Making a Low-cost Resistance Solderer

Welcome! I am Glenn Edmison. I hail from Bend, OR and I model in N-Scale with some side trips into HO. I do have a home layout, The Oregon Short Line Railroad. It is a 5 ft. X 9 ft., two-level walk around, suspended from my garage ceiling. I have belonged to a couple of HO based clubs, and do some HO modeling.

Several years ago, at my local club, I was installing track for the log-loading area of a new logging division. I needed a three-way switch. Ready-mades are expensive, and, as always, we were working on a shoestring. Our club leader suggested that I hand lay it. I was a new modeler, and up to that point had used only ready-made flex track and turnouts. The idea intrigued me, though, so I did a little research and laid out a pattern. I gathered up my meager set of tools and set to work.

The biggest problem, I found, was using a regular soldering iron while holding everything in place, and getting a joint while not melting everything nearby. I got it done. It didn’t look too bad. And I had only melted a couple of ties a little bit. But when I tried running cars over the switch, they kept derailing. Not good.

Frustrated, I again talked with my fearless leader. He suggested that I use a resistance soldering unit that was owned, by the club, stating that I would have and easier time, and better joints. He was right. This time the three-way turnout worked, and I was hooked. The heating was quick - almost instantaneous. The cooling was almost immediate. I didn’t melt anything that wasn’t intended. I really liked resistance soldering. If I ever hand laid another turnout, I would most certainly want to use one.

Some years later I was working on my AP requirements for Model Railroad Engineer and had to hand lay three turnouts. But at that time I no longer had access to that fine soldering unit. What to do? Armed with the knowledge I had acquired in my earlier experience, I toughed it out and got the job done with a regular soldering unit, mostly because I was working with wooden ties, and most solder joints were relatively far apart. More than ever, I wished for a resistance unit.

This is a picture of The American Beauty brand of resistance solderer like the one I used. It is sold by Micro Mark. It is a wonderful tool. It is durable and likely would last a careful user for a lifetime. However, the basic unit is listed at $490 discounted at Micro Mark to $397. A similar unit from Hot Tip is $615. For only occasional use, I find that a bit expensive. It’s true. I am of Scottish ancestry, and I am “keerful” of my money. But sometime, I thought, I will have one.

Now I am working on a scratch-built model of Beyer-Peacock...
Garratt steam locomotive. There are many small parts needing soldering, and often close together. More than ever I have wished for that type of tool. I wondered if there was not a less expensive solution to my needs.. Now I am retired, so I have a bit more time to check this out. I went to the internet. Here is what I found:

A number of others have been down this path, before me. There are a number of articles on the internet detailing how they did it.

Some use transformed AC current. Some use regulated DC current. Did it make a difference? Apparently not. The determining factor seems to be the wattage output. The projects reported had between 50 and 100 watts output. For example,

\[ \text{Volt} \times \text{Amps} = \text{Watts} \]

- 10 volts \( \times \) 5 amps = 50 watts
- 10 volts \( \times \) 10 amps = 100 watts
- 5 volts \( \times \) 15 amps = 75 watts

\[ \text{Etc.} \]

For most of the home built units, this output is fixed. It works the same every time, so you know what to expect. That is important.

One of the reported projects used a step-down power transformer with outputs of 5 or 10 amps AC

A second project used a battery charger with output of 10 amps DC.

A third project used a salvaged computer power supply with output of 6 amps DC.
Since the costs reported were small, I decided to try several so I could satisfy my curiosity of which worked better. Here is how I proceeded.

The first device used a battery charger that I already had, although a new one was about $50.

I just connected the charging leads to a home made hand piece, applied it to my brass pieces, flipped the switch, and applied the solder. It heated almost instantly, melted the solder. I flipped the switch off and it cooled quickly. Eureka!!.

I still had the problem of needing a way to turn the power on and off while my hands were occupied. I remembered the foot switch that came with the American Beauty solderer. How could I find one that I could use? The answer? An instant on–off foot switch, which had been suggested by several authors.

The source article suggested just getting a simple push button on-off switch, and mount it in a home made metal box. About that time I got a tool catalog from Eagle Tools. They had a foot switch made for power tools that was only $29 dollars. That seemed very reasonable, since the official switch was sold for about $55. And I knew I could use it for many different tools.

I did find that while it worked, there were some differences from using a traditional soldering iron. The hand piece had to be in contact when the current was applied, or I got sparks. That was where the foot switch served me well. When I was all ready to solder, I just stepped on the switch. When I was done, I just raised my foot.

Another problem: If the parts were small and the amperage high, the parts to be soldered over heated, or another nearby solder joint melted, or the circuit breaker tripped. The answer? Some way to control the amount of output. A dimmer switch might work.

