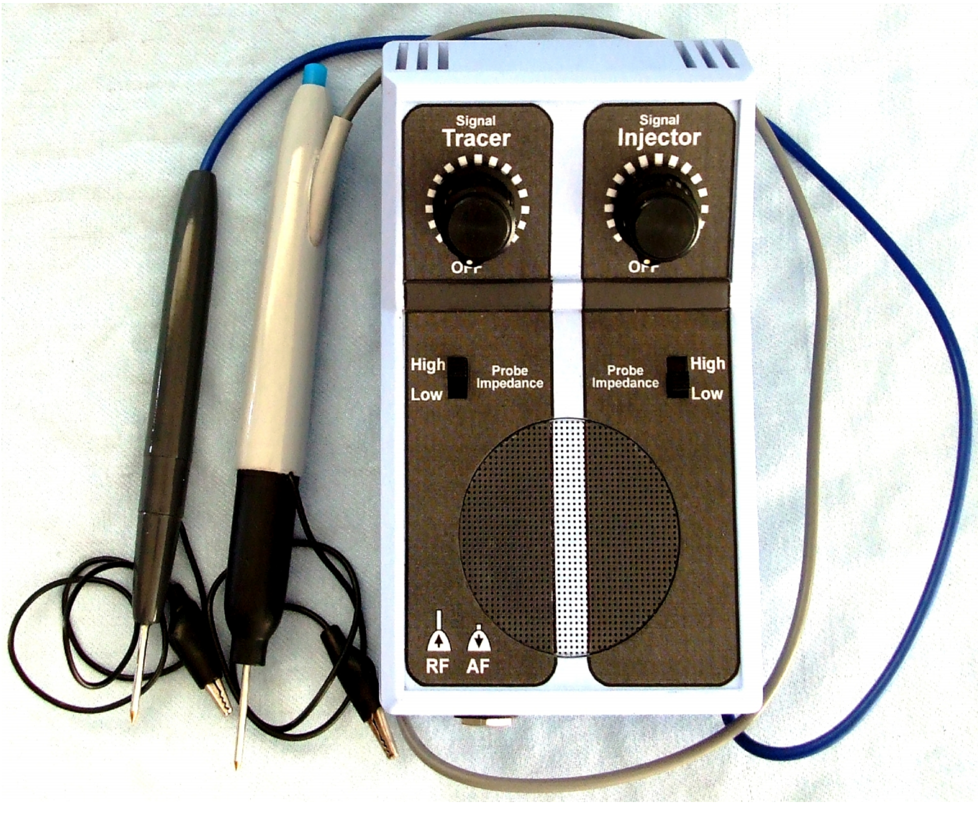
NZVRS BULLETIN

Vol 36   No 2   2015 - ii



AGM "Device" Competition Winner

A Signal Injector and Tracer in one.

NEW ZEALAND VINTAGE RADIO SOCIETY INC.

A non-profit organisation devoted to the preservation of early radio equipment and associated historical information.

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NZVRS LIBRARY
The NZVRS librarian is Bruce Churcher with assistance from Ross Paton. Requests may be forwarded to the NZVRS, PO Box 13873, Onehunga, AK 1643 or Email; library@nzvrs.pl.net

NZVRS BULLETIN is a membership magazine for members only, published approximately quarterly. Contributions are always welcome. Any opinions expressed by writers are their's and not necessarily those of the Society. Any feedback, contributions, letters, etc can be sent to:

THE NZVRS EDITOR
NZVRS Editor, P.O. Box 13873, Onehunga, Auckland 1643. Email: david@nzvrs.pl.net

ASB Bank account 12 3067 0168223 00

A Calendar of Events is listed on our website at **www.nzvrs.pl.net/aaa/calendar**

AUCKLAND MEETINGS are held at the Horticultural Society Hall, **990 Great North Road** (opposite Motions Road.) Western Springs, on the **third Monday** of the month from 7.30pm.
Sept: Monday 21 Bulb nite - it's spring!
October: Monday 19 Auction nite
November: Monday 16 Unusual components & accessories
December: Monday 21 Last auction of the year

TARANAKI AREA MEETINGS are held on the second Sunday in even months. Visitors most welcome; contact either Bill Campbell, Phone 06-753 2475 or Graeme Lea, Phone 06-758 5344

WELLINGTON MEETINGS are held typically from 1pm on the second Sunday of every month at Tireti Hall, Te Pene Ave, Titahi Bay. For details contact Tony Humphris, Email: tony_h@xtra.co.nz Phone (04) 298 1550 .

CHRISTCHURCH MEETINGS are held on the first Tuesday of odd months at the Christchurch West Radio Clubrooms "Auburn Park", 333 Riccarton Road.
For further details contact Jim Lovell, 41 Yardley St, Avonhead, Christchurch 8004. Phone 03-342 7760 .

SUBSCRIPTIONS: The subscription year is a calendar year (1 January – 31 Dec). Subscription renewals are sent in the year end Bulletin with final reminders in the first issue in the new year.
The NZ Rate is $30, with an early-bird renewal reduction. An email E-version is available at the world-wide rate of NZ $20 p.a. Please note that these files are usually about 20 Meg to download.

EDITORIAL

This year's AGM unfortunately saw the venue double booked for the morning but we managed to cooperate and get by with the use of the other rooms. The elected officers again were not changed (or refreshed) so either they are doing something right or apathy has set in! The financial accounts for 2014 are included in this bulletin with a year end gain of $1300 - $1400 depending on your point of view in cash or assets. This is a good result considering our outgoings for the library storage fees. Perhaps slightly less encouraging is the gradual decline in membership – an overall loss of about 20 members per year (or approx 7% per year). However apart from a serious membership drive at some expense for perhaps temporary gain, I think the present members should take advantage and enjoy the society for all that it offers them. Many "groups" I feel have become seriously "virtual", money orientated and lack the face to face social advantages of "special interest" clubs and societies, while others have a flash of enthusiasm then fade away. That said it is interesting to note that some offshore vintage radio societies appear to have increasing membership – or at least a regular supply of new members, but here I think that membership total is in part an indicator of the financial climate of the country.

There were an unprecedented 8 entries in the device competition for the AGM and as the comments of the judges suggests the variety was considerable. Judging was not easy but the criteria guide determined an outright winner – a signal injector and tracer by Colin Bowring which is the cover story.

Cheers, David

ZVRS Bulletin
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CONTENTS

New Members

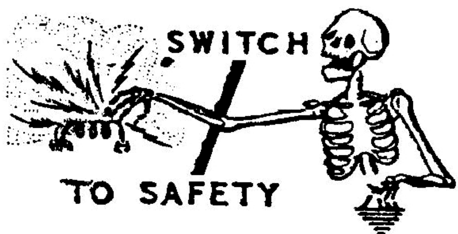
J Thirkell — Havelock North
D Bernstein — Hamilton

Noted Passings

Arthur Williams — Invercargill

The Cover Picture:

The cover picture this issue is the winning entry to the AGM competition for a suitable "device" assisting the craft of vintage radio. The entry maker was Colin Bowring and the details of his device appear later in this bulletin (from page 16).



Always play safe with electricity – take care when servicing any mains powered device.

Correspondence, Feedback etc

Radio Hauraki

Dear Editor,

From time to time we read articles about the trials and tribulations created by bureaucracy and weather for the Radio Hauraki team. I was pleased then to see in the latest Bulletin a well researched story of the technicalities involved and problems encountered.

There is a small detail in the excellent article that I would like to clarify. It is stated that Hauraki was the first broadcaster in New Zealand to use audio compression. Peter and Ross have been misinformed on this point. NZBC had been using compression or limiting amplifiers from about 1950 when AWA brought out their version of the pre-war RCA unit. The Altec compressor would have been very similar. Limiters were and are used extensively both in radio transmission and recording systems.

Not to be confused with the simpler peak clipping methods used in communications systems, limiting amplifiers used a rapidly acting automatic control that reduced the gain of the system above a predetermined modulation level. Used properly there was no obvious distortion generated and I feel sure the Altec amplifier would have been correctly set up by the Hauraki technicians. Whilst it is, of course, quite possible that individual disk jockeys could have driven the system into gross overload, reported distortion may also have been caused by selective fading which, given the distances quoted in the article, could have been very noticeable in the central Auckland area.

Cheers, Peter Lankshear.

Erratum

Bryan Marsh pointed out a couple of errors in the minutes mentioned in the last bulletin. These are now corrected to:

"Bryan Marsh is 91 today. Bruce Churcher gave a summary of Bryan's life and hobbies. Bryan's interests have included model aircraft, hydroplanes, and DXing. He was in the Air force with a period in Fiji where he built a model flying boat. Les Wright designed control units for radio controlled yachts Bryan watched him trailing these designs. Bryan worked for Air New Zealand. He was a keen fisherman and had a 12 foot 6 inch Spencer runabout.

2 cakes were brought out for Bryan to cut."

Shortwave Bell

In the latest issue of the Bulletin a member got a surprise about a "Bell" radio having a shortwave band. I have in my collection a Bell dual wave in a wooden cabinet, also a Bell with an oak cabinet but B/C only using Rimlock valves.

My biggest surprise was when I was given a Fountain years ago. It was dual wave but it was not until I had another look that I saw it was not the usual shortwave band but the Marine band.

Hope this does not cause more confusion on the subject.

Sincerely, Cliff Dittmer, Te Aroha

AGM Footnote from the Library

At the AGM, Society Librarian Bruce Churcher gave a summary of the library search success rate

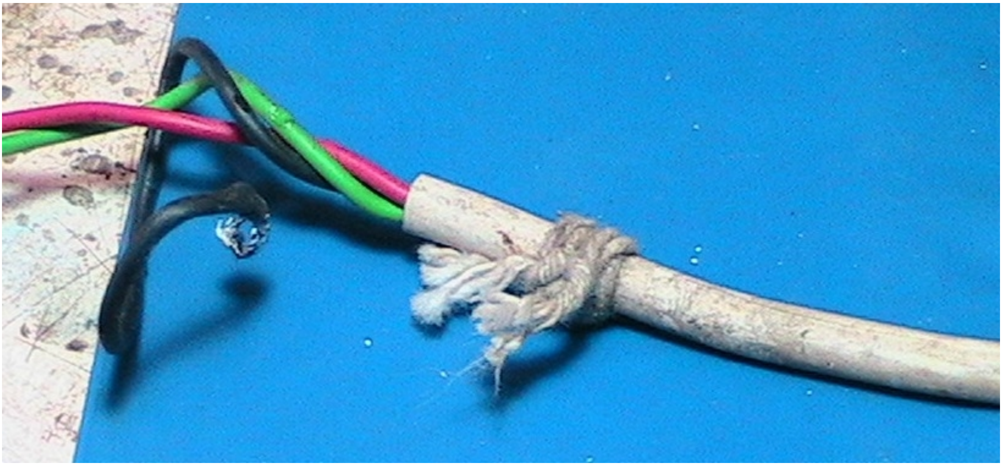
2013-2014 85 requests with an 80% success rate
2014-2015 100 requests with a 78% success rate

The meeting commended Bruce on the fine service provided by the library with acclamation.

