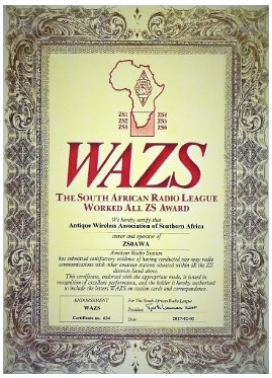
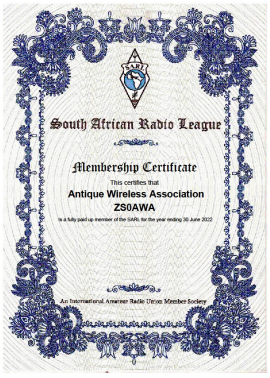
Antique Wireless Association of Southern Africa

205 August 2023





Inside this issue:

AWA Committee:

* President—Renato ZS6REN
* Vice President—Jacques ZS6JPS
* Technical Advisor—Rad ZS6RAD
* Secretary/PRO—Andy ZS6ADY
* KZN—Don ZS5DR
* WC—John ZS1WJ
* Historian—Oliver ZS6OG
* Member—Wally ZS6WLY

Visit our website: www.awasa.org.za

Reflections:

Do forgive me.

It would seem that a very important date fell through the cracks in March, and that was the founding date of the AWA of Southern Africa.

On the 22nd March was the 20th Anniversary of the AWA. Who ever would have thought….

12 Presidents over a period of 20 years and a growth from 6 founding members to 430, excluding the SK's who have come and gone.

What an achievement for a small ham fraternity, in terms of worldwide members. Of course we can boast that we have an international membership too.

I was asked the other day, why use the term "Southern Africa" and not South Africa. With the incorporation of the Collins Interest Group, there were members from Zimbabwe and Zambia, so it was only right to use the Southern Africa.

In one of our Net discussions during the month of July, Renato brought up the subject of Collins and the AWASA, and it was only then that I discovered we had missed our founders day.

Our association with the SARL and the SAIEE are of great importance, then too the building of our own identity, which has really taken time over the years.

The introduction of a weekly HF net every Saturday, expanded to VHF via Echolink and the use of repeaters. This Newsletter, the introduction of Net Topics. The regular meets that were held in the past and are now getting under way again using the SAIEE as a venue. The introduction of the website really opened us up to the world and has been instrumental in the expansion of our membership internationally. The Telegram group that allows discussion on various topics from swops to restoring to procuring of parts to building components.

The committee that sees to the running of the association ably manned by 6 elected members each with a portfolio.

I do believe that these have all combined together to bring us to the place where we are today and none are more important than the other. Each has played an important role in the growth of the AWA of Southern Africa.

What lies ahead for us ?

I think this is totally dependant on the members and their participation in the various activities.

Of course there are restraints to the participation of members, but not anything that cannot be overcome.

We look forward to the next 20 years and hope to see that there will still be growth in membership, participation in activities and that valve radio will forever hold its place in amateur radio.

Please visit our website for more detailed information.

Best 73

DE Andy ZS6ADY

Wikipedia

Coronal Mass Ejection (CME)

In order for pre-eruption CME structures to develop, large amounts of energy must be stored and be readily available to be released. As a result of the dominance of magnetic field processes in the lower corona, the majority of the energy must be stored as magnetic energy. The magnetic energy that is freely available to be released from a pre-eruption structure, referred to as the *magnetic free energy* or *nonpotential energy* of the structure, is the excess magnetic energy stored by the structure's magnetic configuration relative to that stored by the lowest-energy magnetic configuration the underlying photospheric magnetic flux distribution could theoretically take, a potential field state. Emerging magnetic flux and photospheric motions continuously shifting the footpoints of a structure can result in magnetic free energy building up in the coronal magnetic field as twist or shear. Some pre-eruption structures, referred to as ***sigmoids***, take on an *S* or reverse-*S* shape as shear accumulates. This has been observed in active region coronal loops and filaments with forward-*S* sigmoids more common in the southern hemisphere and reverse-*S* sigmoids more common in the northern hemisphere.
Magnetic flux ropes—twisted and sheared magnetic flux tubes that can carry electric current and magnetic free energy—are an integral part of the post-eruption CME structure; however, whether flux ropes are always present in the pre-eruption structure or whether they are created during the eruption from a strongly sheared core field (see § Initiation) is subject to ongoing debate.
Some pre-eruption structures have been observed to support prominences, also known as filaments, composed of much cooler material than the surrounding coronal plasma. Prominences are embedded in magnetic field structures referred to as prominence cavities, or filament channels, which may constitute part of a pre-eruption structure (see § Coronal signatures).

YAESU FT-200 REFURBISHMENT

Chris Turner, ZS6GM
July 2023

I originally bought an FT-200 transceiver in 1972. It was the first out of the box purchase for me and I loved it. I disposed of it in 1978 when I moved to the UK. I wish I had kept it!

I recently acquired a used FT-200. It looked in fair condition but needed some TLC. According to good practice with any used equipment, I removed the covers and gave the radio a good visual going over. It appeared to be in good order and I could not detect any modifications. With the covers off, I powered up the radio and watched for smoke and did a sniff test to detect any overheating.

Next step was to check the power supply voltages. I noticed that the 300 Volt rail was close to 380 Volts with 234 volts mains input. The 150 Volt rail was 165 Volts and the HT was 650 Volts.

The radio was running hot so I decided to reduce the 300 Volt supply from 380 V to 300 Volts. This was achieved by changing the filter circuit from capacitor input to choke input. This provided exactly 300 Volts with one of the benefits that choke input has much better regulation than capacitor input.

After replacing soft valves with known good ones. Receiver was acceptable but the transmitter output would not make more than 30 Watts on 40m and 40 Watts on 80m. The peak to peak grid voltage on the 6JS6C's was over 100 Volts so more than enough to drive the valves to full power.

I decided to replace the 6JS6 valves with a brand new set of 6146A's. After modification output power was no more than 60 Watts on 80. 40 and 20m. There was adequate drive and it made no sense. When increasing the drive, transmitter output peaked and then as the drive was further increased the output power decreased. Disconnecting the ALC made no difference. This pointed to a problem in the plate circuit.

