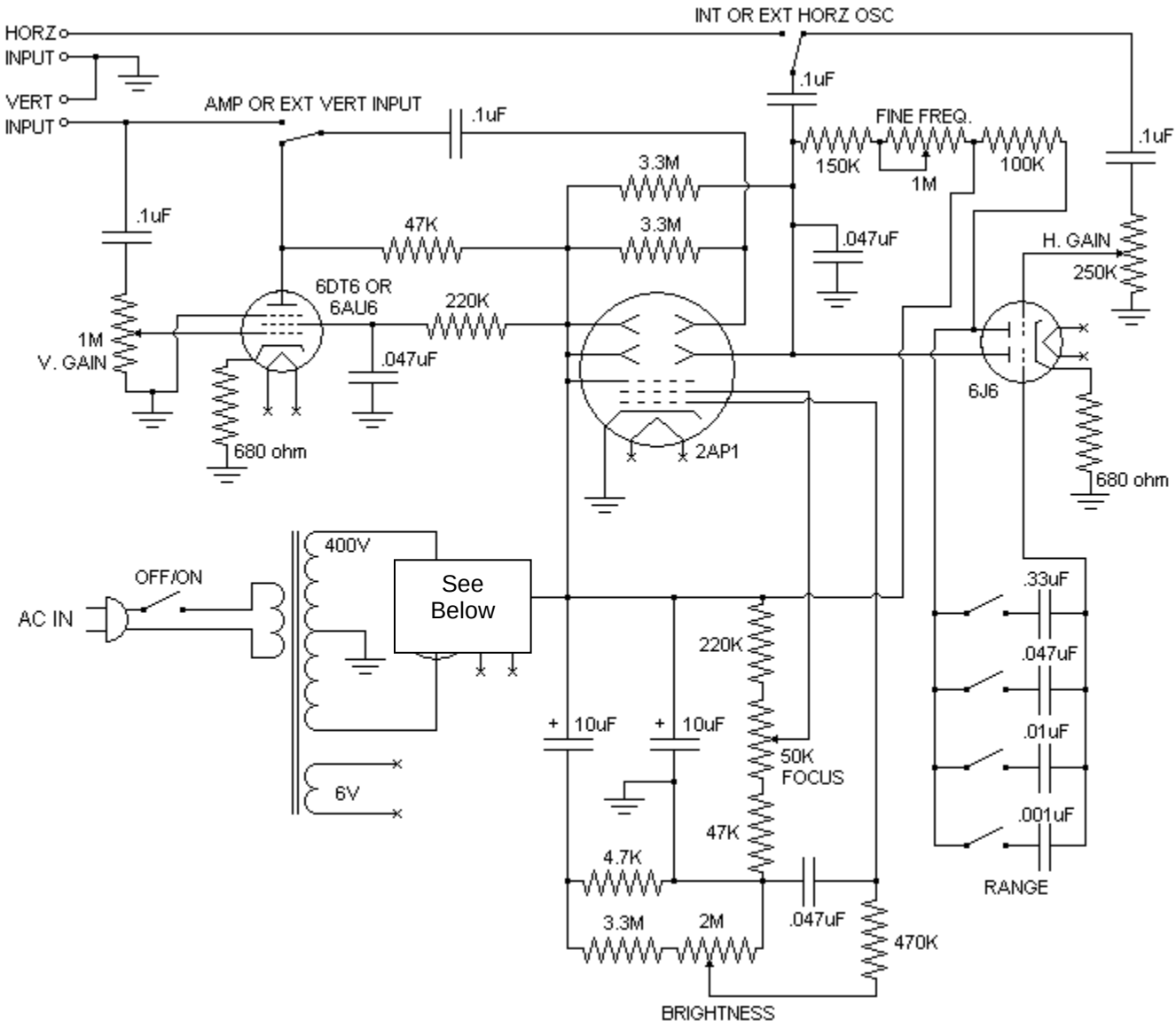
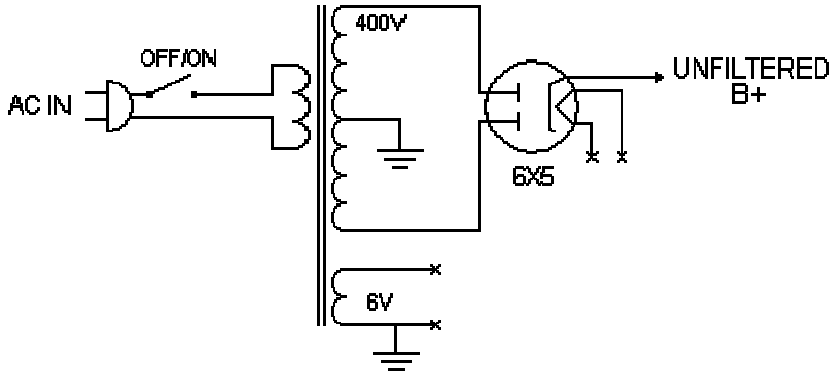
Ultra Simple Oscilloscope

