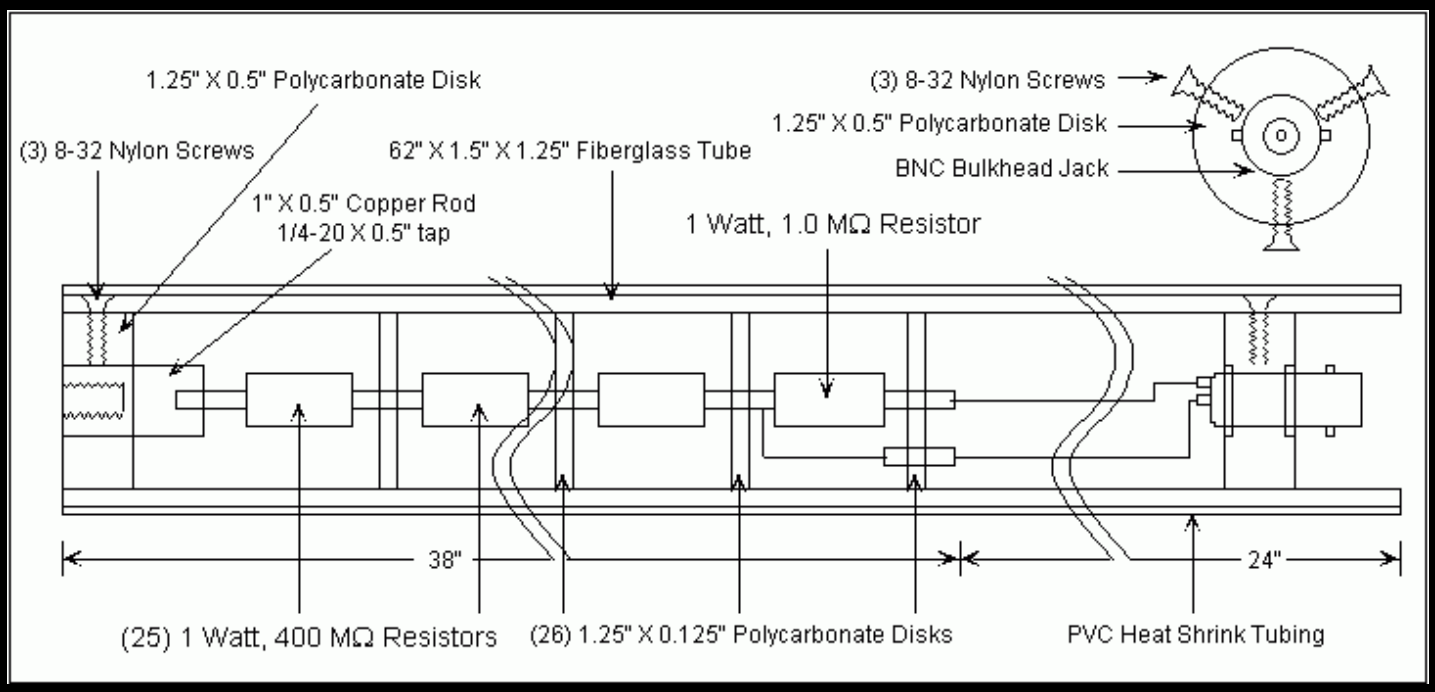
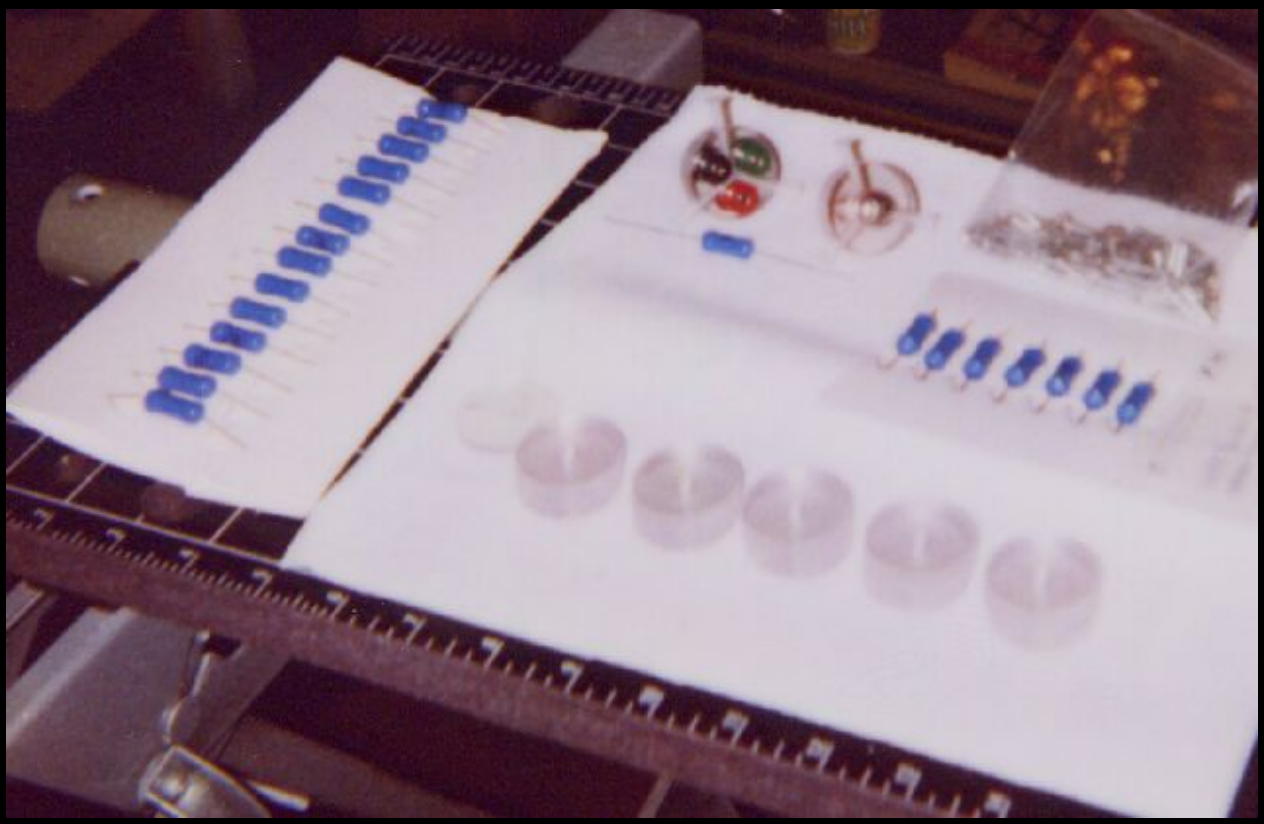
High Voltage Probe

