the graver is held in the right hand with the mushroom handle resting in the palm against the flesh lump below the little finger as shown in Figure 12, on page 14. The thumb is held along the side of the tool pointing toward the cutting face. The index finger is held across the back of the tool to rest firmly upon the work — not curled around the tool. The second, third, and fourth fingers are curled around the handle to steady and support the tool. The thumb is used to give directional guidance. The palm

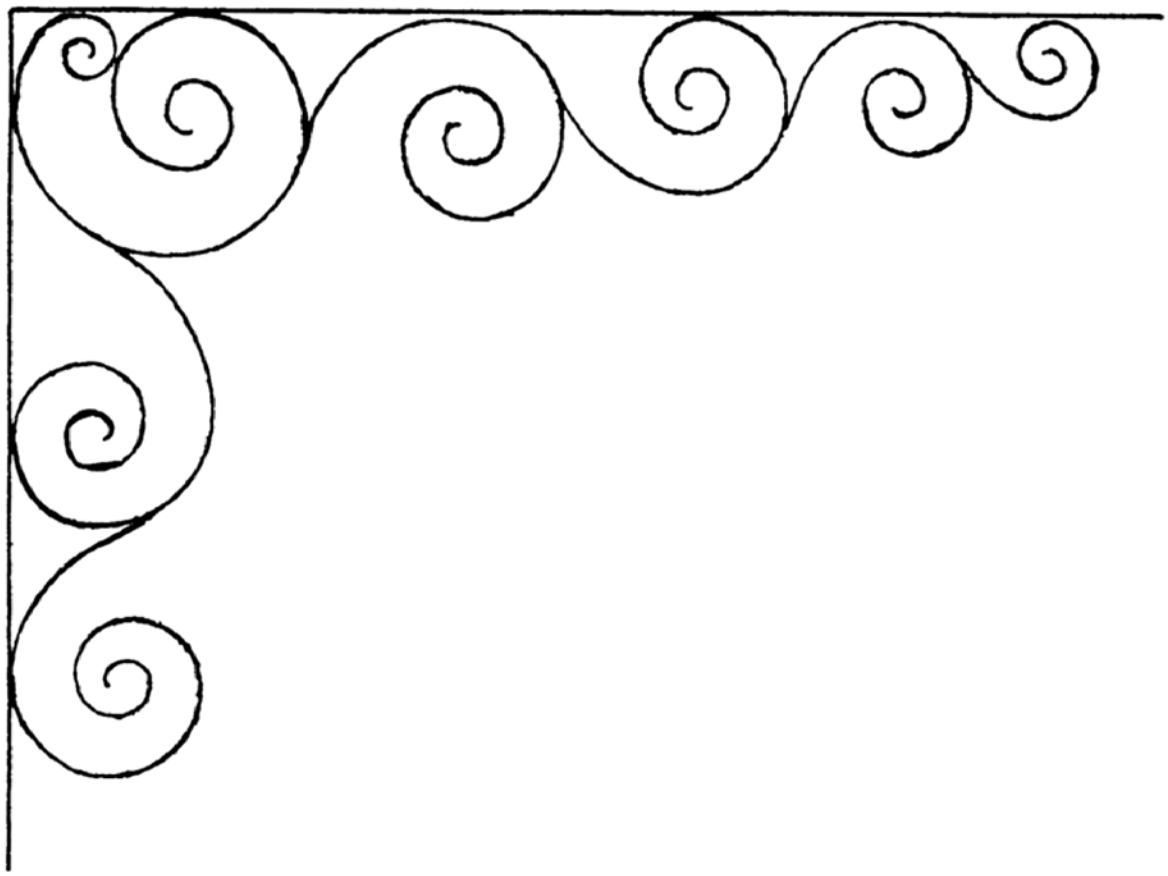


Figure 9: *Once you have mastered single scrolls, try stacking them as shown here. Later on you can dress them up a bit with shading, flowering, etc.*