A Novel Mains Clamp.

The joy of buying at auctions is the incredible amount of knowledge that one gleans when there is nothing left in the barrel.

From Albert Cross



Unfortunately this lowly "standard" of electrical safety can occasionally be witnessed in all sorts of wired installations – especially homebrew test equipment.

NZVRS President's AGM report for 2014

(Presented at the 2015 AGM 18 July)

Hello and welcome, from central Alberta Canada.

Hope that everyone had a good morning at the table sale, either finding a needed item or disposing of an unwanted one.

Last year has proceeded much as the previous years, steadily with no great drama. Overall the Society is in good health. Membership numbers will be noted in David's report.

This coming year will be interesting, with the Brian Baker sales. There has not been a large disposal of radio and parts since the Tarry Martin sale in Taranaki. This will give us an idea of the interest in vintage radio collecting at the present in the Auckland region. It may even get us some more members?

The Bulletin continues to be item to be proud of, and with internet distribution available and can be accessed as soon as it is compiled and edited.

All the best for the rest of the meeting and a safe journey to those who have travelled to get here.

Thanks, Ian Sangster.

A cheap and easy Signal Tracer from John R L Walker ZL3IB

<john.zl3ib@ihug.co.nz>

A signal tracer can be a most useful item for fault finding in both valve and solid-state receivers. It is also one of the simplest and cheapest home-brew, test gear, projects. Essentially a signal tracer comprises nothing more than a simple, low-power audio amplifier plus suitable probes for AF and RF. This can then be used to track signals back from the output stage, or vice-versa, finally through to the antenna input until the faulty stage is discovered.

Construction

The key item is a basic low-power AF amplifier which can be built up from discrete components but it is much easier to use a simple IC AF amplifier kit set module such as those obtainable from Jaycar© and other suppliers and also described in the earlier Dick Smith catalogues. I used a kit-set LM380 IC amplifier in the unit shown in Figure 1.

An even cheaper option is to “cannibalise” the output stages of a junked transistor radio since you will only need the volume control and the audio section following it. To do this discard all the RF and IF circuitry leading up to the top connector on the volume control; then connect this to the input jack via 0.01 µF capacitor. The signal tracer amplifier unit can be housed in a suitable plastic box; I made my case from 115 mm wide rectangular PVC storm water pipe.

For both choices you must include a 0.01 µF capacitor to isolate and couple the input socket section to the amplifier. Note also that if you intend to use the signal tracer on valve radios it is most important that this coupling capacitor must be a high quality, high voltage (400V or higher working) type.

You will need a demodulator probe for your signal tracer. This probe includes a Ge or Schottky diode detector and I built mine into a discarded felt-nib pen case. The probe should be fitted with a shielded connector cable (see Fig 2).

As a bonus I find that my signal tracer unit also serves as a useful amplifier for testing crystal sets etc.

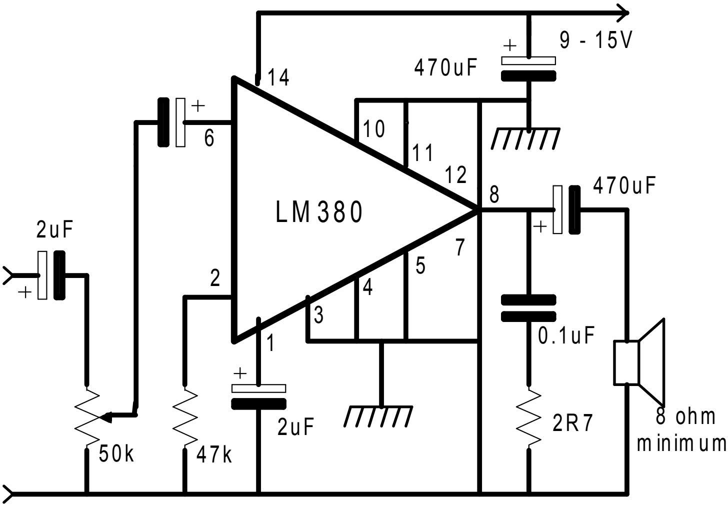
Using the signal tracer

Basically signal tracing comprises injecting an AF or RF signal at the input of the equipment in question and then following its path through the different stages of the circuit; hopefully to localise the problem area. To do this you will need some sort of signal injector which can be a strong signal form a local radio station or, better still, a simple signal injector or a signal generator.

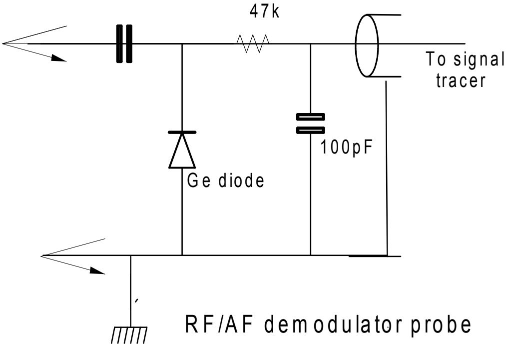
Using the block diagram of a simple receiver shown in Figure 3 you should start at the RF stage using the demodulator probe and you should be able to hear some sort of signal. Follow this through the RF amplifier stage if present on to the input of the mixer stage. For valve sets the grid and plates are the key points to check; for transistor sets the collectors will be the main check point. If you cannot detect a signal here then this stage could be suspect.

If these stages appear to be working properly, follow the signal through the IF stage(s) and on to the detector stage where, if it is working properly, there should be an AF signal at the output. Finally use the same procedure to follow the signal through the final audio amplifier stage.

Finally; a note of caution. If you are working an AC/DC type set with a live chassis you must run it from an isolating transformer.