This homemade tube oscilloscope is based on the WaterMan Pocket-Scope 0510A, a 3 tube oscilloscope made in 1946. It is very similar, but slightly simpler than the WaterMan. This oscilloscope is not intended for professional use, but a great learning experience and educational. The frequency range on this oscilloscope is very small and is quite hard to adjust. The waveforms displayed on this oscilloscope are slightly inaccurate, but good enough. Despite all the disadvantages, it does the job for an ultra-simple oscilloscope.

The tubes used in this ultra-simple oscilloscope are: 6X4, 6AU6, 6J6, and the 2AP1 CRT. Below is a schematic diagram of the oscilloscope.



There is a flaw in the power supply in the original schematic. The 5Y3's filaments have high B+ voltage, therefore the other tubes' filaments are supplied with that B+ voltage. Those tubes have very low filament to cathode voltage ratings. This will reduce tube life or short them. It is better to provide a separate filament supply for the 5Y3 or modify the power supply for a different tube. Below is a schematic for an acceptable power supply.



Here is how it works.

- The 6X4 is the full-wave rectifier tube that provides about 400VDC, and is filtered by the RC filter system.
- The 6AU6 tube is used as a vertical amplifier, so the signals fed into VERT INPUT are amplified.
- The V. GAIN potentiometer controls the vertical amplification.
- Touching your finger on the V. INPUT with the switch on EXT will make a small sine wave, compared to a larger, rough sine wave with the switch on AMP and the V. GAIN turned up.
- The 6J6 is a dual triode that is wired uniquely so it oscillates.
- The capacitors in the RANGE section determine the frequency range the tube oscillates at. The larger capacitor (0.33uF) will make the tube oscillate slower, while the smaller capacitor (0.001uF) will make it oscillate faster. The smaller the capacitor, the faster the tube will oscillate, allowing you to look at waveforms at higher frequencies. However, there is a point where the oscillations will falter and become screwy.
- In the RANGE section, one or more of the switches can be turned on, connecting one or more capacitors to the circuit.

- The 6J6 tube will oscillate its slowest with all the capacitors switched on (when you parallel capacitors, the capacity increases).
- The FINE FREQ control allows you to change a small amount of the frequency of the 6J6's oscillations.
- The INT OR EXT HORZ OSC switch allows you to either use the oscilloscope's internal oscillator (6J6) or provide the oscillations through the HORZ INPUT.
- The H. GAIN serves a similar purpose like the V. GAIN to the horizontal oscillator circuit.

Notice the homemade 11-pin tube base for the 2AP1 CRT in the pictures below. I used the pins from two octal tube bases and put them in the holes. The CRT plugs in nicely (it's plugged in half-way on purpose).

The 3.3 Mohm resistors from B+ to the vertical and horizontal plates of the 2AP1 CRT can be changed out with a 2.2 Mohm resistor and a 1M variable resistor in series for centering.

The power transformer should be mounted behind the CRT to prevent distortion, or use metal shielding around the CRT.
A Z-intensity connection can be added on this scope. All you need to do is add a 0.1uF capacitor to the first grid of the CRT, and feed the signals through the capacitor.

You also might want to increase the 470K resistor from the brightness control to the first grid.

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