Richard Austin (1936-1990) was a metalsmith and author, with several hundred articles to his credit.

After his death I was given custody of an extensive collection of manuscript material-mostly on the technical issues of metalworking.

This text represents the first effort to organize the material—an attempt merely to group the files by topic. None of this is finished, and the text makes reference to illustrations that were never done—illustrations which were stored separately in any case, making it extremely difficult to bring the parts together.

It is unlikely that I will ever be able to spend the time to sort this all out. But it seemed a shame to let these articles languish unread by those who might benefit from them in some small way. So I have decided to release them in their roughly sorted form in the hopes that someone may find them useful.

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HAND MADE WAX WORKING TOOLS

Although I feel that it's impractical to make many casting tools (such as a furnace or centrifugal caster) some tools are practical and easy to make. The small spatulas and cutting tools for working wax are simple to make and the savings are well worth the trouble. A basic set of 6 to 8 tools might cost $20 - $30 at retail. These can be duplicated for a cost of about $1.00 and an evenings work. The three most basic types of tools are:

1. **Spatula** - A flat thin tool. It can be used for wax welding or carrying wax to or from the work.

2. **Point** - A round pointed tool that can be used to weld or texture wax. It does not tend carry wax.

3. **Knife** - Any cutting edged tool to actually carve the wax. The knife would not normally be used hot.

For a starter set I would suggest a set of two each of the above tools. Buy a three foot length of 3/8" dowel, a 3 foot length of 0.016" piano wire and a 3 foot length of 0.032" piano wire. The piano wire can be found in almost any model airplane shop.
TOOLS

The wax working tools or spatulas come in a wide range of sizes and shapes. They can be used cold to scrape or scribe the wax and warm to provide various kinds of texture or modelling. Before discussing the details of how the tools may be applied, it's important to understand that the basic shape itself has some influence on how the tool will work. A flat spatula shaped tool such as a Kerr #7 will tend to pick up and carry away wax. It is useful for wax buildup. If it's heated in the flame of an alcohol lamp and touched to a block of wax, it will pick up a bit of molten wax. This drop can then be transferred to the model. A very sharp tool such as a #9 spatula does not carry very much wax. When heated and touched to the wax, it simply melts the depression. It can be used to weld or develop textured patterns but it's not suitable for transferring molten wax.

Plastics are available in a number of forms besides the conventional sheets, rods or molded shapes. In some cases it's not obvious that the material is even a plastic in the conventional sense. However, there are a number of useful materials made of plastic whose properties provide good burnout and great versatility in modelmaking. A good example are the acrylic polymer emulsions. These emulsions are used as the base for water base, artist-type paints. Obviously, the pigmented forms of these paints would cause problems in burnout, however, acrylic emulsions are available unpigmented. Liquatex (registered trademarks of permanent pigments ink, Cincinnati, Ohio) jell medium meets the requirements of being pigment free in a plastic which
burns out easily. Basically, this material is a transparent gloss medium for painting. However, it can serve a wide range of uses of the construction of models. Used as it comes from the jar, it dries to a glossy finish within a few hours. It can be built up quite thickly to provide brush textures like the one illustrated in the texture sample in Figure #82. Alternately, the material can be thinned with water and used as a sealant to close the porosity in wood or other organic materials. The material does shrink somewhat on drying and will tend to distort materials such as thin leaves or paper. It remains quite flexible so that it is practical to develop the texture on flat shapes and later bend them where required.
TOOLS

As we proceed through this book, I will describe a number of pieces of specialized tools or equipment which are useful for model making. However, at the start, I think it will be worthwhile to discuss the very basic package of wax working tools which you need to get started. It will also be useful to briefly outline the specific uses or characteristics of some of these tools.