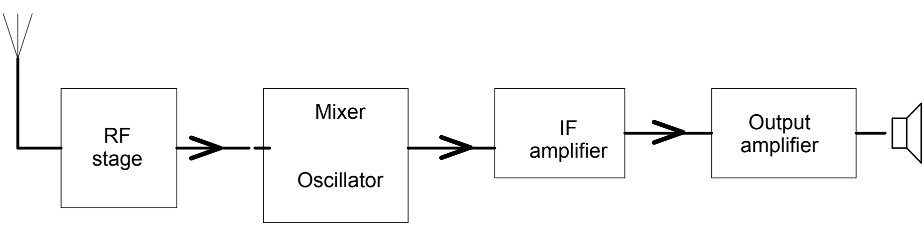


LM380 amplifier



RF/AF demodulator probe

Figure 2 above



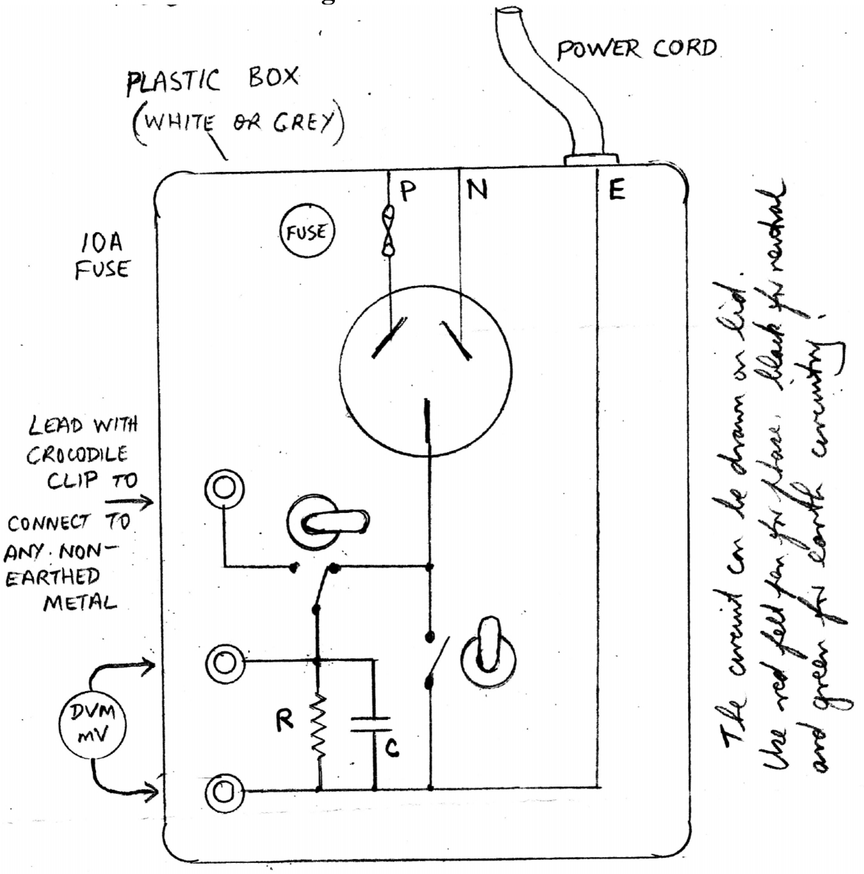
Block diagram of a typical receiver

An Easy Way to Measure Earth Leakage - from Don Beswick

This test box is intended for measuring the earth leakage current of domestic appliances, including vintage radios which may have been stored in damp surroundings. The earth wire supplying the three pin socket on the panel has a 1k resistor in series and it relies on the fact that for every microamp of earth leakage current there is a volt drop of one millivolt across the 1k resistor and this can be easily read with a digital meter on the 200mV AC range. Remember that the leakage resistance is (or should be) many megohms so that 1k in series has no limiting effect on the current. The 0.15µF capacitor is intended to bypass harmonics as mentioned in IEC 701. For domestic appliances the maximum allowable leakage current is 5mA (or 5,000µA) which means that the maximum voltage across the 1k resistor will be 5 volts (and the power loss will be 25mW). Needless to say, if your radio has earth leakage of hundreds of microamps then the transformer is suspect and this should be thoroughly investigated.
Notice that this test box in conjunction with a DVM gives the actual value of earth leakage, whereas most portable appliance testers (PAT's) simply register pass or fail and give no indication of how close to the limit the actual current is. For instance a leakage current of 4,900µA would show up as a pass whereas in the practical situation this figure suggests a partial breakdown of the insulation and it should be investigated.
Most members will have a hand held digital meter capable of measuring AC millivolts, however a calibrated valve millivoltmeter such as the Heathkit AV-3U gives readings very close to those of a DVM. If you use a ground-referenced VTVM, check that the ground of the meter goes to the lower (earth) end of the 1k resistor. If the polarity is wrong then you will short out that resistor and the apparent leakage will be zero - which is too good to be true. VTVM's such as the V7—AU on the 1.5 volt AC range are not sensitive enough to pick up small voltages such as 50mV or so. The meter scale is linear, which is OK for DC, but the response at the bottom end is nonlinear for AC, so those and similar models are not suitable for our purpose.
On the front panel of the test box there is a changeover switch and an additional socket for a clip lead which can be clipped on to any non-earthed metalwork such as a handle, inspection cover, bracket, sleeve, etc to measure the leakage current to earth. This test measures what is called "enclosure leakage", and the maximum allowable leakage current for this isolated metalwork is 1mA (1,000µA) which will show up as one volt on the DVM. Also on the front panel I used permanent marker felt pens with the old colour code (red, black and green) because indelible felt pens with other colours such as brown, light blue, and green and yellow striped are not available.
The prototype test box had an additional switch for disconnecting the neutral and this represents a fault condition. In this situation all of the internal wiring is 230 volts above earth and the earth leakage current is approximately doubled. This test is required only for medical equipment and not for domestic appliances. Initially I made an additional lead with ECG "buttons" as found on ECG pads and this was for the testing of ECG leads. The maximum allowable earth leakage is 10µA and again this has no relevance to domestic appliances. The accuracy of measurements depends on that of the DVM and on the accuracy of the 1k resistor. We know that current equals volts divided by resistance, and when quantities are multiplied or divided then the percentage errors are added. For instance if the DVM has an error of 1% and the resistor has an error of 2% then, the current measurement will have an error of plus or minus 3%. Accuracy of plus or minus 5% is acceptable under the standards.
Readers will have noticed that I have used the phrase "non-earthed" metal, and I hope that most of you can make the distinction between metal that is non-earthed and metal that is unearthed. For the benefit of those who cannot see the distinction, metal that is non-earthed is

metal that is intended to remain isolated from earth, while metal that is unearthed is that which is supposed to be earthed but which has become isolated, for example by a broken wire, or loose connection, or corrosion under a lug, etc.
In passing it is interesting to note that the IEC (International Electrotechnical Commission) standards are written in English and French, both international languages. Pages 1,3,5, etc. are written-in English, and the same text is written in French on pages 2,4,6, etc. French is not a good language for this sort of technical discussion because it is unable to make the distinction between non-earthed and unearthed. It simply uses the negative "n’est pas" meaning "is not" connected to earth, so is unable to make a distinction that shows up clearly in English. (Viva l'Angiais).

Test Box for Earth Leakage



$R = 1k\Omega \quad C = 0.15\mu F$

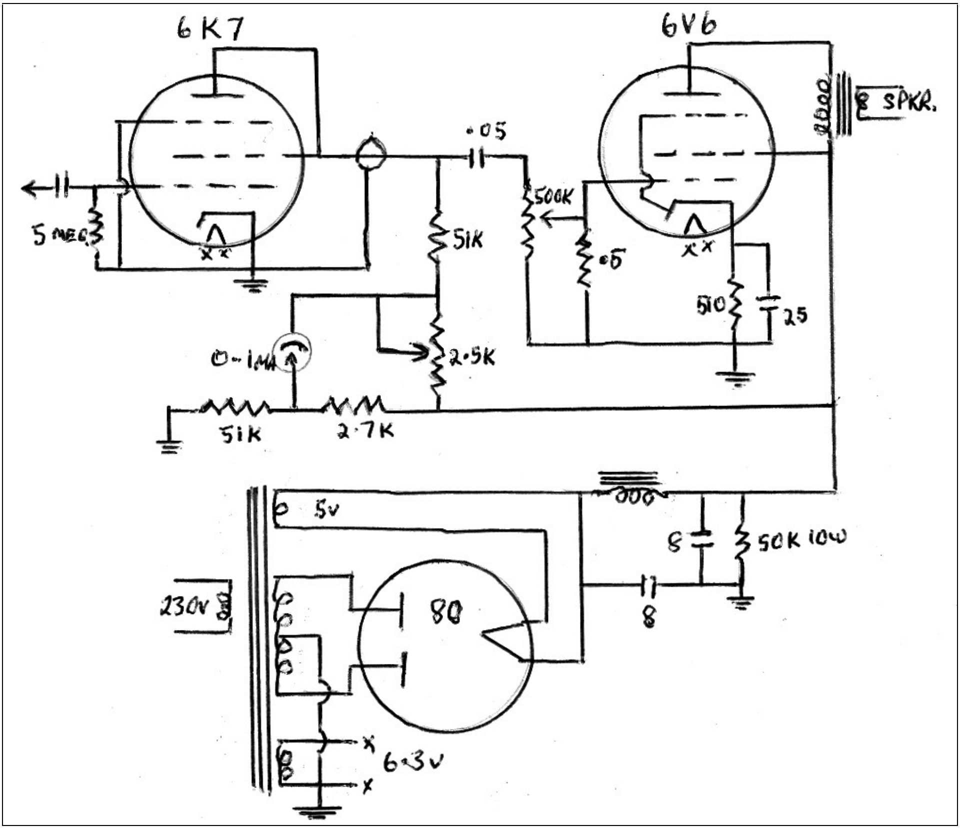
To measure earth leakage, bottom switch is up and top switch is to the right. The earth leakage current flows through the 1k resistor. Connect digital meter (mV AC) across the resistor and for every μA of leakage current the DVM reads 1mV of AC volt drop.

A Signal Tracer – from Gerry Billman

Device Competition for the AGM (second place winner)

This home-made signal tracer is a very useful piece of test equipment. For many years I used a home assembled Heathkit tracer however its rather poor sensitivity meant that it wasn't very useful for tracing the signal through some of the old TRF sets that have come across my workbench lately. Many years ago I read an article in a radio magazine describing the construction of a superior signal tracer and although I was probably only in my late teens at the time my interest was sufficient for me to copy the schematic in to my old note book and include a couple of notes about its construction.

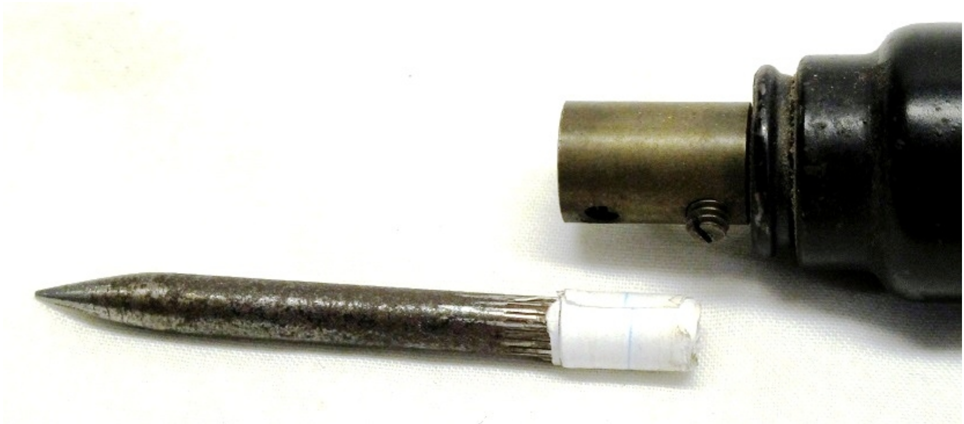
Some time ago while searching for something unrelated I looked again at that circuit drawing and thought that's going to be my next project. Hopefully it will be useful enough to help me with the renovation of these old sets.



Circuit
The design is a very basic fairly high gain two valve 6K7/6V6 amplifier together with a conventional power supply using an 80 rectifier valve. The power transformer and speaker/output transformer were salvaged from a scrapped radio.
The most interesting feature is however the unusual construction of the probe which gives both high input resistance and high amplification. I selected a metal 6K7 for the input valve as shown in the circuit because it had a grid cap that would become part of the actual probe and the valve itself plus a socket would be the hand held probe.

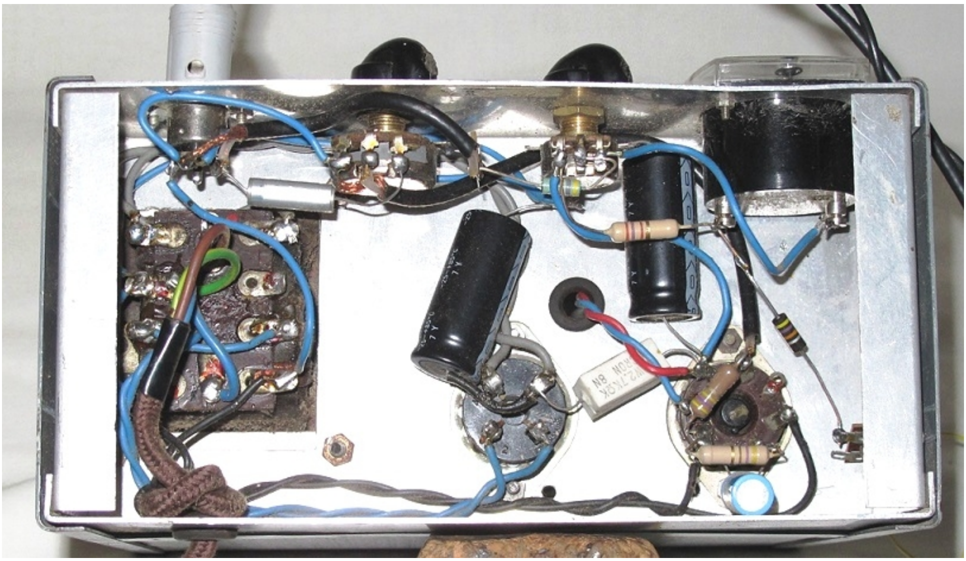
I used a Din type plug and socket to connect the cable to the main chassis.

An eighteen inch long extra earth wire is attached to the socket earth and the other end has a suitable alligator clip soldered to it. This lead is used as an earth connection to the chassis being tested.