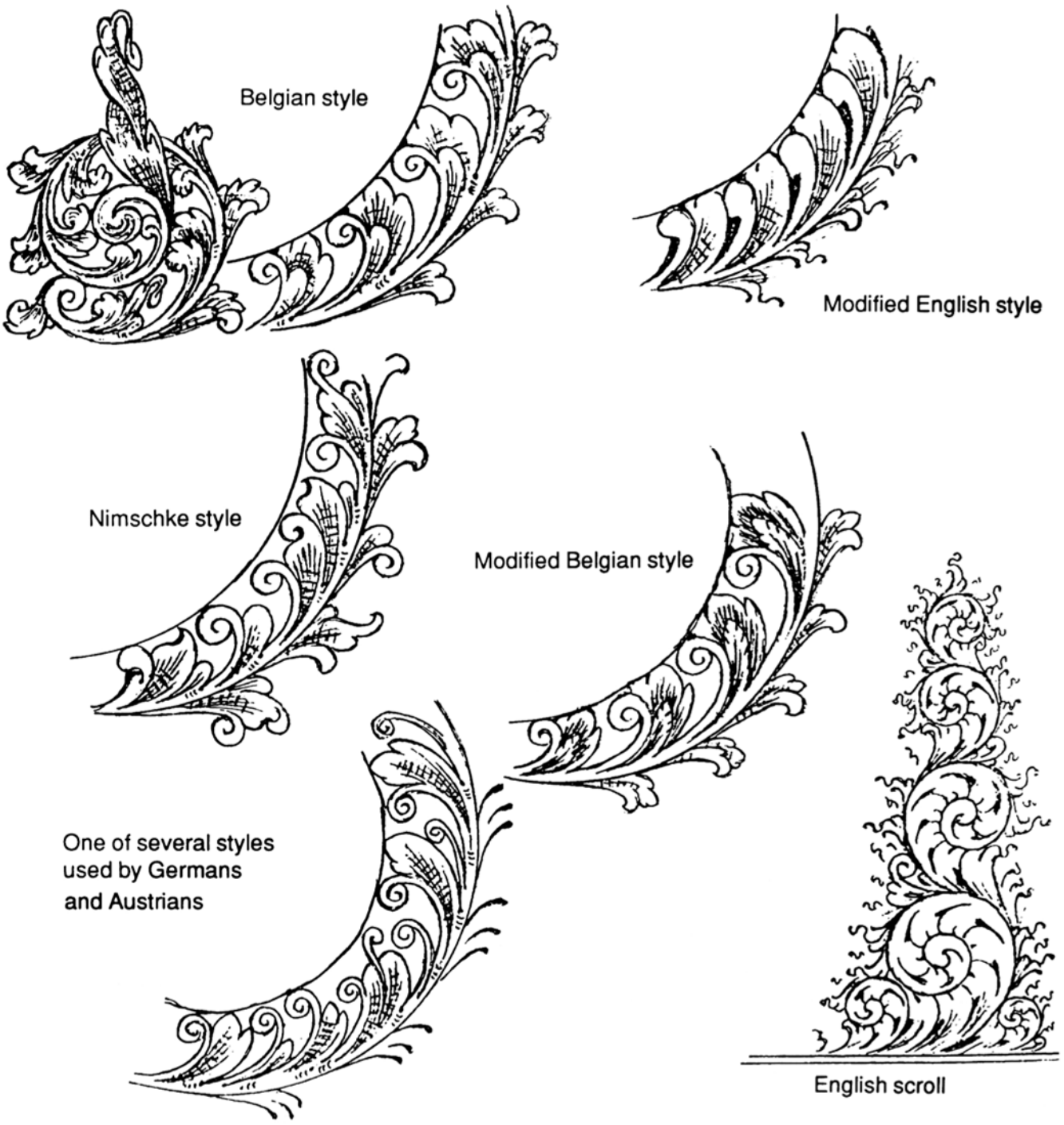


***Figure 10**: Different styles of fill leaves for use inside scrolls; also various types of spurs for use on the outside scrolls.*

transmits the driving power from the arm while the index finger acts as a stabilizer.

The graver should be held comfortably and firmly. Most people find it is easier to work standing than sitting. When using a swivel vise, rotate the work when making a curved cut, particularly a small, tight curve as in fine scrolls. As far as possible, cut in a straight line across the body, similar to cutting checking lines in curved gunstocks. The main objective at this point is to get the feel of the tool as the point "bites" in and starts to cut.

Dig the point of the graver into the metal and then to avoid making too deep of a cut, lower the handle end of the tool until the angle of the cut is running parallel to the surface. By varying the depth of penetration into the metal before leveling off, you will eventually be able to adjust the heaviness (or lightness) of the required cut.

To finish a cut, give the graver a sharp upward and forward flick. With practice, this motion should break off the chip or curl of metal and leave a neat, clean cut.

CUTTING CURVES AND CIRCLES

To begin, get a practice plate of soft steel and scribe a number of circles of different sizes.