The spachla is one of the most basic of all the wax workers tools. Applied hot, this tool can be used to mold cut soften or texture the wax. There are all kinds of sizes and shapes of these tools, but really there are 3 basic styles which would be most useful in getting started. These are illustrated in figure 1. The basic shapes are the spachla, the oval and the round point. Each of these tools has somewhat different characteristics. The spachla is the one tool that can be used to carry wax or remove wax from the surface. The flat area on the tip will tend to pick up and hold wax for transfer. If you heat the spachla gently in the alcohol flame it can be used to carry materials such as blue inlay wax to a well joint. Neither the pointed or rounded tip _______ will carry wax in quite this manner. By the same token you can use the spachla tip to pick up wax from the model and carry it away. One of the annoying things that happens during the wax modeling operation is the gradual build up of wax on the tools, if you don't remove this it ends up in the wrong place. For many years I kept a rag around my bench and would quickly wipe off the warm wax when it got in the way. When I was really in a hurry, I would often
simply wipe the wax off on my blue jeans. However, this got to be a pretty unpopular approach, and finally one day I made a simple cloth pillow. This little pillow is illustrated in figure 2. Just take a small rectangle of wood (2 or 3 inches square) and tack a pad of clean cotton rag to the board. You can leave this on your bench and wipe off your tools as you are working. As the surface becomes loaded with wax you can turn it over and refold it and give yourself a new surface whenever you desire. This device will clean up your work area considerably. The spachla can also be used to weld or cut off wax as needed. For example in spruing I often heat the spachla and place it beneath the tip of the sprue rod and the model and heat both surfaces at the same time _____ the spachla both surfaces are melted and they will join quite securely. Time and experience will teach you the many applications of this tool. You can also use it to texture the materials as _____ the texture samples which are illustrated later. The all or short point is useful when you wish to weld or texture the model without carrying any material away. The small surface area _____ means that it will remove very little material when it is applied to the wax. I use this for operations such as the welding on of prongs and the application of fine texture to the model. It is also used for techniques such as ______ method of piercing which is illustrated later. The round tip tool is almost exclusively used for texturing. It provides a nice soft even texture that is particularly good for application inside the tops of ring models or on the backs of pins or pendants. The application of spachla texture to areas such as this will dramatically decrease the amount of time which is needed to polish or clean up these hard to reach
areas in your jewelry.
production work. Although I have a large variety of plain spatulas in my shop, I also keep an electric spatula for operations such as spruing where the temperature remains quite constant and the process is repetitive. If you are working with a lot of detail and have to keep changing tips and/or waxes, the spatula is slow since the tips have to come to temperature and the spatula itself has to come to equilibrium.

Heating time is a problem which many people ignore with the electric spatula and the wax pens. Many of these units require from anywhere to 10 to 45 minutes to come to constant temperature. If you're going to use one of these units it's important to turn it on well before you begin to work. Otherwise, you'll be frustrated by a constantly shifting temperature during the work process. This makes it difficult to produce consistent results in texturing or even in operations such as spruing.
WAX WORKING TOOLS

There are several ways to think about wax working tools. The simplest is to divide them into tools which are used heated, and tools which are used at room temperature. Let begin by discussing the various tools which are used hot. Suppose there must be thousands of possible shapes for wax working tools, but after awhile, you come to realize that there are only three fundamental tools shapes. These are:

- Pointed
- Ball Shape
- Spatulas

These tools vary in one principle characteristic. That is their surface to volume relationship. As you progress down this list, the tools develop more and more surface area relative to their volume. This means that when they work the wax they behave differently. Fundamentally, as the surface area increases, they tend to pick up and carry wax. This means that the pointed or low area tools are more suitable for texturing and welding, and the spatulate shapes are more suitable for high levels of heat transfer and adding or removing wax.

Electric Spatulas - A number of manufacturers supply electrically heated spatulas. These are especially useful in
Wax Pens - Several manufacturers also make a tool called a wax pen. These are various kinds of heated devices which have a small reservoir and some kind of a valving mechanism which allows you to add small amounts of wax through a hollow tube.