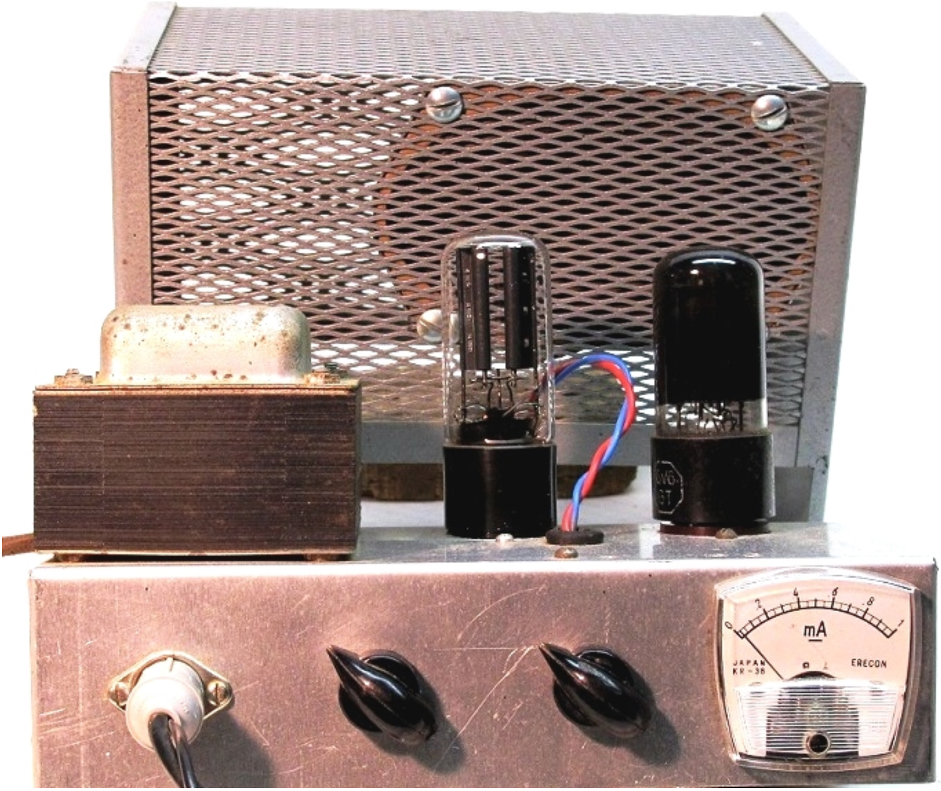


I found that a one inch long quarter inch shaft extender would fit neatly on the grid cap and the grub screw held it securely in place. The next step was to make the pointed probe. For that I used a two inch length of quarter inch brass rod with one end ground to a point using the bench grinder for this job. (Note to self, next time use a leather glove to hold that piece of rod because it gets very hot very, very quickly).
It is necessary to isolate the brass rod tip from the grid cap tube and this was achieved by wrapping a couple of layers of craft paper around the end of the rod so that the rod was a tight fit when it was forced in to the tubing. This made a very effective input capacitor.

The metal case on the 6K7 is earthed via the screen on the screened plate cable to the main chassis. The small five Meg grid leak resistor is soldered between the quarter inch shaft extender and a small area on the valve that has the black paint scraped off to expose the clean metal underneath for soldering. A shielded female socket was used to complete the assembly and provide a suitable place to connect the cable that would carry the wiring to the main chassis. This cable will have a shielded plate lead and a filament lead.



The wiring for the amplifier was assembled in a small chassis that I was saving for just such a project.



The ventilated cover provided a convenient place to mount the small oval speaker.

There was enough space on the side of the chassis to mount the volume control with on off switch, the sensitivity control for the meter and the 0-1 mA meter.
The meter gives a visible indication of the incoming signal and is adjusted to zero by first grounding the tip of the probe and adjusting the 2.5kΩ pot.
When signal tracing through a receiver, the alligator earth clip on the probe is attached to the receiver chassis. Either a radio station or an oscillator signal can be used to trace the signal from the aerial input right through to where the signal disappears.

Transistor Radio Serving Tool - from Colin Bowring

AGM Competition Entry

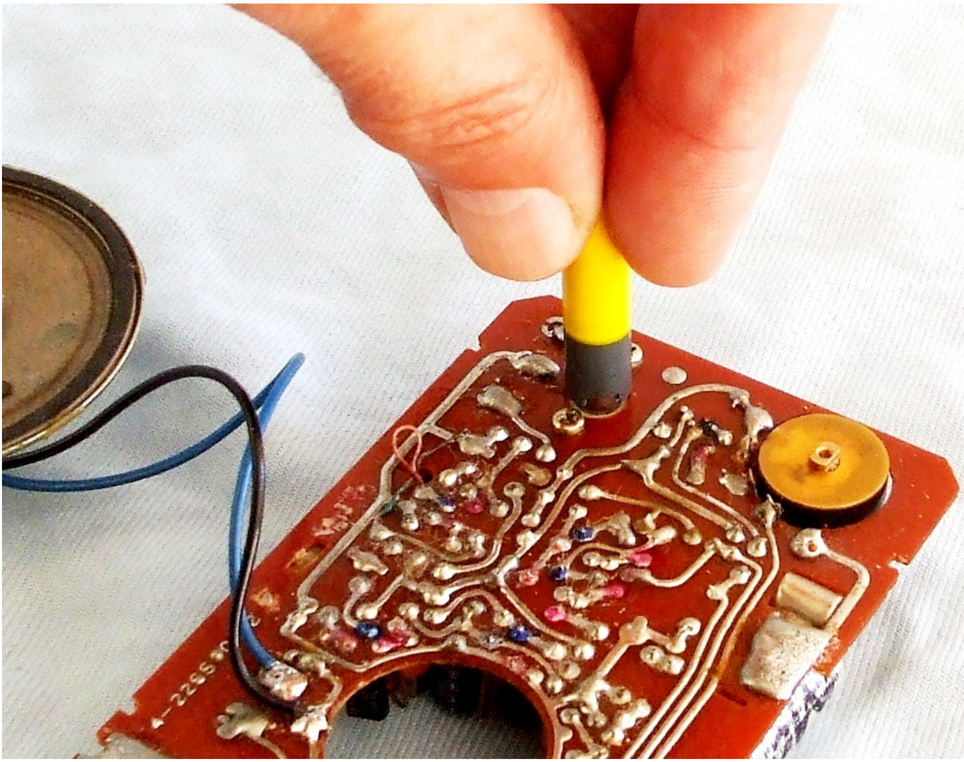
This tool enables quick and easy on/off, volume control and tuning when servicing transistor radios.

When a transistor radio PCB is removed for service or repair, it is often found that the volume and tuning knobs/dials obscure a portion of the printed circuit. By using this tool the knobs/dials can be removed exposing all the tracks and still allow easy manipulation of the controls during the service/repair operation.

The tool fits the standard size volume and tuning condenser shafts that are encountered in small and pocket size transistor radios.

Made from 6mm diameter PVC rod. One end is slotted to fit the volume control and the other the tuning condenser. Both ends have brass pins that locate in the controls screw hole to prevent slipping off in use.

The bright yellow band makes it easy to spot among the stuff that accumulates on the work bench during a typical servicing operation.



AGM Competition Winner: Signal Injector – Tracer.

A transistor radio fault finding aid from Colin Bowring

When it comes to servicing transistor radios, a signal injector or signal tracer can often speed up the process of locating the defective stage. However, the over simplistic design of many of the commercial and home build units often leave a bit to be desired in actual use. Most annoying are, one piece probe injectors that give no indication of battery condition, or indeed if it is working, along with awkward on/off output controls etc. Then there is the tracer; typically an amplifier with all the lead plugging and so on in order to get it ready to use. While this sort of thing can do the job, the primary objective of this project is to bring it all together in a device that is quick, easy to use, and reliable. Except for sharing the same battery and common ground (-ve), the injector and tracer are separate units housed in the same enclosure, and this is emphasized by the panel layout. Either injector or tracer can be used alone or both at the same time. Operational status can be verified any time during proceedings by touching the probes together.

Injector: The injector is a square wave generator.

Frequency: Preset via internal trim pot to give a suitable ‘tone’ to suit the user, typically around 400 – 600Hz.

Probe: Direct connection (no plugs). Fully shielded PCB to tip.

Probe impedance: Relative high and low; switchable to suit various test points.

Output: Adjustable from zero (switch on) to high.

Tracer: The tracer is based on a LM386 op amp configured as a high gain amplifier with a switchable FET front end to enable high or low input impedance. RF/AF input is selectable from the probe.

Output: Adjustable from zero (switch on) to high.

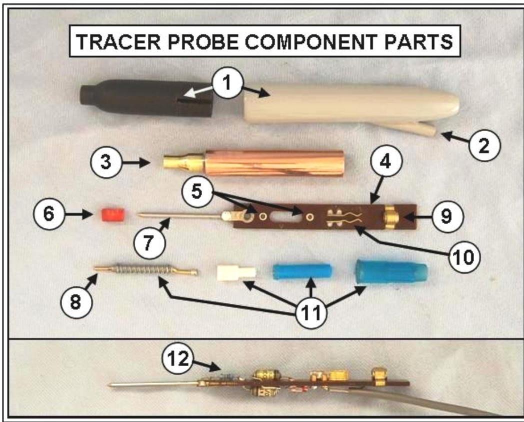
Probe impedance: Relative high and low switchable to suit various test points.

Probe: Direct connection (no plugs). Fully shielded PCB to tip.

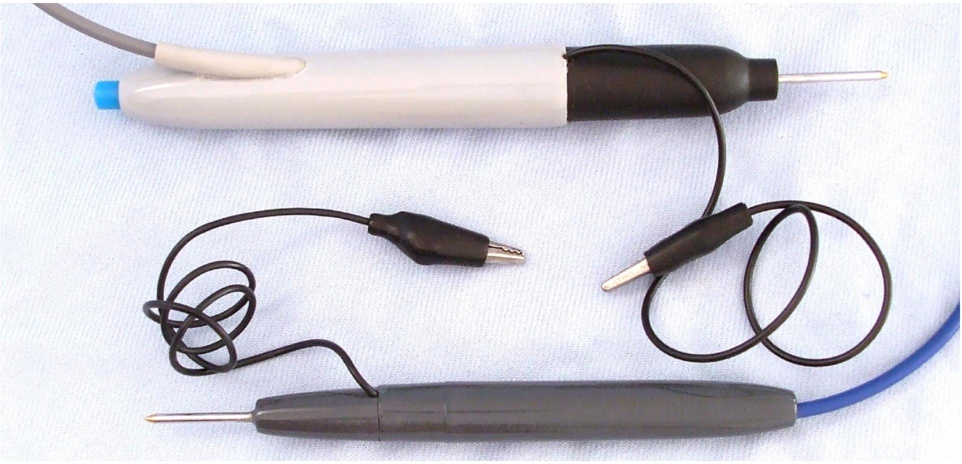
RF/AF: Switchable from probe (thumb press)

Phone jack: Using phones allows the signal to be clearly heard above ‘other’ noises.