Cutting Counterclockwise. Refer to Figure 12, on page 14 and incline your wrist over to the left, to a greater or lesser degree, depending on the sharpness of the curve. This incline is similar to a motorcyclist leaning the cycle over when rounding a left-hand bend or corner.

Cutting Clockwise. Incline your wrist in the opposite direction from cutting counterclockwise: over to the right. Again, think of the motorcyclist.

Cutting Straight Lines. You will soon realize that it is much harder to cut a straight line than it is a curved or wavy line. In other words, it will take more practice. To begin, use a straightedge and scriber to scribe some short, straight lines on your practice plates; then use your graver to cut them. Chances are, the lines will not be very straight at first, but keep practicing on these shorter lines. When these start to get relatively straight, make the lines longer and try cutting these. You should eventually arrive at something approaching a straight line.

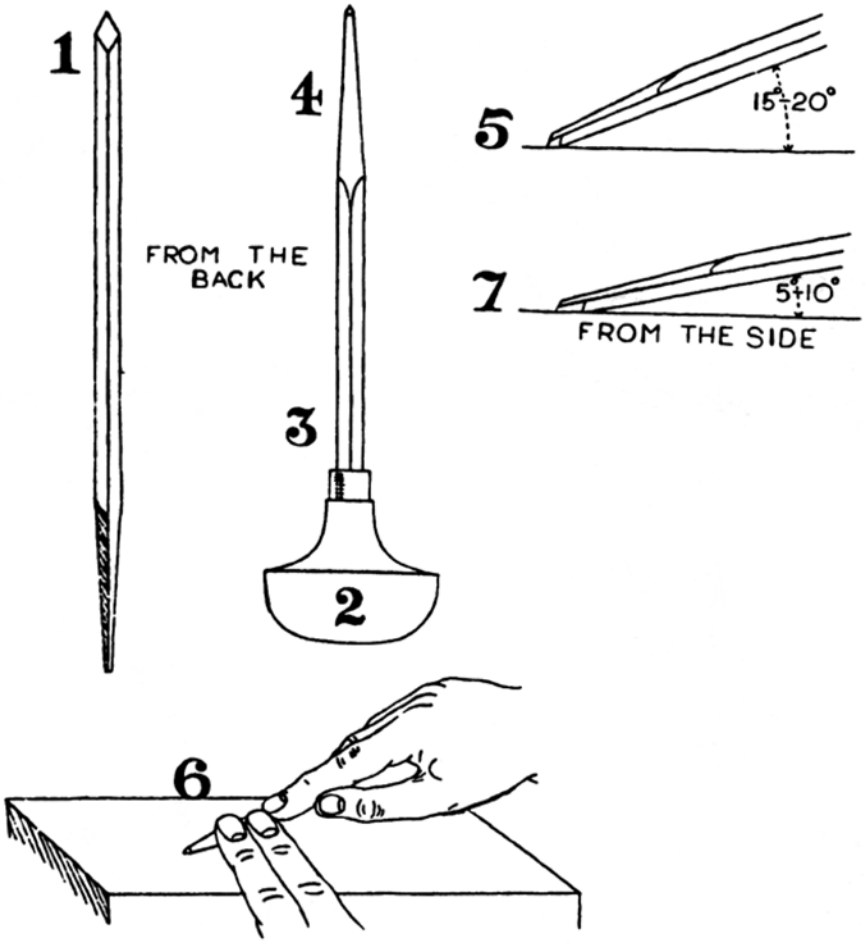


Figure 11: Characteristics of a No. 6 square graver.

