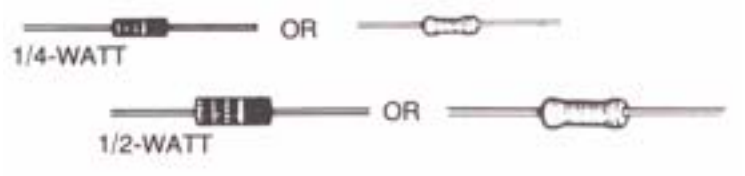
Phantastron
Manual Pages
2,3,7,11 (of 14)

So, what does it do to audio? Well, it takes any input wave and reshapes it according to the delay time. This delay time is set by the 2M potentiometer and the capacitor between the grid and the plate in our circuit. As resistance is raised (and reactance, hence), the frequency of the phantastron's delay cycle slows down. As resistance is lowered, the cycle happens faster and the frequency is raised. Thus, in an audio circuit we can impose the pitch.

Preamble:

When assembling the Phantastron, you will primarily be connecting parts to a circuit board, turret board and external components like switches and potentiometers (knob controlled variable resistors).

Let's start with a brief explanation of these parts and how to attach them.



Resistors:

Measured in Ohms, these parts' values are color coded. Hold the resistor so the GOLD or SILVER band is on the right. Then read the color bands in sequence from left to right. For instance a resistor held in this orientation might be red-red-orange-GOLD. Each color corresponds with a number. The first two colors indicate the value of the component, the third component indicates the number of zeros after the value (sort of like scientific notation). The gold or silver band indicates how precise the resistor is, and also tells us which way to read them (with the gold band on the right).

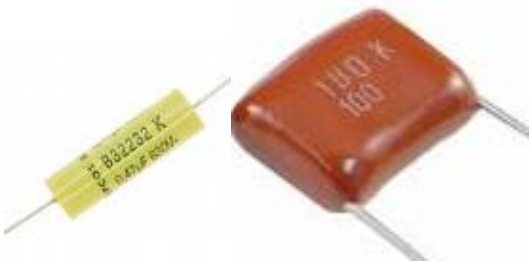
Resistor Color Values:

Black = 0	Brown = 1	Red = 2	Orange = 3
Yellow = 4	Green = 5	Blue = 6	Violet = 7
Gray = 8	White = 9		

So, that Red-Red-Orange-GOLD resistor is 2-2-3, or 22 with 3 zeros, or 22,000 Ohms. Generally, we abbreviate terms with many zeros using kilo- or mega- etc. So, this resistor would be known as a 22k resistor by most.

There are many online guides and widgets that help identify resistors. Just try a google search for "resistor color codes". If you're in doubt, online guides can help.

Capacitors:



There are plenty of capacitors in the phantastron. Since they reject DC electricity and pass AC waveforms, they are used extensively to shape audio signals. Among other things, capacitors determine the frequency of the oscillations and filters in the circuits.

Most of the capacitors are metal film capacitors, which look like yellow tubes. They are not polar, which means they can be oriented in any direction, and the value is generally typed on the side (ie. 0.01uF {micro-Farads}).

At least a couple capacitors will be ceramic disk, polyester, or an "orange drop" style metal film capacitors. Their values are usually coded.

Reading the capacitor code is easy – simply find the three digits on the capacitor (ie. 103). The first two are the value, and the third is the magnitude or the number of zeros. So, 103 would be 1-0-000 or 10,000. The tricky part is that most coded capacitors are in pico-farads, or pF. So, to identify a capacitor labeled in nano-farads or micro-farads you must convert the magnitude.

Here's a little guide to help:

1,000 pF (pico) = 1 nF (nano) = 0.001 uF (micro)
1,000,000 pF = 1,000 nF = 1 uF
1,000,000,000 pF = 1,000 uF = 1 F

So ol' 103 is 10,000 pF and also 10 nF and also .01 uF. It's all about the number of zeros...

Vacuum Tubes:

Vacuum tubes are really not as tricky as many think. They're robust components, can take a lot of abuse, and sound awesome. However, there are a few oddball things about them.