I stripped out the PA choke, C59 the HT decoupling cap and C58 plate coupling cap (500pF). The plate choke checked at 520 uH but the Q was lower than I would expect which points to possible shorted turns. The 500pF coupling cap measured slightly over 300pF which would make it lossy on lower frequency bands. I substituted the choke with one from my junk box and replaced C58 with a doorknob style 500pF, 7.5kV unit. I replaced C59 the choke decoupling capacitor with a new one of the same value.

In class AB_1 the 6146A screens are specified by RCA at 195 Volts for a 750 volt plate voltage. I installed a voltage divider fed by the 300 Volt supply to provide the required screen voltage.

Output power is now greater than 100 Watts on all bands but the efficiency was low on 80m and 40m and the load capacitor is fully meshed. After measuring the pi inductor at 7.3 uH and calculating the plate and loading capacitor values, it was clear that there is a problem with component values. The inductor needs increasing to 7.9 uH or the load capacitor needs to be increased considerably. After calculating values I increased the switched loading caps on 40m and 80m. Output power is now nearly 120 Watts on 80m and 110 Watts on 40m and the loading capacitor is 2/3 meshed when tuned for best efficiency, instead of fully meshed as before the changes.

Modifications:

<u>This modification replaces the 6JS6C output valves with 6146A devices.</u>

- Remove 6JS6C valves and bases
- Install International Octal bases with pin 1 on the outside,
- Re-wire and make sure that pins 1, 4 and 6 are linked on each valve base,
- Connect a 1mm tinned wire between pin 8 (6146A metal skirt) and chassis,
- Install a 15k, 5 Watt wire wound resistor between pin 3 and chassis,
- Discard and sleeve the orange screen grid feed wire,
- Install and new orange wire from pin 3 and route around the chassis to near the accessory socket,
- Install a 2k5, 5 Watt wire wound resistor on the chassis and connect the orange screen wire to one end and a new orange wire to the other end of the resistor to pin 3 (300 V) on the accessory connector.

<u>PA plate pi network improvements</u>

- Change C41 (neutralising cap) in the PA box for a 4.7pF 1.5kV capacitor. Alternatively install a 5.6pF capacitor in series between TC3 and C40 underneath the chassis.
- Remove C60 on the loading band switch and discard. Remove C61 680pF and install it in place of C60.
- Install an 820pF 400 volt Mica capacitor in place of C61.

Power Supply Modifications:

This modification changes the 300 Volt supply from 380 Volts to 300 Volts by re-configuring from capacitor input to choke input. This mod also makes the supply stiffer.

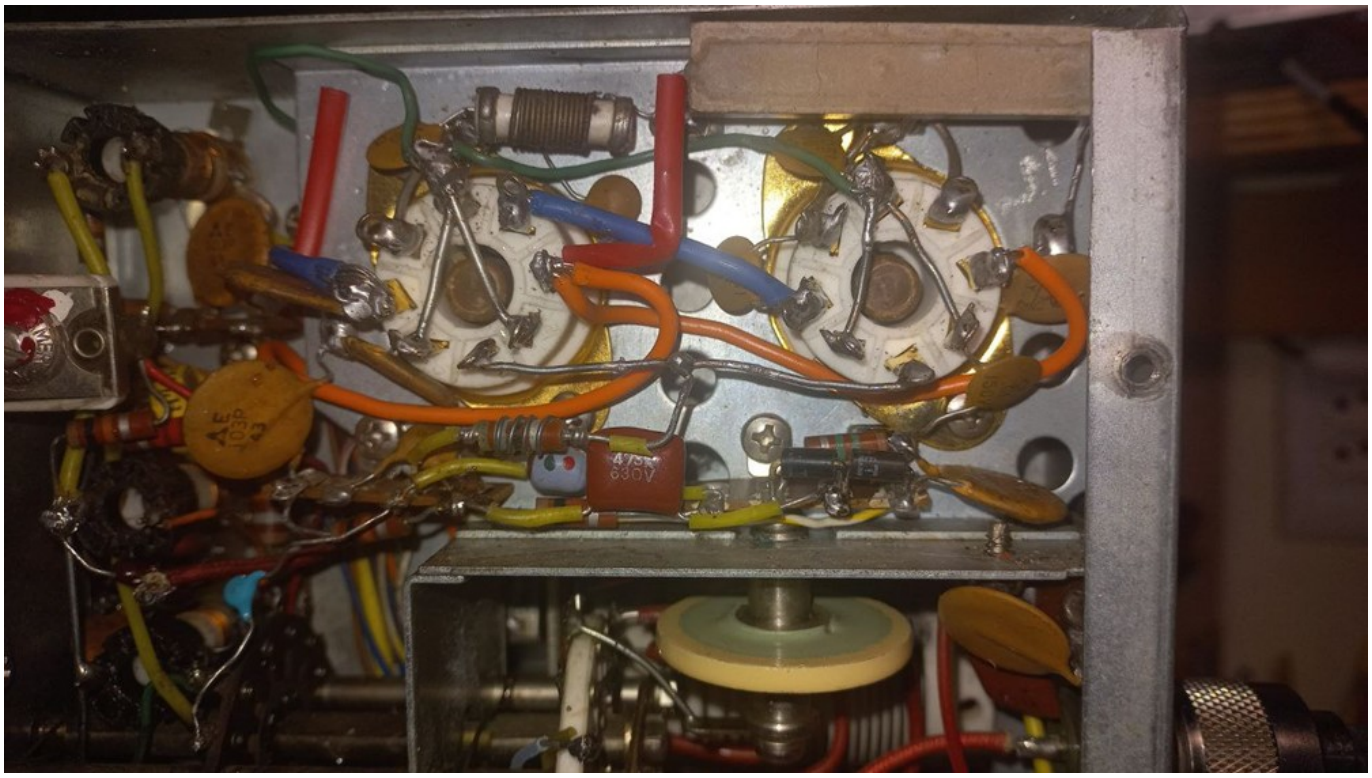
- Disconnect the red wires from C103, 20uF smoothing capacitor, connect together and sleeve. Jumper C103 and C104.