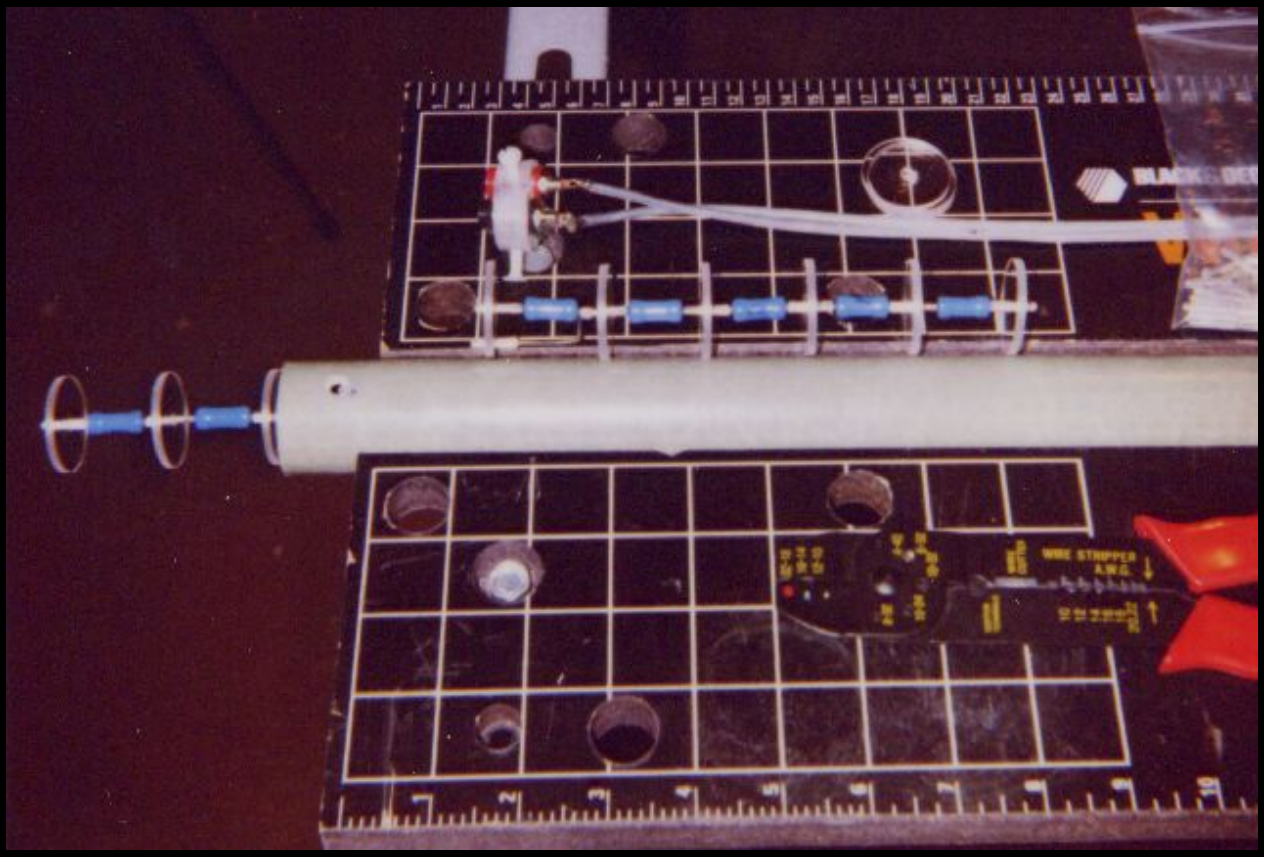
When I first seriously considered building a Tesla Coil, one of the first things I bought was a high voltage probe (Fluke model 80K-40) good to 40,000 volts. Now, with an operating Tesla Coil, Cockcroft-Walton voltage multiplier and Van de Graff generator, 40KV is way too low. Commercial test probes for higher voltages are available, but are very expensive. So I decided to design and build my own.