Firstly, most vacuum tubes require two sources of power: one high voltage and one low voltage. The high voltage is referred to as the B+ supply or the "plate supply". The lower voltage, usually 6.3V or 12.6V is referred to as the heater supply. This makes powering many vacuum tube devices trickier and more expensive. Also, the presence of high voltages like 104V in our circuit makes the possibility of electric shock more probable. This often dissuades people from experimenting with vacuum tubes. However, in the Phantastron, the high voltage source is current limited to provide enough power for the tubes, but not enough power to kill someone. Still, though, be careful around the B+ wires and connections in particular and NEVER work on the circuit while it is powered up. Although you'd probably have to take a salty bath with a powered phantastron to seriously shock yourself, touching the B+ supply is unpleasant -- So don't. And, Electric Western and Lorin Parker ain't responsible if you do. If you want to shock yourself please spare me the liability and get a "violet wand" or just comb your hair and touch some doorknobs. Okay?

For a great explanation of how tubes work with illustrations and everything, check out www.tubedepot.com/whisbipo.html. Also look around the net for other articles by Eric Barbour or Vacuum Tube Valley.

Essentially, though, our heater is making a cloud of negatively charged electrons inside the vacuum. These negatively charged electrons want to go to a more positively charged space, so we provide the high voltage charged plate for them to migrate to (which they love). This establishes a flow or **current** of electrons being shot from the cloud around the cathode and heater to the plate.

connect to multiple parts. Hook the leads through or around the tube socket solder tabs. Again, avoid soldering until all the components connecting to a tab or turret are first wrapped.

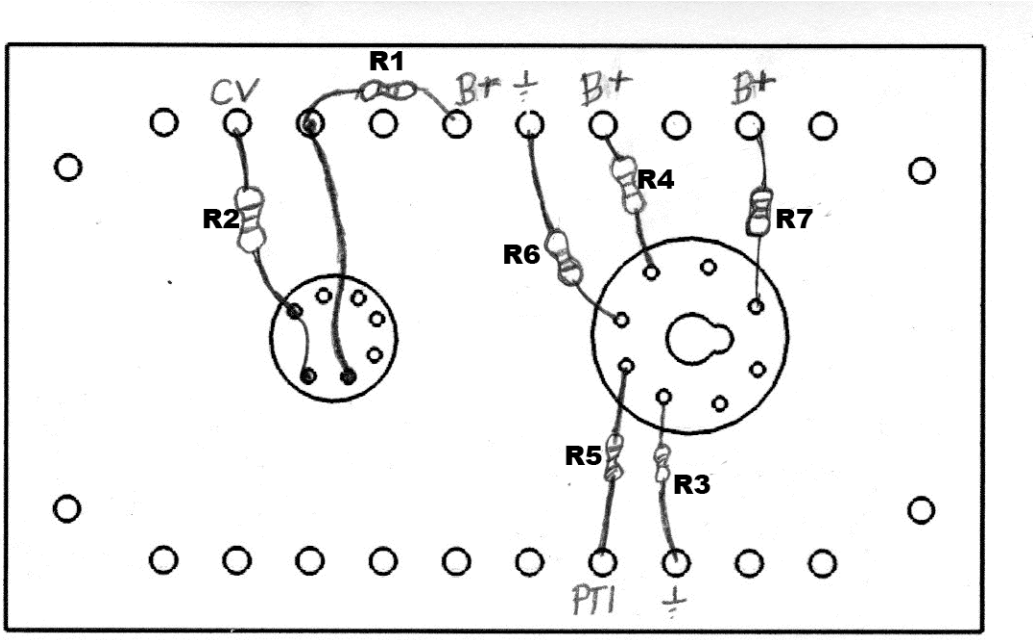
When soldering turrets and tube sockets, be sure to apply enough heat. The turrets will absorb heat from the soldering iron and become the same temperature as the wires connecting to them – the solder will "flow" at this moment between the turret and the wire. Make sure you're making contact with the turret or socket tab, not just the wire.

If solder joints are not heated enough or if the turrets are not heated, the solder will seem to cling to the wire leads and will not fill the gaps and cling as well to the turrets and tabs. Good solder joints will appear smooth and not bulbous.

Turret board components are rather heat tolerant, so don't worry too much about melting things. However, if you overheat something, the board can scorch (not easy to do with an ordinary soldering pencil, but try to avoid it). Also, don't eat the solder.