The power supply modification results in the radio running cooler and valves operating closer to their design values.

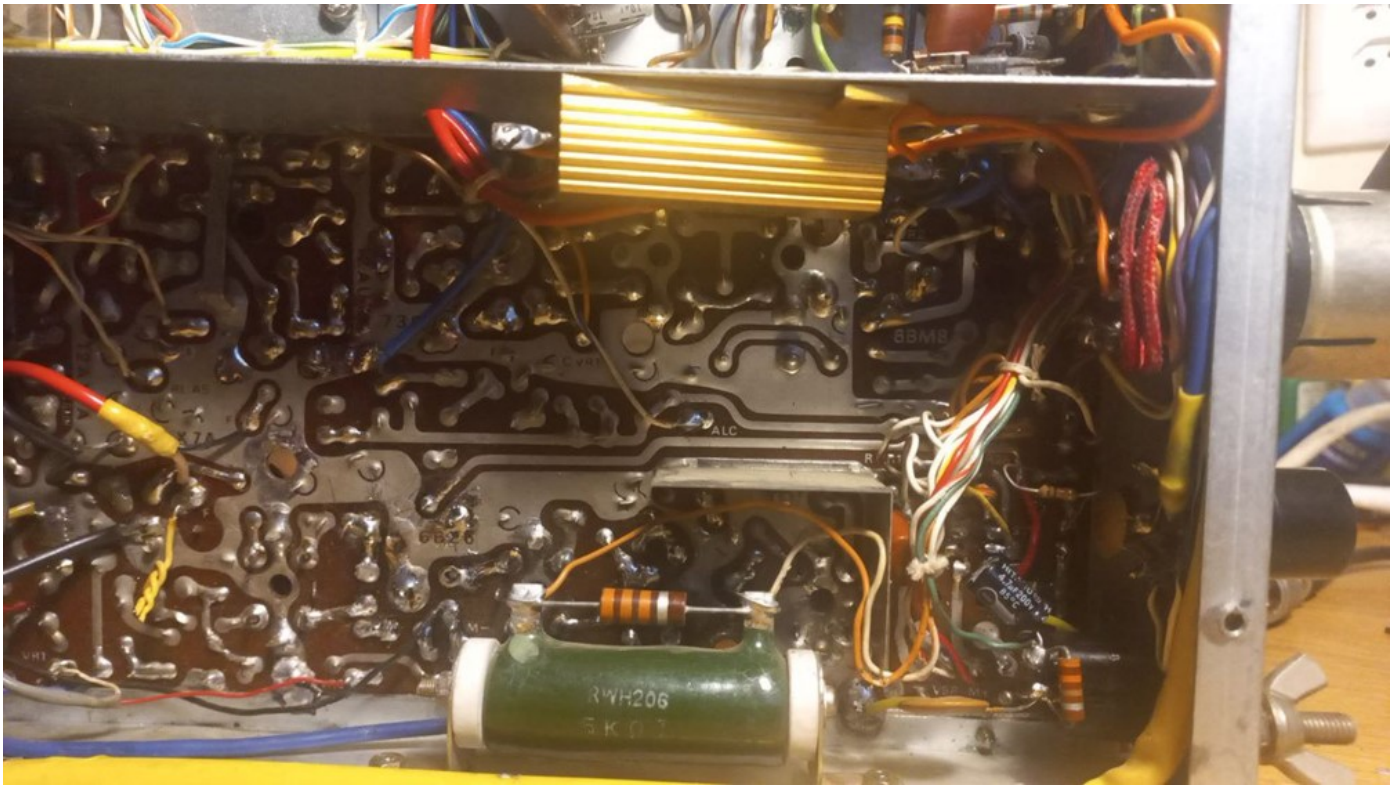
Note: The 6146 modification by Roger Davis ZS1J / ZS5L in Radio ZS October 1995, calls for a zener diode to drop the screen voltage but there is no bleeder for the screen supply. If the zener diode goes open circuit or the screen voltage is lost allowing the 6146 screens to float, the valves can run away. For safety, install a 15k resistor from screens to chassis.

FT-200 transmitter output modifications.

PA compartment, note replacement 500pF, 7.5kV doorknob plate coupling capacitor.



Bottom view of the PA. Note the 15k screen resistor at top right.



Gold resistor top of picture is 2k5 voltage dropper wired to Accessory connector pin 3.

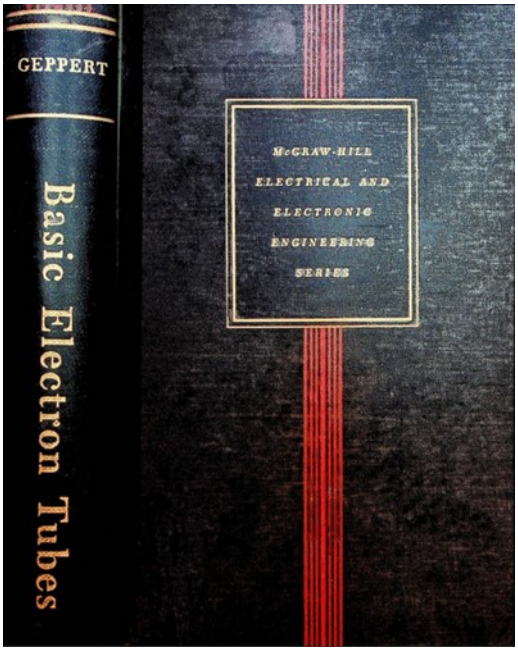
Vintage Equipment Simulation

by Daniel Romila VE7LCG

The traditional method of “being into vintage equipment” is to own several beauties of the past, maintain them, use them. It is a glory – for example – to get a Collins 51J1 receiver, built in 1949, with 19 tubes:

(from http://www.armyradio.ch/radio-e/e-629-e.htm)

Of course, this comes with a cost, and the owner would have to think in advance for a place where to put such a heavy 21.3 kg object, long more than a half meter (53.6 cm).