The picture above shows a schematic drawing of my design. The voltage divider circuit contains 25, 1 watt, 400 MΩ, high voltage resistors and one 1.0 MΩ high voltage resistor connected in series with crimp style butt connectors. This gives a 10,000:1 division ratio and a voltage limit of 500,000 volts (to dissipate 25 watts). The barrel of the probe is a 62" length of 1.5" OD X 1.25" ID fiberglass tubing. The probe tip and the three banana jacks (high potential, test ground and earth ground) **[10/20/01: the banana jacks were replaced with a BNC bulkhead jack]** are mounted in 1/2" thick circles of polycarbonate connected to the barrel with 8-32 flat head slotted nylon screws. Each butt connector is mounted in the center of an 1/8" thick polycarbonate circle. The probe is covered with PVC heat-shrink tubing (fiberglass makes me itch).



This picture shows the parts ready for assembly. The polycarbonate disks were cut with a router and compass attachment. The fiberglass tubing was cut with a carbide hacksaw blade and the end trued and trimmed with a Dremel rotary tool with diamond cut-off wheel (glass dust everywhere, seriously itchy too). The six holes through the fiberglass tube for the end cap mounting screws were drilled with a 3/16" titanium nitride coated drill bit and counter sunk with an 82º high speed steel bit.



This photo shows the parts being put together. Most of the resistors are in the tube (except for the five assembled above the tube and four which were still on back-order from Newark when this picture was taken). Also shown are the two 24" insulated leads which will run through the handle and are soldered to the banana jacks (which are color coded so I can't screw up and put 500,000 volts through my multimeter) **[10/20/01: the banana jacks were replaced with a BNC bulkhead jack]**.

Here is the unwieldy finished product, covered with PVC heat-shrink tubing, balanced on my Cockcroft-Walton voltage multiplier.

In this photo, you can see the ribbed handle of the probe and the read-out of 80,400 (8.04 X 10,000) volts from the C-W.

A quick check of one of my small Van de Graff generators gave a reading of only 18,000 volts, suggesting that the 10 giga Ohm impedance of the probe is still drawing more current (1.8 µA in this case) than the generator can deliver.

I'll try it out on my Tesla coil soon.

Tried it with the Tesla coil. Whenever the coil was running, the multimeter display blanked out. I'll probably need an oscilloscope and a Faraday cage to make this work. Time to cruise E-Bay.

Home