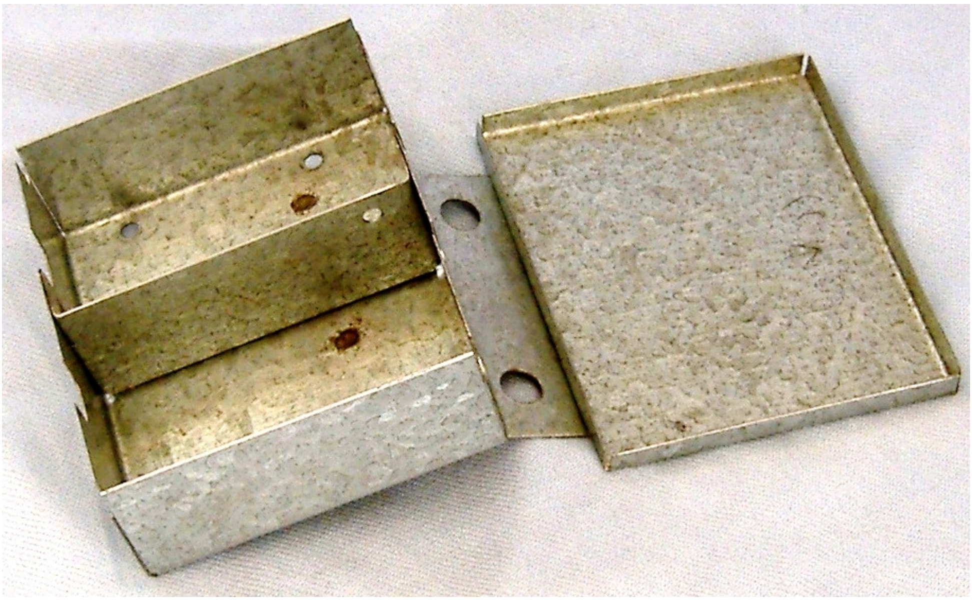
Tracer probe: Electronic components are close to the tip. RF/AF switch is also close to the tip electronics, but the insulated actuator is some distance away. There is a generous gap between the metallic shield and tip and shield and probe body (to minimize noise pick up from the user’s hand/body).



1 Probe case (marker pen)
2 Lead in (PVC tube)
3 Copper & brass shield (bullet shell & tube)
4 Component board (fiber board)
5 Component mountings (rivets)
6 Tip to shield insulator (HT cable outer)
7 Probe tip (chromed brass rod)
8 SW bridging contact (10mm long brass rod)
9 SW contact guide (brass fabricated)
10 SW contacts (fabricated brass strips)
11 SW actuator parts (ball point pen)
12 Electronic components mounted on board

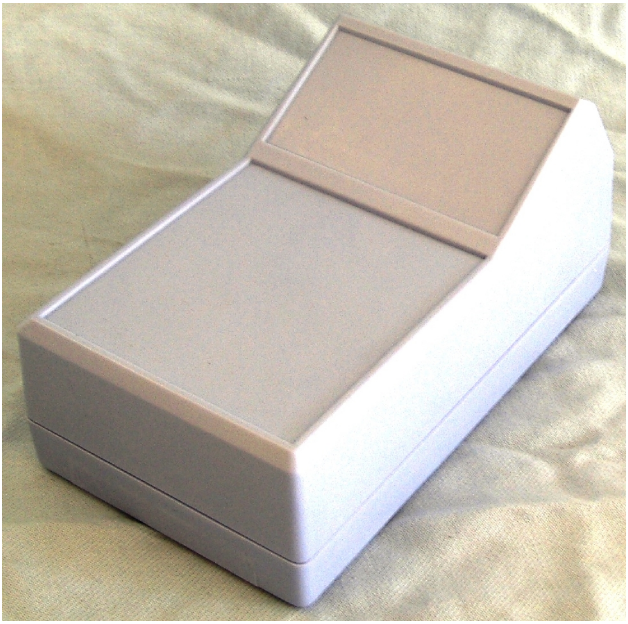


Construction: Most of the components used in the construction were from stock at hand including the enclosure. Specialized parts were made by hand; such as the tracer probe, made from various odds and ends, the speaker grill, cut and formed from an old transistor grill and painted to ‘blend in’ with the control panel, and the metal shielding box, made from 22 gauge galvanized steel sheet.

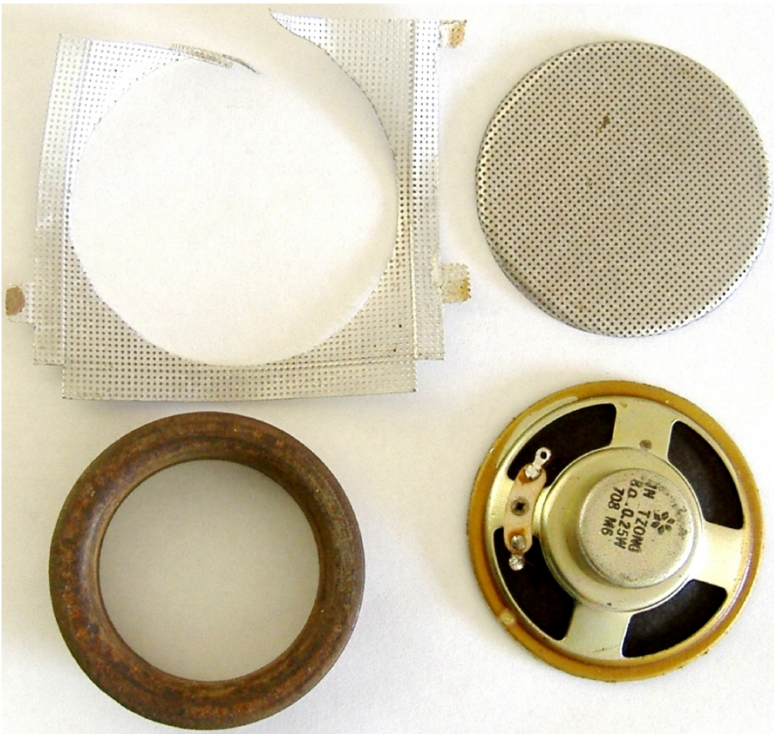


Due to the high sensitivity of the tracer and radiated noise from the injector circuitry, extensive shielding is used between the two units and the outside world. The PCBs are fully enclosed in metal boxes with shielded wiring to sensitive external components such as switches, potentiometers etc.

The cover picture of this bulletin shows the finished product.

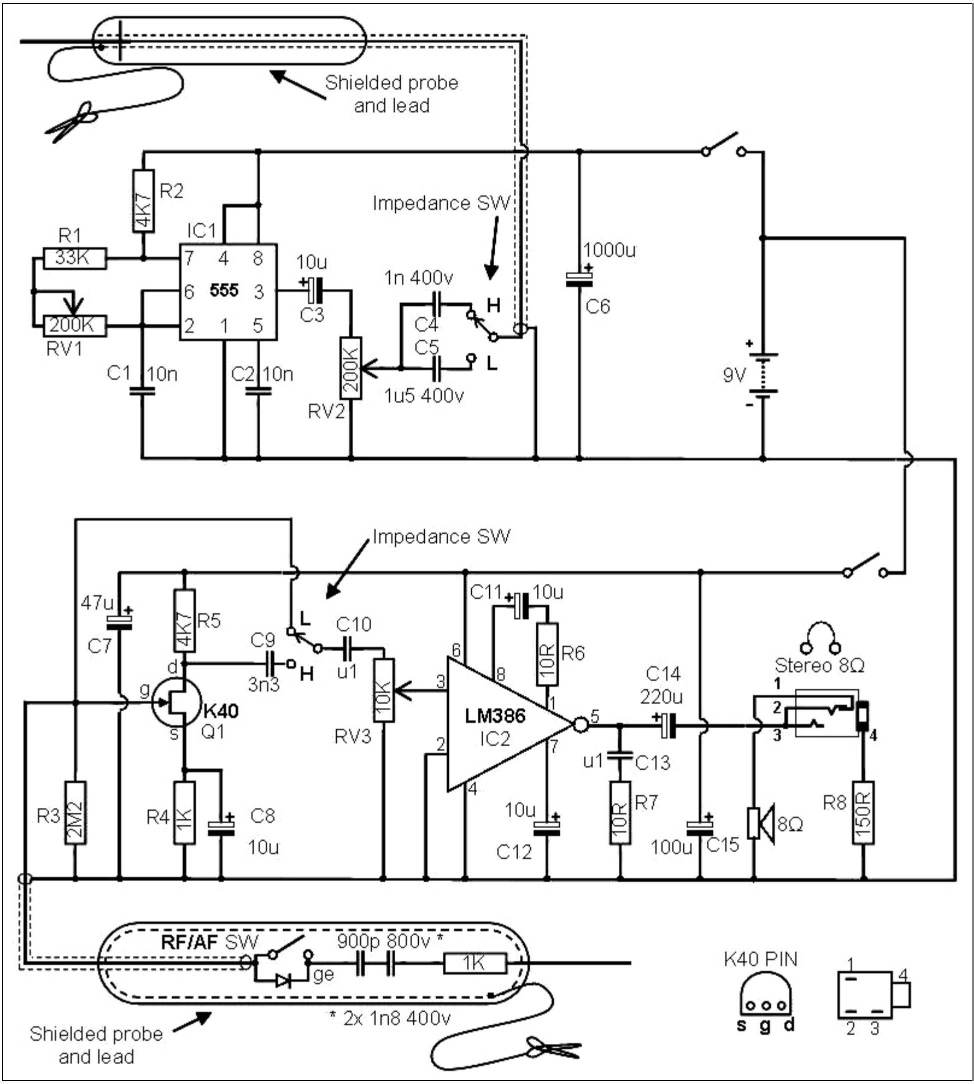


Original instrument case blank.



Forming the speaker grill.

Electronics: The 555 based injector and LM386 amp are standard circuit configurations. Full and extensive data on these can readily be found in data books or online.
Some points specific to this device are: The FET gives a high input impedance of about 2 meg ohms (set by R3). The direct input to the LM386 is about 50K. The fairly high value of C6 is necessary to prevent interaction between the two circuits, i.e. with a lesser value the injector tone can be heard faintly through the amp. The 1K resistor in the tracer probe acts as a buffer between the probe and the circuit under test.