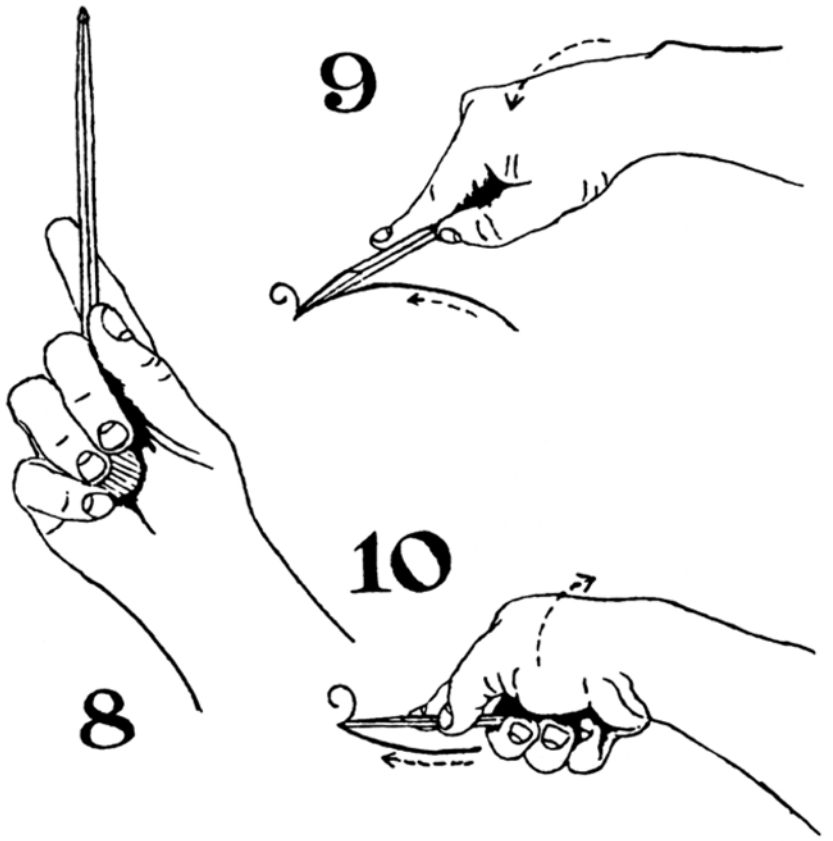


***Figure 12**: Methods of holding and cutting metal with the square graver.*

After you have practiced the curves, circles, and straight lines, and have them looking pretty good, you are now ready to start trying a few advanced designs—namely, scrolls and borders.

ENGRAVING GUN METAL

The first step in engraving a design into hard gun metal is creating the design itself. The simplest, most universally used gun engraving design is the scrollwork pattern.

Basic scrollwork comes straight from the outdoors, where they are seen in patterns of leaves, branches of trees, etc. The serious amateur might go out in the field and practice rendering these patterns into freehand scrollwork drawings.

But if there is not the time for that, there's a shortcut. Scrollwork patterns exist on innumerable firearms. Pictures of these may be found on-line, or in many gun books and magazines, old and new. Get the feel of scrollwork designs by freehand copying some of these. After some practice at copying the identical design, try adding your own touch.

After you get the feel of scrollwork styles, you are ready to try transferring them to hard metal. Select a design that you like, and use it as your base pattern. Be sure it is symmetrical: the right half is the mirror image of the left half.

One way to work with small practice metal plates is to secure one on a block of wood with four brass wood screws. Smooth off the screw edges with a file to avoid cuts. Then you can hold the wood-mounted plate in a conventional bench vise.

It is important that you sit or stand in a position which will not be overly fatiguing. You do not want the work so low that you have to bend over it too much, or so high that your arms are under a continual strain. It's also important to have the correct lighting. The light should be bright enough but it should also be diffused.

With the aid of a 2.5X power magnifying glass, or Optivisor, practice scribing some straight lines into the practice plate. Use the scriber in a way similar to using a pencil. Make the lines short and shallow. Then scribe a series of parallel lines, varying the distance between them. After some straight practice, try scribing short arcs to the left and right, as discussed previously.

After a little practice at scribing the lines, you are now ready to start cutting. With the square graver handle in the palm of your hand, place the cutting tip on one of the scribed lines (the cutting tip will be on one edge of the square-shaped tool to produce a V-shaped groove). With the graver handle held very low, push the graver down the scribed line. At such a low angle, the tool will glide over the line without cutting. Now raise the handle slightly and push it down the line again. When the handle is raised, cutting will begin. It is important that the cuts be kept very shallow — just a hairline scratch at a time. If the handle is raised too high, the cutting tip will dig in and you

will lose control, with the added possibility that you will break the graver. Strive for consistency of depth along the line. Use the magnifying glass or Optivisor to check your work as you go. It is important to make the cuts shallow and more often, rather than making them deep and inaccurate.

After some conscientious practice on straight lines, arcs, and scrolls, try scribing a whole element from your base scrollwork pattern. Then, spend some time cutting this element with the square graver.

Once you have gone through six or eight practice plates, you should be ready to try a practice plate the size and shape of the gun part you plan to engrave. It is important that this gun part be relatively flat. A beginner attempting to engrave on a three-dimensional surface is asking for trouble. An additional requirement is that the part you choose to engrave not be made of case-hardened steel or hardened metal alloys. If it is, it will be nearly impossible to cut. Try making a tiny scratch on the surface with a scriber. If you cannot scratch it, you cannot engrave it.