I bought an ordinary household wall dimmer switch. I reasoned that it was designed to control household voltage of 115 volts AC and might not work on 12 volts DC, so I wired it into the input circuit in my design. In a test run, it worked fine at about one-third setting. I got the heat I wanted, and could crank it up a little if I had a larger joint. I think the internal resistance of the battery that was ordinarily the victim of the charger should be taken into account. There is relatively little resistance in my modeling joints, so, I reasoned, I would be well-advised to not push the apparatus too far. Most of my soldering jobs were small, so it would do fine. Just avoid big, heavy metal jobs, and it would work well. Here is a picture of the finished unit.
The second device. That not being too difficult for a non-electrician, I thought I might be able to try the computer power supply device. Many older computers are scrapped. It is the digital processor that becomes obsolete, not the power supply which has remained fairly uniform over time. The article suggested visiting my local computer repair shop to find a salvaged unit. I did find one, for only $15. That was reasonable. At first I was intimidated by the spaghetti-like mess of colored wires coming out of it. That just about put an end to the experiment. Rereading the source article, it told how to identify the important wires. They are all color coded. The article told me to look for a set of two blacks, a red and a yellow wire. AHAH! So I chose the correct set, cut off the connector that came with them No sweat. I plugged in a salvaged computer power cord (Computers have cords with weird ends). I put probes from my multimeter into the red and yellow sockets and turned the unit on. Zounds! What is this? Nothing at all happened. But then, I remembered the article had said that most power supplies have a protection circuit that requires the black wires to be grounded to a green wire. Just make a jumper wire between them, and it should work. Easy enough, I told myself. I did as directed and again turned on the power. This time the cooling fan in the unit began to work, and I got an output reading of 10 volts and 6 amps on the meter. I still needed a quick-hands-free way to turn it on and off, but, I already had the foot switch I had purchased for the first unit. I could use it on this one, too.

Connecting my contact tool to the output leads, I tried it on a piece of brass. Good heat. The solder melted in only a few seconds. Off with the foot switch, and it cooled just as rapidly. Success! Three lusty cheers!!! I had another working unit.

The hand pieces. Next, I tackled the creation of suitable handpieces. The original and various other articles told how to make two different types. The first was a converted 30 watt soldering iron of the pencil type. This was converted to hold a single tip made from a piece of carbon arc soldering rod. A visit to a local welding shop netted me a couple for only $1 each. That should be enough to last me for quite a while. I had to remove the heating unit from inside the tip, drill out the socket end to fit my rod, and rewire it attaching one lead to the welding rod, and routing the other out through the side of the handle terminated with a common electrical clip. I added 1/4 inch phono plugs to the power end of the leads with matching sockets on the power unit, in this case, both the computer power supply, an the battery charger units which I had installed into
a carrier box for each.

The second hand piece was made from a simple bamboo kitchen tongs which I found at a kitchen supply store for only $1.49. This unit simply added two wires terminated by, of all things, some salvaged pieces of drafting pencil lead. These I had among my own tools, I created a slightly revised version of the lead holder suggested by the author, connected the handpiece to my power supply and tried out a solder joint. It worked pretty well until I applied too much sideways pressure and the brittle tips broke. Well, the article was right again. One had to adjust the technique of making contact with the articles to be soldered so contact was a straight downward pressure. I wondered if I could find stronger tips. Micro Mark advertised replacement tips for the American Beauty single handpiece I remembered that these I had used before were copper clad, so should be stronger. So I ordered them. This was the single most expensive purchase I made. You get a half dozen for $37. I reasoned that I could be careful, and they would last for a long time. I found they were stronger, but still required some care. They could break as well.

Here is a picture of my completed hand pieces:

**Another method** I did think of another possibility. I have a venerable old Weller soldering gun that I have had for years. It is instant on and off. It uses a specialized application of resistance soldering to heat the tip by passing the current through a resistant metal tip. What would happen if I substituted the closed circuit of the tip for two contacts, similar to the tips on the kitchen tongs handpiece? I noted that the square copper leads for the ready made tip were just about right to fit into the copper tubing I had bought for the tongue unit. And I already knew the copper tips from Micro Mark would fit the tubing. I cut off the resistant metal tip to leave just the square copper ends. I inserted each of them into a piece of copper tubing and soldered them in, to be sure I had a good circuit. I put a piece of the Micro Mark tips into the other ends of the copper tubing This way, connecting these new tips in place of the old one gave me two contacts for my resistance unit. I tried it in a similar way to how I had tried the other units, pulled the trigger, and proceeded to solder my joint. Again, it worked.

Well, That was interesting. I learned a bit. I now have some alternatives to having a hot soldering iron setting around. I think the computer power supply unit is my choice of the three. I really did not gain much with the weller unit. It works pretty well in its original form.

Thank you for coming to my clinic.
Two Soldering Methods Compared

Typical Soldering:

An object of some mass is heated. Touching this hot object to another - to be soldered - transfers heat to the other until it is hot enough to melt solder. The hot object is removed and the second, with its solder, cools until the solder freezes.

Resistance soldering.

Two objects of little mass are touched to another - to be soldered. Electric current is passed through the other object creating heat within it until it will melt solder. The electric current is turned off. The heat dissipates quickly freezing the solder.

Comparisons:

Traditional soldering uses great amounts of energy to create the heat but uses very little in the actual soldering process. The electrical energy continues to be used between soldering tasks.

Resistance soldering uses only a small amount of energy for a very short period of time and none in between soldering tasks.

Traditional soldering requires heating two objects - the heat source and the soldered objects.

Resistance soldering generates heat only in the portion of the objects to be soldered.

It is evident that resistance soldering is much more energy efficient.

Some Internet Sources

Computer power supply

Battery charger:
http://www.girr.org/girr/tips/tips1/solderer.pdf

Transformer:
http://slimguageguild.erikensandra.nl/soldering/soldering.htm
http://www.geocities.ws/kammer0072000/lawrence_boul_RSU.html