The tracer has high gain so as to have plenty of reserve rather than not enough amplification.
Loudspeakers can be tested in or out of circuit with the injector set to low impedance and near maximum output.
The following is an extract on how to use an injector and tracer in servicing transistor radios.

Receiver test points

In the schematic of Fig. 403, the logical test points in a transistor radio are shown. By using either signal-tracing or signal-substitution methods, the service technician can quickly and easily isolate trouble. A good place to start, using the signal-tracing method, is between the detector and audio amplifier (point A). A signal at this point indicates that the trouble lies somewhere between this point and the speaker. If no signal is present here,

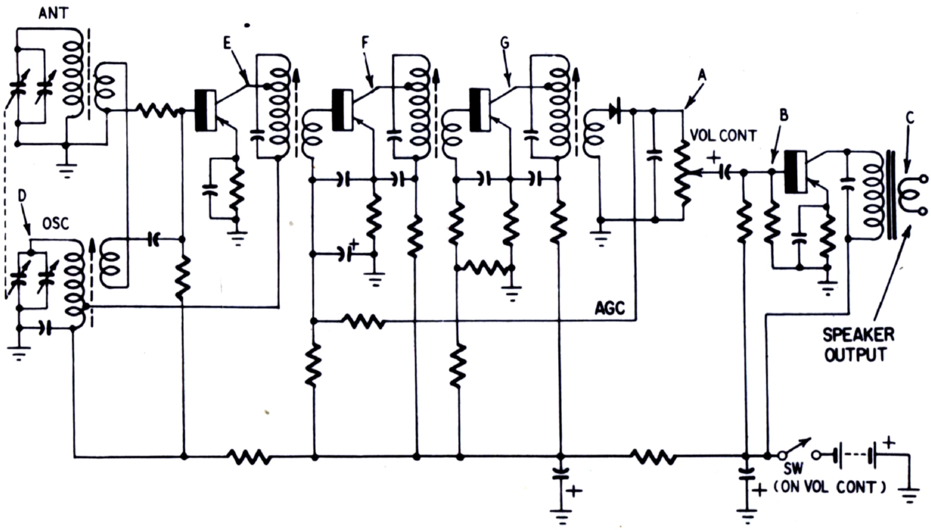
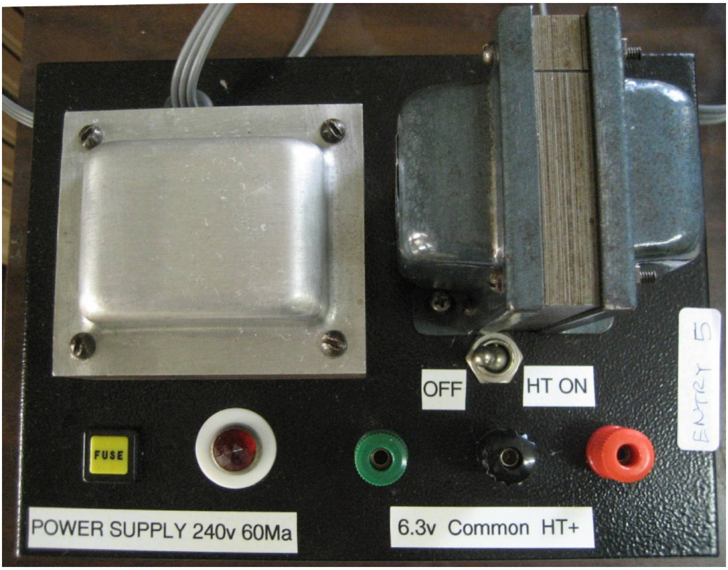


Fig. 403. *Test points in a typical transistor radio. Many service technicians start probing at point A as a first rough guide toward localizing the trouble.*

then the trouble lies between the antenna circuit and the detector. Additional test points, in either direction, would be B and C or D and E.

Reducing the number of circuits to be tested by half, as in this method, has the advantage that with one check you can tell in which portion of the receiver the fault occurs. Of course, when injecting a signal into the various test points it is necessary to use the proper generator impedances (this can be quickly determined by referring to the transistor characteristics sheet), frequency and signal amplitude. For audio tests at points A, B and C, a frequency of 400 cycles can be used. For points E and F, the receiver intermediate frequency should be used with 400-cycle modulation.

AGM "Device" Competition – some more pictures



Left:
Phil McGechie's entry was a power supply module providing 6.3 volts ac and 240 volts DC

Left:
The Signal Injector and Tracer from Colin Bowring even came complete with its own box.

Some Judging Comments:

- "There is no doubt that there had to be a clear winner but to be honest the diversity and quality of all the entries made it very difficult to decide on an overall winner. Indeed it is fair to say that had the weighting of the marking criteria been different then there would have been a different winner. Such was the level of the entries. In particular the nature of the problems that each addressed was interesting in itself.
- "As a judge I definitely learnt a good deal and what also impressed me was the ingenuity used to solve these problems."
- "All entries were winners as in their own way they had identified a requirement and designed a solution."

The remaining entries will appear in the next bulletin. Ed.

Some notes on upgrading Hickok valve testers by Terry Collins

Introduction

There is a lot of information about these testers available on the internet and while this is useful I have not found any that details specific data concerning modernising and re-calibrating Hickok testers these after any such modifications. My object in writing this article is to provide some solutions for the major perceived issues and make valve testers more readily available to our community. These testers operate in a very different manner to the well-known AVO instruments that may make prospective purchasers reluctant to "take the plunge". I do not claim originality for all the information contained in this article, most has been gleaned from several years searching the web and some experimentation on my testers, never the less my hope is that after reading this some of the reservations about these testers will have been resolved. Note that the US army valve tester model I-177 is a Hickok product and these modifications are therefore applicable to that instrument.

It is worth keeping in mind that these testers are not precision laboratory instruments! They were made to a price to give an indication of the approximate state of a valve under test. The fact that the meter is minutely calibrated in 0.05 μGm increments is, I suspect, more of a marketing ploy than any serious indication of a precise mutual conductance value. That said they do provide a very useful means of assessing the likelihood that a particular valve is faulty and thus responsible for a failure of the equipment in which it is used.

Most of the pre-war and 1950s Hickok testers employ the same technique, and basic circuits vary little between models. The original designs were not very flexible with few (if any) field adjustable components and relied on all the parts (particularly the rectifiers) working 100% to ensure accurate results. Drift in components will have taken its toll over the years but with modern parts and techniques it is possible to restore these testers to factory standard operation. The modifications detailed here can be applied to most of the testers of this era.

General

These testers employ components of the day, that day was 60 to 70 years ago so I wouldn't trust the Carbon resistors, waxed paper or mica capacitors that you will find inside. As a matter of course replace the resistors with suitably rated Carbon or metal film parts, 5% is better than the originals, they are easy to source and reasonably priced. Likewise with the few capacitors, these can be replaced with suitable polyester film capacitors without concern for operation or accuracy.

The precision resistors are in general of the hand trimmed spool type. I usually replace these (if necessary) with a fixed value film resistor and a multi-turn pot to allow precise adjustment to the required value.

In general the wire wound power resistors do not degrade quite so badly as the carbon parts but inspect them for corrosion and cracked or flaking vitreous coating. If you consider they do need replacing it is likely that a combination of resistors will be required, most of the original values used are not E24 series. Some testers use a tapped power resistor with two taps to allow adjustment of bias and reduced screen voltages, if this needs replacing I recommend using fixed and adjustable parts, the final configuration is far easier to set correctly than the original. The filament circuit uses a fixed 100 Ohm centre tapped resistor of about 8W dissipation, if this needs replacing a combination of resistors will be satisfactory.

The testers use very complex switching arrangements to select the various electrode configurations on the tester deck. These switches are normally the multi-ganged Yaxley type and are in general difficult to work on or around. I must confess that I have never been able to

work out from the published circuits just how this magic is performed and if anyone out there could enlighten me I would be most grateful.
If, however, the switches are dirty or intermittent something must be done. I council caution here, simply spraying switch cleaner may result in even greater woes. If you must clean these switches use a lubricating cleaner such as Electrolube EML, not one that leaves a heavy residue. After application allow plenty of time for the cleaner to dissipate before attempting a test, and keep in mind that high voltages are present.

Fuses

The Hickok testers do not use conventional cartridge fuses for protection. The original mains input fuse is a General Electric #81 6V automobile bulb. Genuine bulbs are now hard to find and expensive, there are however many suppliers that claim to supply #81 bulbs. I’m not sure that these meet the original 1.02A at 6V GE spec. but they seem to operate fine in my testers. I didn’t observe any difference in operation between the genuine and after-market part, I suspect that it is only when testing very high power valves that any difference would have a noticeable effect.
Some models of tester also have a “Bias” fuse, this is to protect the “Bias” or “R” pot, (a wise precaution). This pot has a unique track taper and if a faulty valve fries your pot the only way to fix the tester is to source a replacement part from a “junker” unit but it’s not likely you’ll find one these days. Hickok used a GE #49 lamp to protect this pot, it’s specification is 2V at 62mA. If your tester doesn’t have this fuse or you can’t locate a #49 lamp add a fuse carrier and fit a fast blow 60 ~ 62mA (or even a 100mA if you can’t get the lower rating) fuse in series with the slider of the “Bias” pot, this is cheap insurance.