One gun part that is universally used as an engraving surface is the floor plate of a bolt-action rifle. Therefore, a floor plate is used to demonstrate laying out an engraving pattern in Figure 13.

To begin, you should make a template of the floor plate. Remove the floor plate from the rifle and use a wide piece of masking tape around the floor plate. Trim off the excess with a sharp knife. Now peel this trimmed masking tape off the floor plate and lay it on a thin piece of cardboard. By cutting the cardboard to the shape of the masking tape, you have an exact replica of the slightly curved floor plate. Now, by tracing around the cardboard onto drawing paper, you have an area the exact shape of the floor plate.

Once the outline is on the drawing paper, use dividers and a straight-edge to draw a centerline (long way) through the floor plate. Remember, this is going to be a symmetrical design, so it will be necessary to draw only half the design. Practice incorporating your base design into half the floor plate area.

After you feel the design has become good enough on paper, it is time to practice engraving it onto a practice floor plate. Using your template, draw the outlines of the floor plate on some fresh, clean tracing paper.

Tape your design onto a window or other back-lit surface, and trace the half-design onto the tracing paper. By flipping the drawing over, you can trace the other side, giving you a complete design on the paper.

Take the cardboard template and scribe its outline onto a practice plate. Lightly draw in a centerline. Take some Damar Varnish, and with a rag or cotton swab, coat the practice plate.

When you have the basic design perfected, trace the final, clean version onto a fresh template. Then, flip the design over and complete the other symmetrical side. Refer to Figure 13 top and bottom.

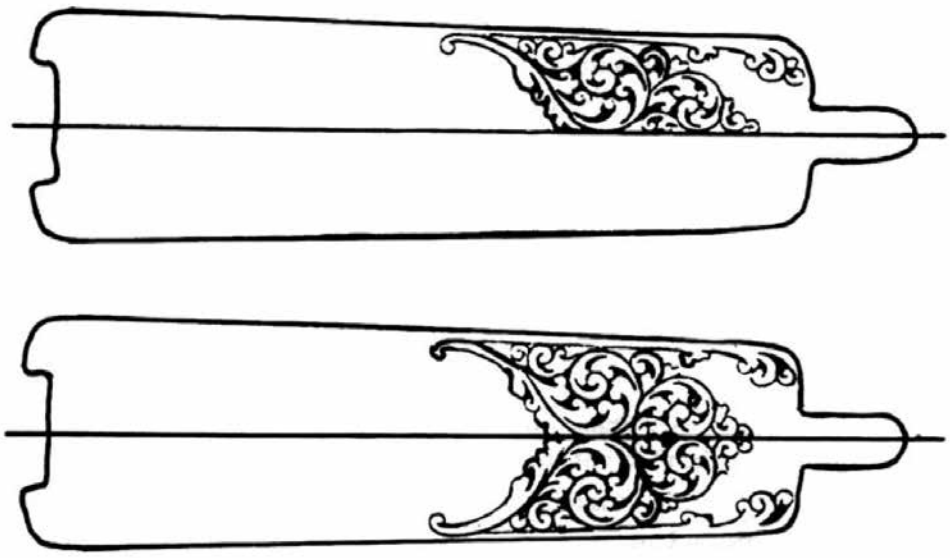


Figure 13: *Laying out a symmetrical engraving pattern on a floor plate for a bolt-action rifle.*

You may now scribe the design into the steel. After finishing, you will have the pattern scribed into an outline exactly the size and shape of the floor plate you intend to engrave. Next, after washing the varnish off (kerosene works well), cut the pattern into the steel. When you are finished, you will have a basic two-dimensional scrollwork pattern cut into steel.

Now is the time to go back and study those scrollwork designs you found on guns on-line or shown in gun books and magazines. Note that the leafy scrollwork patterns aren't merely two dimensional, but rather three dimensional in appearance. By cutting some of the background away at the edges of the leaves with a chisel graver and hammer, the design is made to stand out. Adding shallow lines near the edges of leaves, etc., produces a modeled effect, as shown in Figure 14—the closer together the lines, the greater the curve. A series of cross-hatched lines can give a shadow effect—the deeper the lines, the darker the shadow. Try experimenting with these simple effects on a number of practice plates.

Practice engraving your base pattern into a practice plate. After a dozen or so renditions of your base design, you are probably ready to engrave the real floor plate or other relatively flat gun surface. Just remember to keep the design simple. The professional has many tools and years of experience. But even the inexperienced student can, with a few basic tools and some practice, patience, and time, execute a simple engraving job equally attractive as some professional renditions.