I live in a small apartment. With progressing in age, many radio amateurs downsize and it becomes difficult to keep around vintage equipment, which is known to be big and heavy. But I can keep in a computer many pictures, schematics and technical manuals of new and old equipment. It does not really give the same thrill.

I found it is a fun activity – at least for me – to enter deep into the schematics of vintage equipment, draw and re-draw blocks or even full schematics. I can optimize without burning any device and without risking electric shocks (LOL) schematics I knew for years and for which I always find amazing things by simulating them on the computer.

There are many free and paid programs that can simulate new and vintage schematics. This article is not a tutorial, but more an information about what it is possible. So, I will exemplify with schematic simulated by me, in something “very polished” and professional, Proteus 8.16, the recent July 2023 version of Computer Assisted Design for electronics. I also like Multisim 14.3, another commercial program, but the reader can opt for many, many free available programs, like KiCAD, for example.

One can get from the Internet free books about old devices and old

equipment. One book giving an exhausting idea about tubes and how they function, but which also has the advantage the reader can go through it and understand the functioning without being bothered much/ignoring the mathematics formulae is shown on the left.

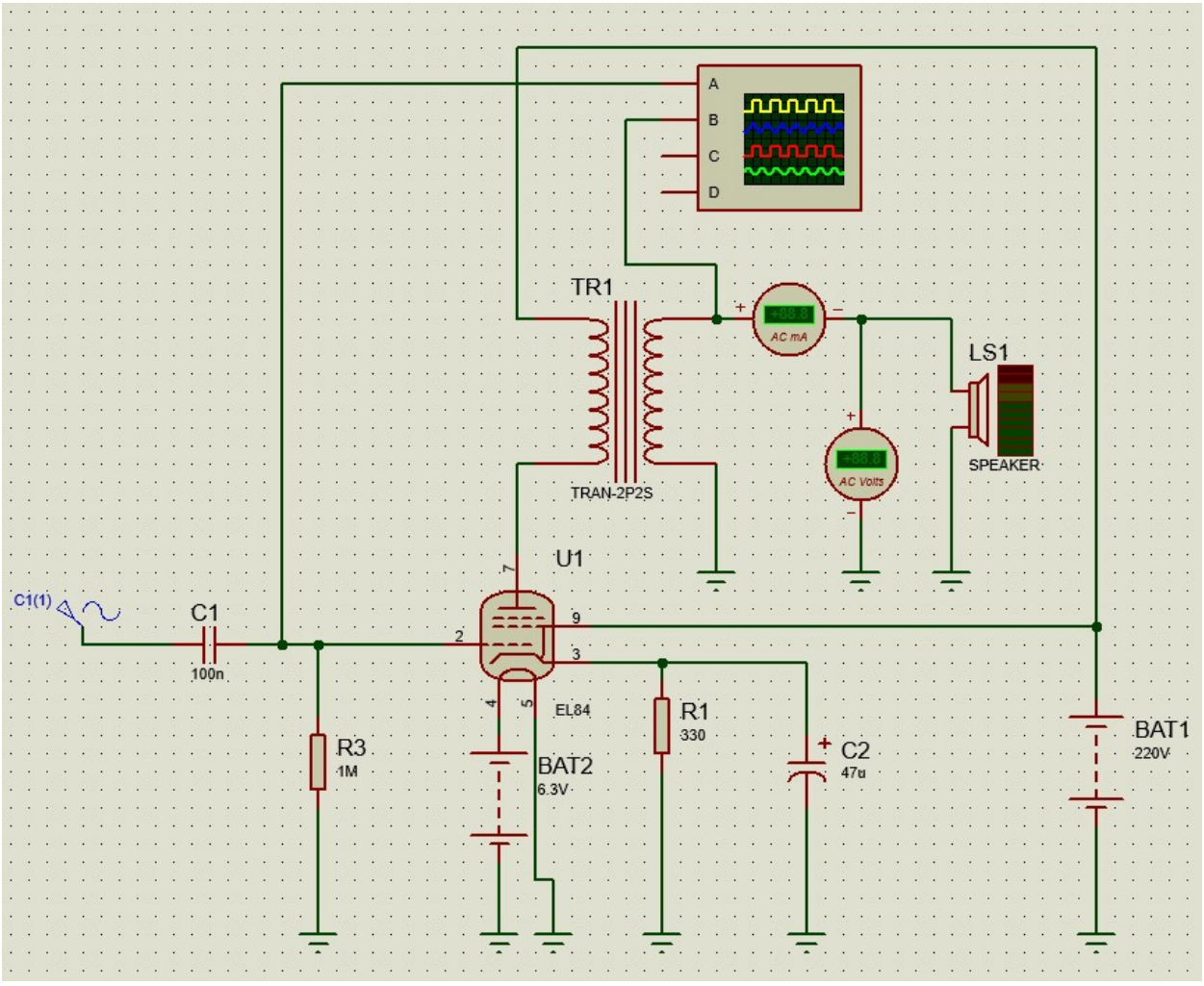
I got that book and many books with schematics, old transmitters, receivers with one tube up to very sophisticated tube receivers made in the past (and also by hobbyists, more recently), from: https://www.qsl.net/va3iul/Files/Old_Radio_Frequency_Books.htm

I would never be able to put on the shelf (a real one) so many books as I collected in electronic format, and which I indeed look into and get info from.

Starting at least some 10 – 15 years ago (I wrote this article in July 2023) computers started to be easily connected with big displays, LCD, LED backlit and so on. A HDMI connection allows me to connect a 55 inches TV to a laptop and post various pictures of vintage equipment that would fill hundred museums. I can also simulate schematics and sometimes I "build" (=draw on Computer Assisted Design software) long filters, receivers and transmitters.