Power transformer

Since Hickok testers are of US manufacture it is no surprise that most are designed to operate exclusively from a 110V 60Hz supply. One unit I restored had had a burnt out transformer by the previous owner not being aware of this point. The lower mains frequency in New Zealand (50Hz) usually results in an increased magnetising current in the transformer and consequent temperature rise. Keep this fact in mind when using these instruments (or any instrument

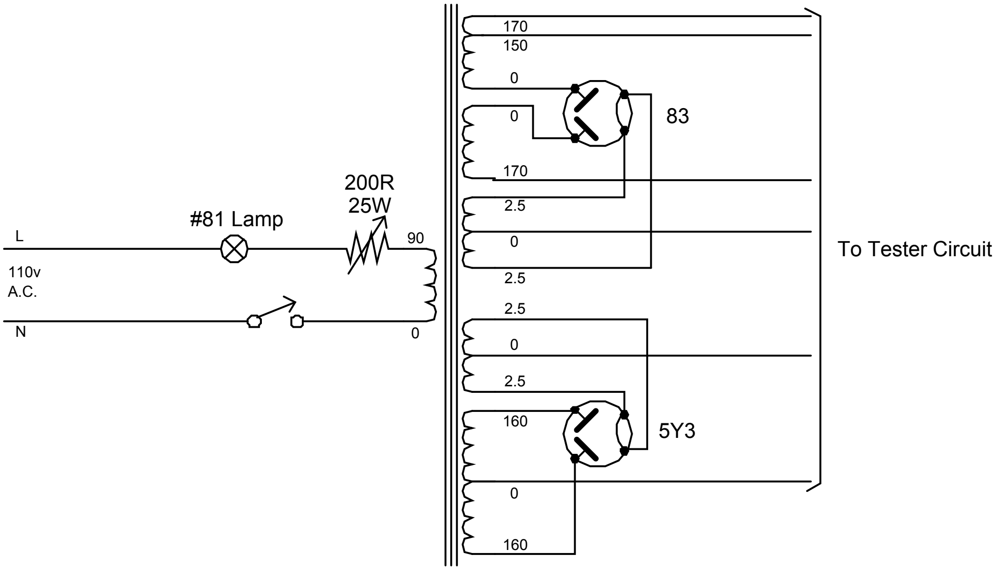


Fig. 1a

originally designed for 60Hz operation), don't leave them "idling" for long periods, all it is doing is reducing the life of the tester to no purpose. A typical Hickok power supply circuit is shown in figure 1a.
To allow operation from 230V it will be necessary to add a 230 to 115V transformer. I would recommend an auto-transformer rather than an isolating transformer for the following reasons:

1) They are smaller and lighter than the isolation type and should thus be easier to fit inside the tester case.
2) Isolation from the mains supply is provided by the existing mains transformer.
3) They are likely to be easier to source and cheaper than an isolating transformer.

If the auto-transformer is mounted within the case it will be necessary to rewire the existing On/Off switch to the input of the transformer and include a fuse (about 1A) in the 230V side of the transformer. As you can see from the circuit above there is no earth connection, therefore I recommend that during modification one is added but it's your life not mine so fill your boots!
The tester operates at about 80VA max. The auto-transformer must be capable of supplying this as a minimum; however I recommend a 100VA part or greater be used. This should make the operation of the tester simpler due to reduced regulation being experienced under load, this is of concern when testing power output valves or any valve that requires a high heater current.
Variations in the mains supply are compensated for by the use of a 200Ω 25W variable power resistor in series with the 110V input to the tester (in fact these testers are designed to operate at about a 93V input to the main transformer).
This resistor frequently needs to be replaced as it usually suffers considerable wear over the years to a very small portion of its track. Fortunately a replacement part can usually be sourced from various vendors on eBay at a far lower cost than the original US part although the replacement part may require some minor mechanical modification. In the testers I have worked on the shaft required shortening and it was also necessary to cut the fixing nut(s) in half, these modifications allowed the original knob to be fixed at the correct height and the lid of the cases to shut properly.

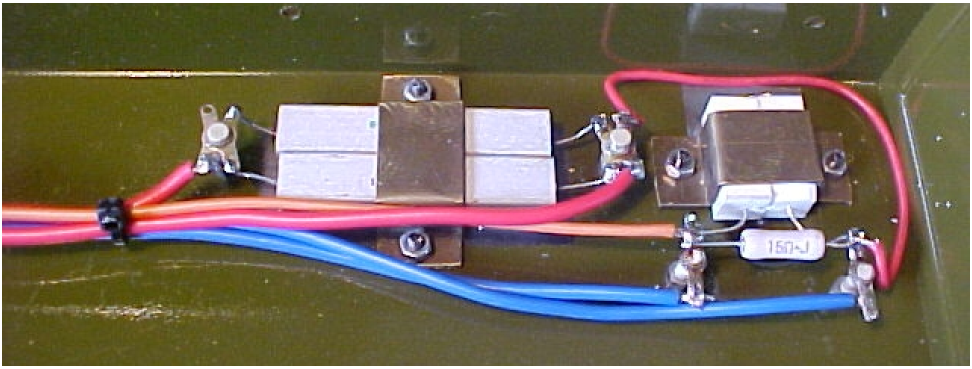
Rectifiers

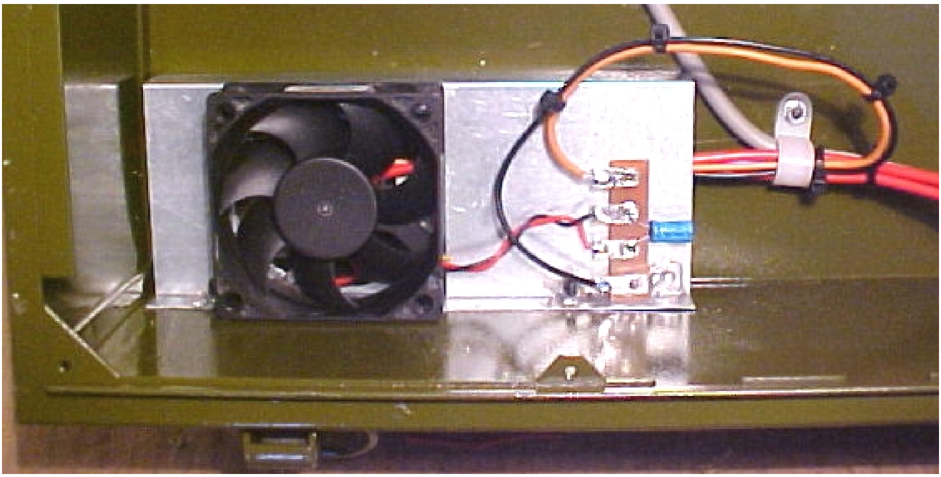
One of the major concerns with Hickok testers are the 5Y3 and type 83 rectifiers used to provide the DC supplies necessary to establish the required test conditions. While the 5Y3 is still common and reasonably priced the type 83 is now difficult to find in a condition (and at a price) that won't make the eyes water!
The type 83 valve does not have a long service life, because it is a Mercury vapour type rectifier. The short life is probably due to movement of the tester causing splashing of the condensed Mercury onto the internals of the valve. These valves were never intended to be moved around in service and were supposed to be mounted vertically at all times, Hickok in their wisdom ignored both of these requirements. However Hickok did recommend that the tester be switched on for a period of at least a one-minute prior to operation (to allow the condensed Mercury to vaporise) but it is unlikely that this precaution was observed much in actual practice.
It may be helpful here for the reader to be aware that all the potentials used within the tester are assumed to be correct when the variable power resistor is adjusted to set the anode supply to 150V +/- 2V D.C.
It is clearly desirable to replace both rectifier valves with solid state devices. This can be done but it is not simply a question of replacing only the rectifiers, it is also necessary to ensure that the tester is returned to the correct internal calibration levels for accurate operation. The combined power required by the filaments for these rectifier valves is 25W, (a significant proportion of the 80VA total). If this load is removed and not replaced the voltage dropped across the power pot on the mains input will decrease proportionally. Therefore it will be

necessary to increase the series resistance of the adjustment pot to restore the correct operating conditions. The higher source impedance of the supply effected by this change will have two major results:

1) The resultant poorer regulation of the supply to the transformer will make it extremely hard to run the test as constant attention will have to be given to ensuring that the 150V internal supply (and thus every other voltage within the tester) is correctly set.
2) The test setup for each valve type has been defined to take into account that when the test is carried out the variations in the voltages (that must still occur) are compensated for by the setup parameters. If the supply impedance increases significantly the accuracy of the setup and thus the accuracy of the test result is destroyed.

To avoid these problems it is necessary to replace the load presented by the rectifier filaments. This is realised using high power wire wound parts available from local suppliers. The 5Y3 load should be 2.5Ω at 10W, the type 83 is 1.67Ω at 15W. The 2.5Ω load can be obtained by a parallel combination of 5.6Ω and 4.7Ω, both 5W parts,. The 1.67Ω load is a parallel combination of 2 x 3.3Ω resistors, both 10W parts





On the testers that I have modified I mounted these load resistors to a heat sink. This reduces the very high surface temperatures that will otherwise result and the slight over dissipation of the 4.7Ω resistor should be negligible under these circumstances. The heat sinking also reduces the small change in the load resistance due to the temperature rise. When wiring these loads to

the transformer I used about 1mm conductor wire to avoid an undesirable voltage drop. Since these windings are now "floating" I wired the two loads in series and rectified the resulting 10V AC. This was smoothed with a 100uF and the (approx.) 10V DC was used to drive a 12V DC fan mounted on the heat sink, the fan was obtained from a scrap computer PSU.
The filament loads of this I-177 are mounted to the metal case. In this instance the 2.5Ω load is provided by two series connected 1.5Ω, 5W parts with a 15Ω wired across these giving a total load of 2.5Ω. The larger resistors to the left are 2 x 3.3Ω, 10W rating giving close to the required 1.67Ω load.

The loads are covered by a small tin plate heat shield to which is mounted the fan. The terminal strip to the right provides mounting for the bridge rectifier and the 100μF capacitor.
This approach was necessary, as there was insufficient room inside the instrument case to accommodate a separate heat sink.

I replaced both valve rectifiers with a pair of 1N4007 diodes, these have a wide margin of current and voltage capability, are cheap and easy to mount. The solid state diodes do not however have the same forward voltage drop as the original rectifiers so some adjustment arrangement of the final delivered voltage had to be added.
Since the tester operates with un-smoothed power it wasn't simply a case of adding a couple of high voltage regulators. I decided on stacked Zener diodes in series with the two supplies then selecting the values so that the voltages delivered were correct on a true RMS reading meter. As a guide only, on a model 600A I recently modified the 150V supply was trimmed with a single 3.9V 400mW diode while the 130V supply required 3 x 5.1V 400mW diodes in series. This modification distorts the applied test voltage waveform slightly, however "before" and "after" testing on a range of valves (small signal amp, power output, diodes and rectifiers) indicated that the test results were not noticeably affected by this small change.