***Figure 14**: The appearance of roundness can be obtained by cutting parallel lines. The closer and deeper the cuts, the greater the feeling of curvature.*

EVALUATING SKILL AND ARTISTRY

"How can I tell a good job of engraving when I see one? I'm a gun collector, not an art collector." Every engraver has been asked a question like this. He or she has also met dozens of self-proclaimed critics. Some of these people have read a couple of articles about engraving by gun writers who may have expert knowledge regarding shooting, hunting or military weapons, but have little or no knowledge of art or engraving. Again, this takes experience; experience in the form of examining and comparing engraved firearms at every opportunity — at museums, in gun collections, in gun magazines and books. By doing

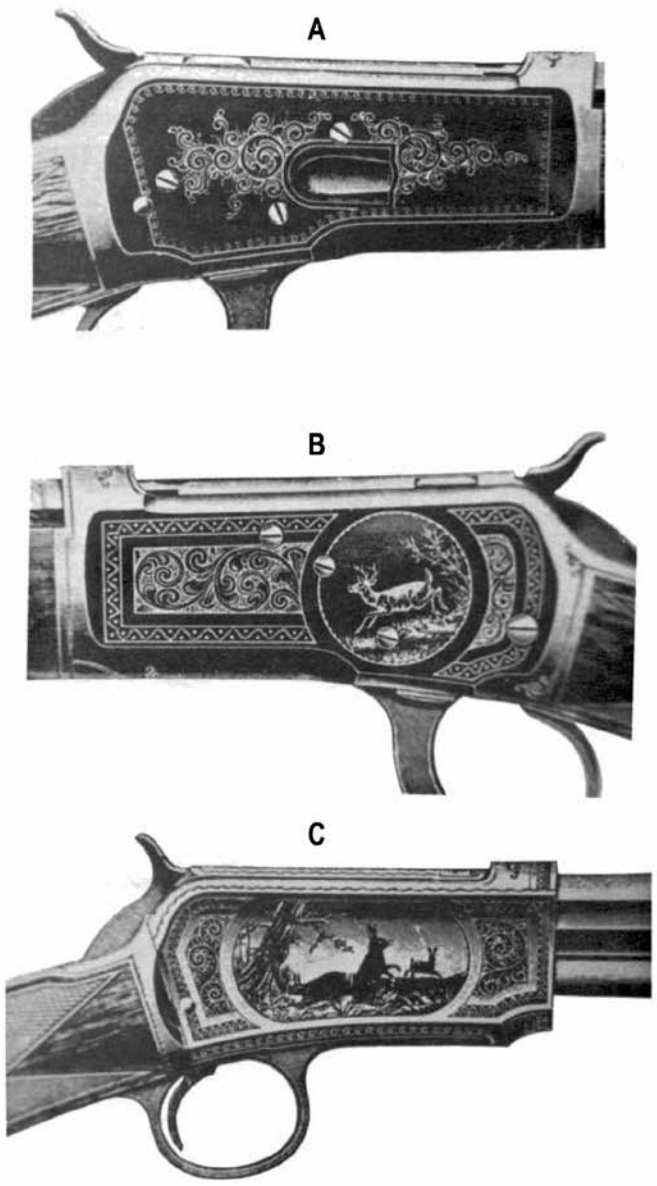


***Figure 15**: Turn of the century Winchester-style engravings. (A) A Winchester Model 92 lever-action rifle with simple scrollwork; (B) Winchester model 92 with a running deer scene; (C) Winchester Model 1890 rimfire rifle with a rabbit scene.*

so, your eye will become more educated. As a collector or investor, this education will pay off in the form of wise purchases.

Figure 15 shows some early Winchester engravings. Note the relatively simple scrollwork in Figure 15(A). The more elaborate work in Figure 15(B) shows a running deer on this Winchester Model 92 rifle chambered for .44 W.C.F., which was used extensively for deer hunting in the late 1800s. A deer scene, however, would not be appropriate on the Winchester Model 1890.22 rimfire rifle, Figure 15(C). Consequently, a rabbit scene has been engraved — a game animal more suited to the .22 rimfire cartridge. A Belgium-style engraving is shown on the shotgun action in Figure 16. Learn to recognize the different engraving styles on different types of firearms. They will pay dividends in your future as a gunsmith.

SELF-TEST QUESTIONS

Please check your answers on page 21.