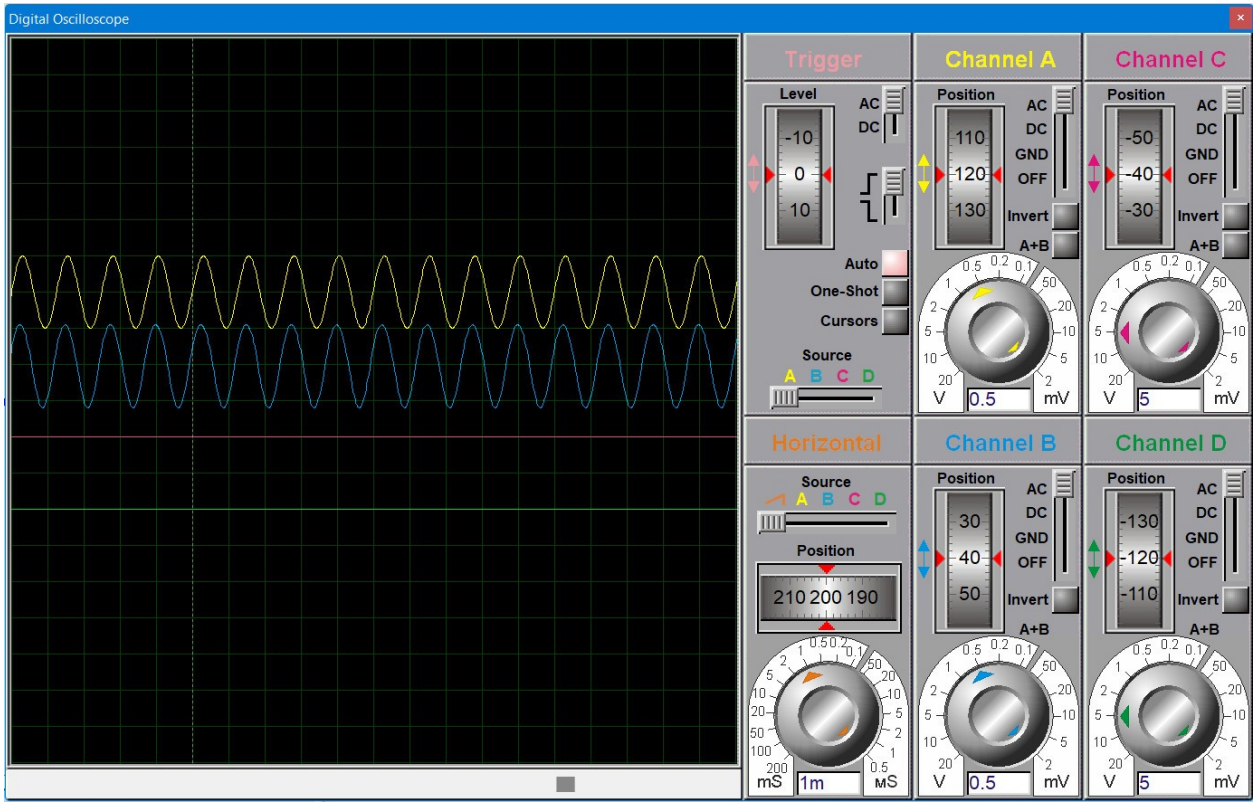
We are lucky in the last years computer engineers focused more on reducing the power consumption of computers, more than on increasing the actual processing power. So, even a vintage Hewlett Packard all in one computer, more than 10 years old in 2023, with processor i7 or i5 from the second or third generation, 6 gig of RAM, can offer a fluid CAD experience on the screen. Such all-in-one computer usually have touch screens, and allow to work in Windows and Windows programs with mouse and keyboard, but also by touching the screen, dragging electronic components from one place to another, placing virtual oscilloscopes and other instruments.

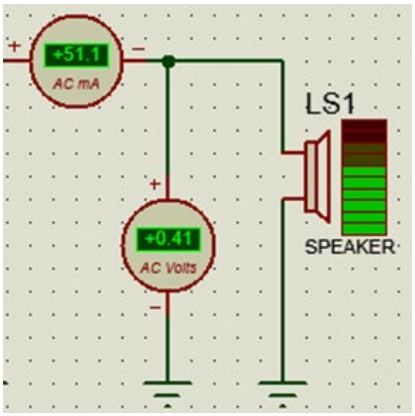
A vintage HP Envy D119 can even be "convinced" to run Windows 11 without problems.
To go directly on the subject, here is what I can do with a computer, in a CAD (computer assisted design) program:



The above schematic is a final audio amplifier, made with the pentode tube EL84. Proteus 8.16 is a 'polished" program, more than the free ones, and allowed several easy things, like placing an oscilloscope with four spots, on which I can see the input and output signals. The program is so polished the oscilloscope looks like a real one when

pressing the simulation button, and can be adjusted as a real oscilloscope, by moving its buttons:





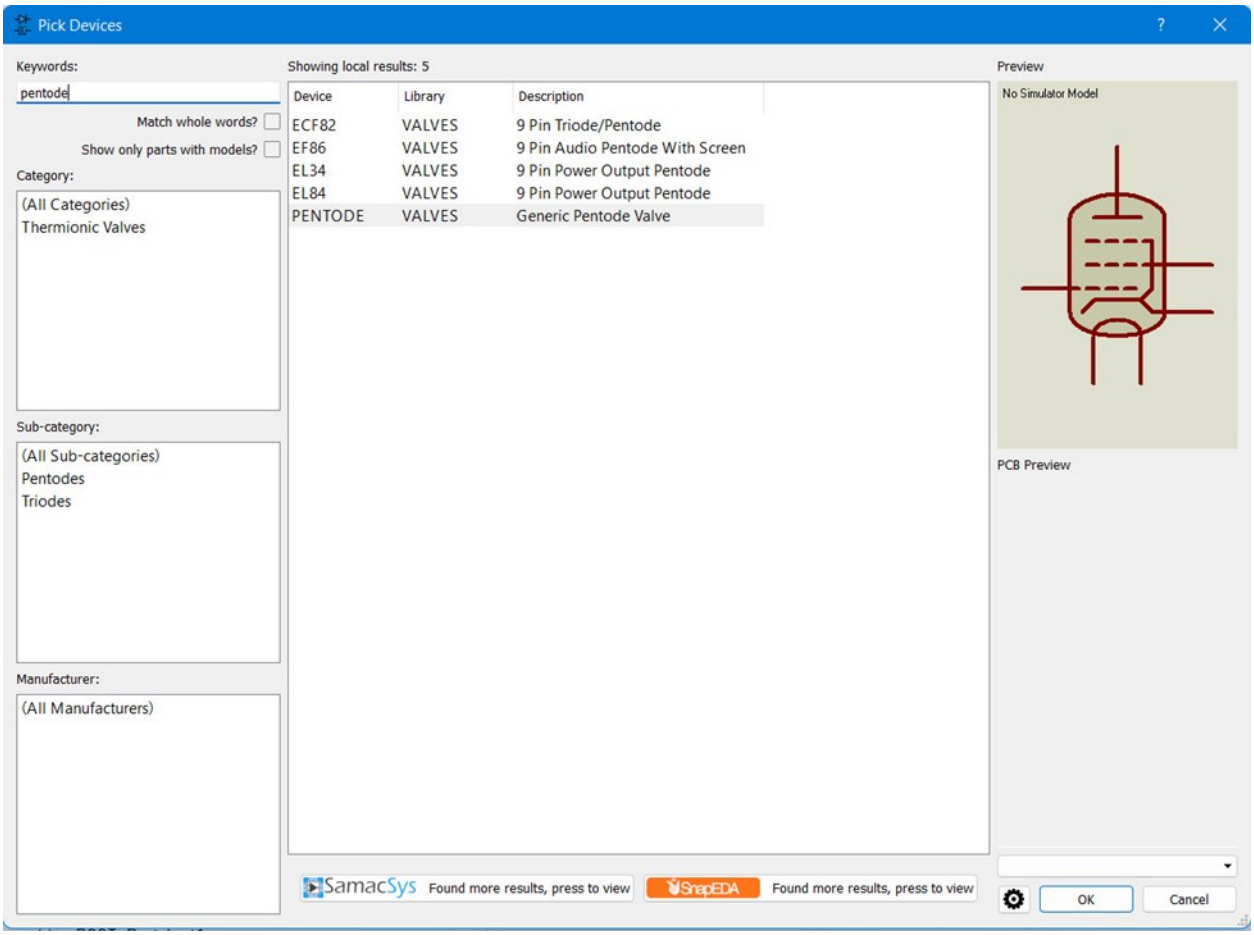
Another fun and useful fact is that the speaker from the schematic is the speaker from my computer. I can hear on the computer whatever signal I virtually introduce into the amplifier. I can design an audio signal generator, a police kind of sound alarm and verify the schematic, simulate it and listen on computer's speaker the final resulting sound. During the simulation I see on the placed instruments into the schematics that I can obtain around 200 mW on the 8 Ohm speaker. I also have a kind of vu-meter indication next to the speaker, active only during the simulation.

It is easy to replace in a CAD (computer assisted design) program the final tube. No problems with different socket, no problems with re-wiring. Proteus 8.16, with its built-in library for pentodes, offers me some choices. Various programs, especially the free ones, were very much enriched by hobbyists. Libraries with a bunch of components can be add to the original program. I built myself components and I made the simulation SPICE model, based on datasheets of electronic components. Some programs allow the hobbyists to do it just in several steps, immediately, others require more work. It is always useful to search first on the Internet if somebody else did already the model for the component you eventually need. More probably several other people attacked and solved the problem years ago, and freely posted what they did.

I had a lot of fun simulating and optimizing OTL amplifiers (Output Transformer-Less). It is not possible to obtain the same good results by directly jumping and soldering an amplifier without transformers as it is if one starts in the practical experiment with a schematic, he/she first optimized and verified in CAD. I do not want to use again Proteus to exemplify the OTL amplifier, so I mention here the work done by somebody who calls himself 'usagi electric":

He used a different CAD, and in the left picture he tried first with the speaker put directly in a cathode of a triode – so a lot of DC current going through the speaker.
https://www.youtube.com/watch?v=qGkn6C5cd1E

This article just wanted to show there are many possibilities out there to remain involved in electronics, radio, vintage or new, without spending money and without having space constraints. Any such activity is good for the brain to keep it active and young.