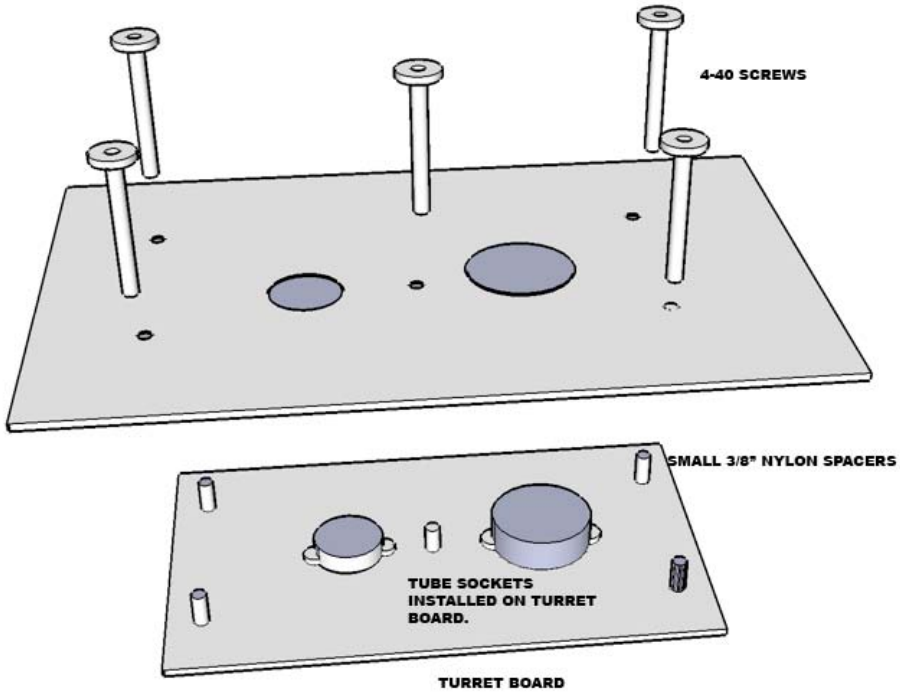
( ) Connect the RESISTORS on the turret board (wrap, do not solder yet)

- ( ) R1 – 100k [brown-black-yellow]
  --B+ to 2D21 (6)
- ( ) R2 – 10k [brown-black-orange]
  -- CV to 2D21 (1 & 7)
- ( ) R3 – 100k [brown-black-yellow]
  -- GND to 6SJ7 (3)
- ( ) R4 – 33k 1/2W [orange - orange - orange]
  -- B+ to 6SJ7 (6)
- ( ) R5 – 470k [yellow-violet-yellow]
  -- PT1 to 6SJ7 (4)
- ( ) R6 – 10k [brown-black-orange]
  -- GND to 6SJ7 (5)
- ( ) R7 – 100k [brown-black-yellow]
  -- B+ to 6SJ7 (8)



Turret Layout Showing Resistor Connections (Above)

ASSEMBLING THE TOP PANEL AND TURRET BOARD:



Above: Turret board is fastened to metal top using machine screws, spacers and nuts.

Align the 5 mounting holes on the top panel with the 5 mounting holes on the bottom panel. Mount the turret board, turrets facing down, to the top panel – slide the small 3/8" nylon spacers over the screws, between the turret board and the top. Fasten the nuts to the turret side of the turret board securing it to the top panel. The spacers should keep the turret board from touching the aluminum top (which could cause a short circuit).

Mount & Wire the Power Supply: The power supply sits on top of nylon spacers, attached to the inside of the wooden box with 4-40 machine screws and nuts. To make wiring easier, solder wires to AC1, AC2, GND, B+, and A+ on the board before mounting. GND, B+ and A+ wires will connect to the turret board. AC1 and AC2 will connect to the front and back panels.

First, mark on the box, the locations of the 4 mounting holes on the PCB. This is easily done by tracing the outline of the holes on the bottom of the wooden box with a pencil. Drill 1/8" holes at the marks through the bottom of the wooden box. Place 4 long 4-40 machine screws through the holes from the bottom of the box.

Turn the box over and place it on a flat surface being careful not to let the screws fall out. Place a nylon spacer over each screw. Seat the board on top of the spacers with the screws going through the mounting holes. Finally secure the board to the wood with the 4-40 nuts and tighten with a screwdriver.

Attach the solder the A+, GND and B+ wires to their respective turrets on the turret board (this is shown in the turret connection diagrams).