5. *True or False*. **Once you have mastered cutting single scrolls, you should try stacking them to form a simple pattern.**
6. *True or False*. **When first cutting lines into steel, you should cut them as deeply as possible.**
7. *True or False*. **Before attempting to cut a pattern in steel, you should practice drawing the pattern on paper several times to get the feel of how it is laid out.**
8. *True or False*. **The cutting point or edge of the square graver is called the back.**



***Figure 16**: A sample of a Belgium-style engraving.*

Principles of Etching Metal

Metal surfaces, like the revolver in Figure 17, may be etched with an etching solution usually consisting of nitric acid, but first the metal surface is covered with an acid-resistant coating called a *ground*. This coating can consist of wax, pitch, or asphaltum. The desired design is then scratched through this coating and the metal underneath may then be treated with the etching solution. To obtain the design, you can use the GRS patterns as discussed previously or design your own, or you can even use a combination of etching and engraving as shown in Figure 18.

Coat the metal surface with the ground, transfer the pattern to the ground, then scratch through the ground — following the lines of the pattern — to the metal surface below the pattern. Then, you are ready to apply the etching solution. But let us stop right here and say that nitric acid is highly corrosive and should be handled with great care. Wear rubber gloves, a face shield, and wear protective clothing when mixing it and always slowly add the acid to the water; never add water to acid! If you should spill any on your skin, flush the area immediately with cold water and if burns are severe, get medical attention immediately.

Do not try this method on anything of value until you have had plenty of practice on scrap pieces of metal, and then only if you have assured yourself that you are capable of doing the job. In fact, this is good advice for any phase of gunsmithing, not only etching. When etching metal, it is best to seek professional advice and let the professional supervise while you practice a few times.



Figure 18: *Some firearms contain a combination of both etching and engraving.*

The professional gun engraver normally uses a lacquer which he or she mixes to cover the metal. White beeswax is melted in a clean receptacle to which the same amount of mastic is added. The two ingredients are mixed thoroughly before adding an amount of pulverized Syrian asphaltum equal to the two parts already in the container. All of these ingredients are melted together evenly by stirring them while they are being heated. When they are thoroughly mixed, the mixed ingredients are poured into a pan of water, and while still warm, they are pressed into small bars with the fingers. When ready to cover the metal to be etched, a small amount of this substance is scraped off the bar into a shallow container and enough turpentine is added to dissolve it.



Figure 17*: Etching metal is one way to decorate firearms. Many manufacturers use this process for mass-produced arms.*

The design is scribed on the gun metal and is then covered with the lacquer using an old ink pen as an applicator. The lacquer should be just thin enough to flow readily through the pen. When this is dry, the remaining surfaces on the gun part are covered with wax, pitch, asphaltum, or a combination of these. Most gun engravers use a mixture of wax and asphaltum that is heated until mixed and slightly warm so that it can be painted on the gun surface with a small brush. When completely covered, the part is dipped in acid for a given length of time so that the metal surface not covered with the asphaltum mixture will be eaten away to a certain degree and leave the design. It is then cleaned.

For the covering, ready-made asphaltum varnish may prove the best to use while scribing the metal parts, because when allowed to dry hard, it will cut well and leave clear, sharp lines. After etching, the varnish may be removed with turpentine.

Solutions for etching metal should always be mixed and applied in glass containers or containers heavily coated with asphaltum. For fast etching, nitric acid is usually used full strength. For slower action, the acid may be diluted by carefully adding 1 part water. When the process is done with a diluted solution, it should be stirred occasionally to remove bubbles and scale that may interfere with even biting. Store the solution in glass bottles with acid-proof caps.

Aluminum trigger guards, for example, can be etched in the same way as steel except muriatic (hydrochloric) acid is used instead of nitric. Full-strength muriatic acid will etch to a depth of about 0.003" per minute. The etching is slower, but can be kept under control much better by diluting 1 part acid to 3 parts water.

JEWELING

Jeweling is one gunsmithing technique that is normally used on bolts of bolt-action rifles. However, the practice is also useful on other gun parts such as hammers, internal action parts, etc. Jeweling metal, often called engine turning or Damascening, involves overlapping spot-polish marks on metal that give a hammered effect. To perform this operation, you will need an engine turning chuck. This tool consists of a steel holder with a 1/8" shank and an abrasive charged rubber tip. The specially made abrasive tip gives an even impression on steel and simplifies the work of engine turning and eliminates the danger of cutting deep rings.