Heathkit Equipment / Archive PE1GVK

Radio Receivers With Direct Heated Mini Tubes

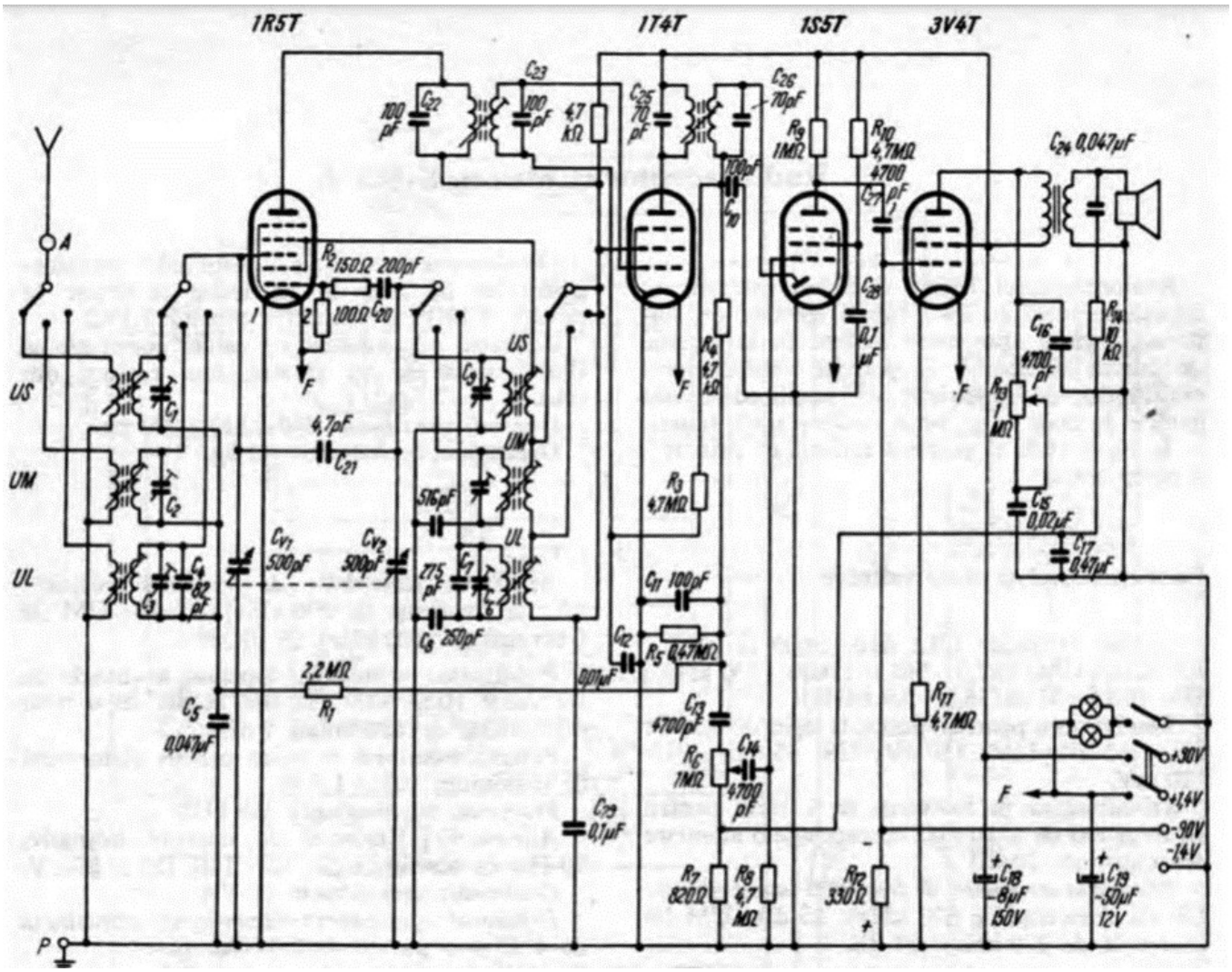
by Daniel Romila VE7LCG

A good source of old radio receivers and information about such old receivers is Eastern Europe. Sturdy receivers, some still in function in 2023, were built with Russian, East German and American tubes. One category of radio receivers with tubes were equipped with direct heated tubes.

The picture on the left is of the receiver “Olt S-555B. There are many receivers with similar look and schematic. This one, for example, is capable of receiving Long Waves, Medium Waves and Short Waves. The output audio power is some 50 mW, with maximum being 150 mW, at 10% distortions.

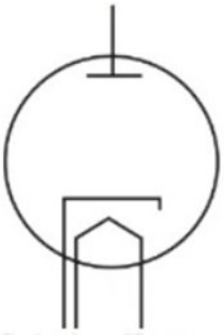
Those radios were never great. They were power supplied from batteries. There was 1 battery for 1.5 Volt for the filaments, and a pile of batteries in series making up 100 Volt for the anodic power supply.

A bunch of schematics of early receivers with tubes and some with transistors can be found freely at:
https://ia800102.us.archive.org/34/items/CartiElectronica/Scheme%20de%20radioreceptoare.pdf

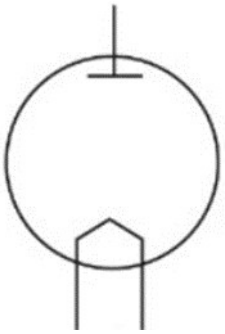


For the direct heated tubes, the cathode is the filament. For indirect heated ones, the cathode and filament are separate elements. In the electric schematic representation, the direct heated tubes look like missing the cathode, because the cathode and the filament are physically the same.

If it is to draw the same diode from the right, but for a tube with separate cathode (indirect heating) we would



clearly see the separate elements. See left picture.



The typical set of tubes were 1R5T for RF amplifier, oscillator and mixer, 1T4T for intermediate frequency amplifier, 1S5T for AM detector and audio preamplifier, and the power (150 mWatt) for the final audio was given by the tube 3V4T.

For one reason or another these direct heated tubes are very expensive on the Chinese websites. I suspect many indirect heated tubes are nowadays in production in China, while the particular category of direct heated tubes is not made there. In June 2023 1R5T can be found with around 6 USD, 1T4T with 5 USD, 1S5T with 3.55 USD and 3V4T with 9 USD.

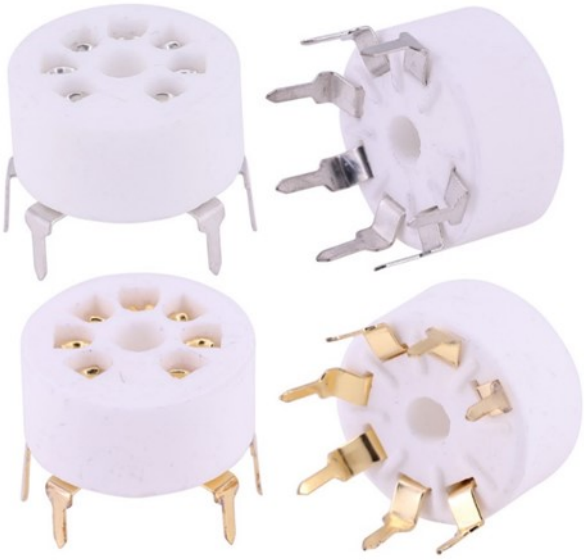
I took the prices from https://www.tubesandmore.com/products/vacuum-tube-1r5-dk91-heptode
On the above website those tubes are declared NOS (new old stock).

1R5 (equivalent with DK91) is a miniature 7 pin pentagrid-converter (heptode) designed for use as a combined mixer and oscillator in superheterodyne circuits.

The maximum plate voltage is 90 V, with a maximum cathode current of 9 mA.
1T4T (equivalent with DF91) is a miniature 7 pin remote-cutoff pentode designed for use as a radio-frequency or intermediate frequency amplifier. Its remote-cutoff characteristic makes it particularly suitable for use in stages to which automatic-volume-control is applied.

The General Electric datasheet declared the maximum plate voltage 90 V and the maximum cathode current 3.5 mA. 1S5T (equivalent with DAF91) contains a diode and a sharp-cutoff pentode. The 3V4T (equivalent with DL94) is a power amplifier pentode designed for such battery-operated radios. The filament is center-tapped to permit operation from either a 2.8-volt or 1.4-volt filament supply voltage.

The maximum audio power to be obtained from 3S4T tube is declared in its datasheet as 270 mWatt. The manufacturers limited the audio power they put in their radio specification for power consumption and distortion reasons (they are battery power supplied radios).



All those tubes presented here have a 7-pin socket and 90 Volt maximum plate power supply. It is easy to find online 7-pins sockets both for chassis and for PCB:

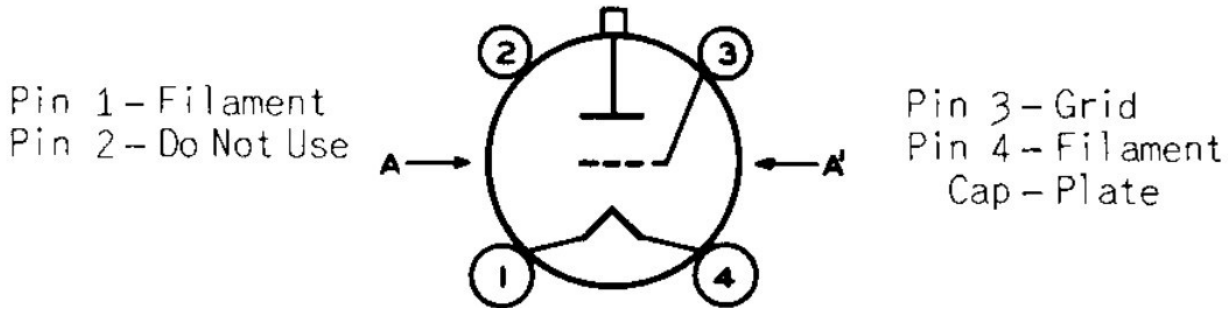
Restoring such direct heated tubes radios is easy due to the low number of components. Finding batteries for power supplying those radios, as in the original intention, can prove to be more difficult. There is not a “biggie” to adapt and get the required 1.4 Volt and 90-100 Volt from DC-to-DC converters, due to the low current needed.

If it is to build from zero today a receiver with tubes, I would not consider those tubes. They have low performance

and they were used solely for the battery operation capability. Actually, many of those receivers were built exclusively with transformers and full power supply in them, so no battery functioning was even intended.

Hobbyists reported operating those tubes even at 27 Volt. This is not a surprise, because non-dedicated to battery operation tubes, like 12AX7 (ECC83) successfully works at 12 V in many projects shown on youtube.com, for example:
https://www.youtube.com/watch?v=BTrUJC_vpyc

Not all directly heated tubes are low power, low amplification. The well-known tube 811A (produced in China today under the name FU-811) has the filament supplied at 6.3 Volt and a whopping 4 Amps.



It has an amplification factor of 160. One can count on 340 Watts output for 4.4 Watts input, at 1500 Volt plate power supply, for 313 mA cathode current.

As a fun fact the old 811A tubes can be used to see if a radiation counter works, because they are slightly radioactive (they have a Thorium based cathode-filament). M0UKD made a video playing with such tubes and a Geiger-Muller counter: https://www.youtube.com/watch?v=BKLFA1zVv4E

If you want to play with a real radioactive tube, try 1B22, made in 1943. I never used myself an 811A tube, but I used the similar/identical look 807 tubes.

AWA Open Day at SAIEE

The AWA in conjunction with the South African Institute of Electrical Engineers is holding another open day at the grounds of the SAIEE.

The museum will be open for viewing, the SAIEE shack will be operational. Should you wish to bring along some of your valuable jewels that you no longer have space for and want to either sell or barter them, bring them along. A boot sale will be available. There are no tables, so if you need one, you can bring your own along.

There will be refreshments available, and maybe even some rolls with meat inside.

If you want to come and view what the AWA is all about, (Our amateur Heritage) it is there to be seen in all it's glory.

Times will be from 10:30 to 14:00

The address is 18a Gill Street, Observatory or look for directions on the AWA website, under "Museum".

Dates are 19 August; 16 September; 14 October….further dates will be announced.

Any members wishing to help out at the SAIEE can let Andy ZS6ADY or Renato ZS6REN know when you will be available. We need more hands to help out.

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Get your backdated issues at
http://www.awasa.org.za/index.php/newsletters

Visit our Website:
www.awasa.org.za

Antique Wireless Association of Southern Africa

Mission Statement

Our aim is to facilitate, generate and maintain an interest in the location, acquisition, repair and use of yesterdays radio's and associated equipment. To encourage all like minded amateurs to do the same thus ensuring the maintenance and preservation of our amateur heritage.

Membership of this group is free and by association. Join by logging in to our website.

Notices:

Net Times and Frequencies (SAST):
Saturday 07:00 (05:00 UTC) —Western Cape SSB Net— 3.640; Every afternoon from 17:00—7.125
Saturday 08:30 (06:30 UTC)— National SSB Net— 7.125; Sandton repeater 145.700
Echolink—ZS0AWA-L
Relay on 10.125 and 14.135 (Try all and see what suits you)
Saturday 14:00 (12:00 UTC)— CW Net—7025

AWASA Telegram group:

Should you want to get on the AWA Telegram group where a lot of technical discussion takes place, send a message to Andy ZS6ADY asking to be placed on the group. This is a no-Nonsense group, only for AWA business. You must download Telegram App first. …..+27824484368

Wanted:

I am looking for replacement switch buttons for a Philips PM5326 signal generator. Most of the PM5000 series equipment uses identical buttons. A faulty/ scrap unit would be ideal. I am reluctant to deface a working instrument, in order to harvest the buttons. John ZS5JX 0824865280