Many shops use engine turning brushes rather than the tips. Those brush wires follow the contours of the rounded gun parts better, giving a complete jeweled pattern. They are also reported to be superior on flat surfaces with long tool life. Silicon carbide abrasive and oil are used in conjunction with the wire brush to obtain the pattern. The drill press rpm should be fairly high: above 2000.

The bolt (Figure 19) is secured between an arbor inserted into the rear of the bolt and a centering pin in the firing pin hole. The fixture containing the bolt is placed on a drill press table against a straight-edge fence and clamped to the table. The bolt body should be centered under the engine-turning tool which is held in the drill chuck. Coat the bolt with abrasive compound and start the pattern. Start at either end of the bolt, but once started, continue from this same end for all rows. Bring the engine-turning tip or brush down on the bolt and make the first spot. Then move the fixture along the straight-edge fence approximately one-half the diameter of the spot and bring the brush down again on the bolt to overlap the first spot.



Figure 19: *Jeweling bolt attached to a drill.*

Continue this procedure until one row of spots is completed. Then the bolt is rotated approximately ½ of the diameter of a spot and the process is repeated for another row. This continues until the entire bolt has been fully jeweled in the areas desired (Figure 20).



Figure 20: *Sample of jeweling on a bolt.*

SELF-TEST QUESTIONS

Please check your answers on page 21.

9. **What is another name for Damascening or engine turning?**
10. **What type of acid is normally used when etching steel?**
11. **What type of acid is normally used when etching aluminum?**
12. ***True or False.*** **To perform jeweling, you will need an engine turning chuck.**

Answers to Self-Test Questions

1. False.
2. Square.
3. False.
4. NgraveR Electric Engraving Tool.
5. True.
6. False.
7. True.
8. False.
9. Jeweling.
10. Nitric acid.
11. Muriatic or hydrochloric acid.
12. True.

Lesson Questions

THIS IS LESSON NUMBER 2195.

Make sure you print your name, student number, and lesson number in the space provided on the Lesson Answer Form. Be sure to fill in the circles beneath your student number and lesson number.



REMINDER: A properly completed Lesson Answer Form allows us to evaluate your answers and send the results and additional study material to you. Do not hold your Lesson Answer Forms to send several at one time. You may run out of study material if you do not send your answers for evaluation promptly.

You may also complete your exam online at www.sdi.edu, click on the *online exams* tab.

1. **How far back can metal engraving be traced?**
   a. 5,000-6,000 years.
   b. 3,000-4,000 years.
   c. 1,000-2,000 years.
   d. 300 years.

2. **Which of the following is a tool used for engraving steel?**
   a. Crowning bit.
   b. Twist drill.
   c. Graver.
   d. End mill.

3. **What is the name of the most widely used hammer in gun engraving?**
   a. Cross-peen hammer.
   b. Straight-claw hammer.
   c. Ball-peen hammer.
   d. Chasing hammer.

4. **What is the name of the engraving tool that is used to cut several parallel lines simultaneously?**
   a. Knife graver.
   b. Veining tool.
   c. Metal liner.
   d. Square graver.

5. **Which of the following may be used to get a "closer" view of the design while engraving metal?**
   a. A variable-power rifle scope.
   b. Jeweler's loupe.
   c. A higher bench vise.
   d. Place more light on the design.

6. **Which of the following best describes florentining?**
   a. The cutting of crossed sets of lines, similar to the lines cut in checkering a gun stock.
   b. The cutting of parallel lines, all running in one direction.
   c. Stippling the metal with a nail set.
   d. Cutting patterns that give a flowered effect.

7. **Which of the following best describes the Gravermeister?**
   a. A mechanical device that takes the place of the hammer and chisel.
   b. A mechanical device that turns the workpiece.
   c. An electrically operated miniature jackhammer.
   d. A mechanical engraving tool that operates from a turning shaft.

8. **If you are a beginner, what should be your very first step when starting gun engraving?**
   a. Practice drawing single scrolls on paper.
   b. Practice drawing multiple scrolls on paper.
   c. Practice cutting floral designs on steel practice plates.
   d. Jump in and engrave a floor plate for a bolt-action rifle.

9. **Inclining your wrist when engraving curves in gun metal may be compared to which of the following?**
   a. A motorcyclist leaning his cycle over as he rounds curves.
   b. An airplane pilot doing a complete loop.
   c. A juggler in a circus.
   d. A painter.

10. **What is the simplest, most universally used gun engraving design?**
   a. Triangles.
   b. Circles.
   c. Straight lines.
   d. Scrollwork.