Diagram of a typical Hickok tester power supply after modification:

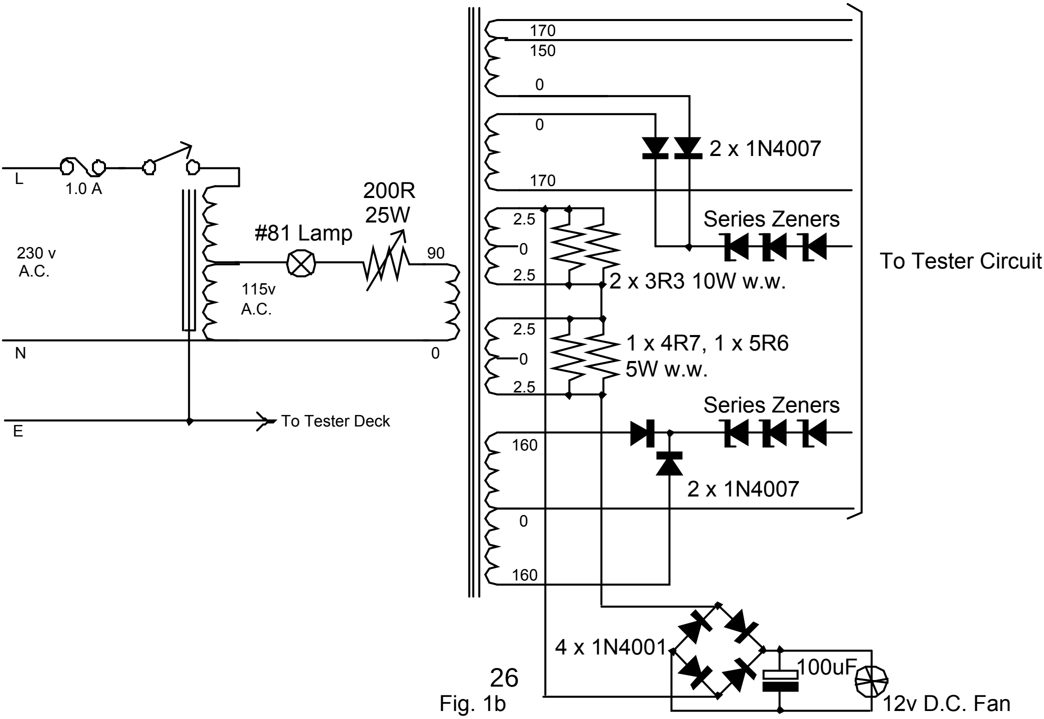


Fig. 1b

Shorts test

To test for inter-electrode shorts the Hickok testers use a Neon lamp circuit. This lamp will glow if the currently selected electrode pair are shorted. Strictly speaking this circuit will generally give a positive indication for a short if a path exists with a resistance of about 200kΩ or less.

The Neon lamp is frequently broken or missing, these are obtainable from various vendors on eBay at reasonable cost. Alternatively a small 80V "Pig tail" Neon bulb available from local vendors may be wired across the existing holder and gives satisfactory results. This is just the Neon bulb without any series-limiting resistor, the necessary limiting is part of the tester circuit.

Fault			Shorts Test Switch Position				
			1	2	3	4	5
Filament	--	Cathode			X		
Filament	--	Grid	X	X			X
Filament	--	Screen	X		X	X	X
Filament	--	Suppressor		X			
Filament	--	Anode	X	X		X	X
Grid	--	Cathode	X	X	X		X
Grid	--	Screen		X	X	X	
Grid	--	Suppressor	X				X
Grid	--	Anode				X	
Screen	--	Suppressor	X	X	X	X	X
Screen	--	Anode		X	X		
Anode	--	Suppressor	X			X	X

The actual electrode pair to be tested for shorts is made via a six-position switch. The first five positions test for shorts, the sixth is used for the quality testing of the valve in question. The electrodes tested by each of the first five positions vary from model to model, the test results are interpreted by use of a table of indications. If this table isn't available it may be determined very simply.

Setup the tester for a known valve type and connect a 100k Ohm between each of the electrode pairs. With a pair of electrodes connected in this manner rotate the "Shorts" switch through the first five positions and note when the neon glows. More than one switch position may give a positive indication, record the positions and the table can be generated from this information. Above is an example of such a table, "X" indicates that the "Shorts" neon is lit.

Meter movement

The actual meter movement used varies greatly, some models use a 1.4mA movement others 500uA and I'm sure there are others of which I am unaware. The point is that in the event that the movement is damaged it's going to be hard to source a replacement. A form of insurance is to fit a pair of 1N4001 diodes back to back across the meter. This won't stop the meter pegging at full scale but it might buy a little time for you to get your finger off the button you have pressed in error before the coil is damaged and for 50 cents why wouldn't you fit them? In the event that you have a cooked movement it should be possible to replace it with a modern part, shunt it to the correct sensitivity and regenerate the scale but this is a lot of work and not for the faint hearted.

Some meters have a bevelled glass and in the unfortunate case that the movement is "slammed" across due to mis-operation it is possible for the needle to be wedged under the curve of the glass. If this has happened it is (sometimes) possible to free it by tapping the meter very gently while applying about 5% full scale current through the movement in the reverse direction (but be careful).

If your meter has a plastic face avoid the temptation to “polish” it, the static created will hang around for hours (or even days) and the tester is out of service until the movement is back to zero.

Later valve types

One of the major issues with the earlier models of these testers is that they do not have sockets for the later miniature valves and being of US manufacture there are (usually) no sockets for the type of valves found in European equipment. The US army provided a simple expansion box (the MX-949) for use with the I-177 tester that included some of these “missing” sockets.

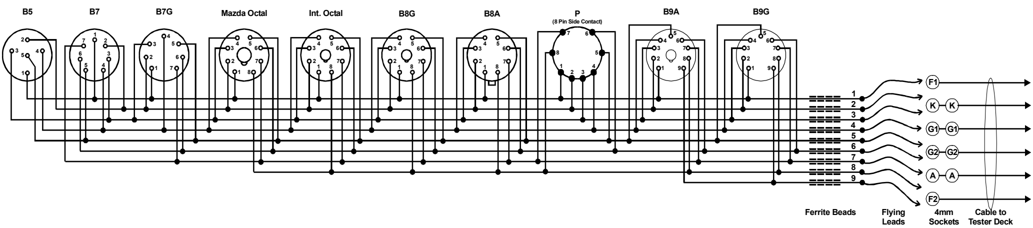
There is plenty of information concerning the MX-949 available on the web but essentially this is a very simple device that is plugged into the existing “International Octal” socket on the tester deck. The tester electrode selector is then setup for one specific valve type. On the box the electrodes (F1, F2, K, G1, G2 and A) are made available at a set of banana sockets and the pins from the valve sockets are presented on short flying leads terminated in plugs. These leads are plugged into the appropriate electrode sockets so that the valve may now be tested. When constructing an expansion box keep in mind:

1) Do not use thin (low current) conductors for the filament leads from the tester to the expansion box, they are sometimes required to carry moderate current.
2) Do not make the cable between the expansion box and the tester too long for the same reason as (1) above.
3) Space the sockets far enough apart so that it is easy to get fingers in and provide some kind of insulated “parking” for the flying leads that are not currently in use.
4) The gain of modern valves may lead to self-oscillation when connected by long wires back to the tester, this could distort the test result. To prevent (or at least reduce the probability) of oscillations fit lossy Ferrite beads over the wires close to the flying lead end. Philips F8 or 3B1 Ferrite material or equivalent is suitable as are some of the modern SMPS suppression beads but avoid “high frequency” Ferrites, you want poor HF performance and as much loss as possible at these lower frequencies. Make sure the beads cannot contact any conductor as they are not all insulators and stray currents will give erroneous test results.

Note G3 (suppressor) does not have a specific connection; this is plugged into the “K” socket when testing a pentode. Since there is sometimes a requirement to plug two pins into one electrode K, G1, G2 and A are presented at two sockets wired together.

The exact “plug-up” for specific valves can be found in data available on the net, if information for the valve in question is not known it is reasonably easy to deduce this from similar types for which information is available.

Below is the circuit of an expansion box made for one of my testers, it is not by any means definitive but is included to clarify the text above.



Test data
There is much test data available on the net for pre and post war valves but once again it is heavily biased towards the US market and manufactures. The European types that have a direct equivalent may be simply tested using the US data, however there are many types for which no data is published. Hickok did, towards the end of tester production, provide some European type data and some other sources of data that I have found are listed at the end of this article. The most obvious lack of information is for British service types but with a little experience and reading it is possible to generate data that will allow satisfactory testing of unlisted types.

Calibration
After modifying the tester as described above it will be necessary to perform a complete calibration. This is not a difficult task but – please note – the excellent calibration procedures published by Mr. Daniel Shoo available on the internet are not strictly applicable to a tester modified as described above. Never the less if you are considering applying these modifications to your tester I recommend that you read these procedures because they provide a valuable insight in to the equipment calibration process.
To describe the calibration in detail will require a considerable amount of space and so must remain the subject of a subsequent offering.

Some suggested reading;

http://padgett.performanceresearch.us/tester/cal600.htm
Model 600 and 600A calibration procedures by Daniel Shoo.

http://www.antiqueairwaves.com/nlee/i177_index.html
The file I-177 108.xls available on this site is a setup and data file for the 177 military tester. It gives details on the how of testing which is applicable to most pre-war models, also giving test information on ballast lamps.

http://www.stevenjohnson.com/hickok/data.htm
This site has a wealth of information on a wide range of Hickok testers and lots of setup data, circuits and useful information.

http://www.saegerradio.com/downloads/Consolidated Test Data For Hickok Model 533A-600A-605A Tube Testers V2.5.pdf
An excellent source of setup data, including modern European valve types

http://www.radiomuseum.org/forum/military_update_your_hickok_i_177_to_fall_1971.html
A very interesting site and a good source of setup data, including modern European valve types

http://tubesound.com/2009/09/07/signal-corp-i-177-tube-tester-calibration/
A calibration procedure for the I-177, useful to compare this with the procedures of Daniel Shoo

http://www.jogis-roehrenbude.de/Roehren-Geschichtliches/Roe-Pruefer/I-177/I-177-man.pdf
Section three of this document details the various test configurations for the I-177 but as stated before most of the pre-war and 1950s testers used the same techniques.

Acknowledgments
I would like to thank Daniel Shoo for his patience and help in getting me to understand these testers. Also Trisha Coffin, John Dodgshun, Murray Clark, Ian Thomson and Mark Atherton for their help in reviewing this article. Their technical input, comments on grammar and sentence construction have been invaluable.

Terry Collins, <Terry295@clear.net.nz>

MARKETPLACE

Advertisements for the next bulletin should reach the editor by the 15th of the prior month. These must be neatly hand printed, typed or printed on a separate page, posted to the NZVRS (for details see page 2) or emailed to

nzvrs@pl.net

Please - no verbal or telephoned adverts, also don't forget to include some contact details; eg postal, telephone & email if applicable. There is no charge for members' adverts but please remember that the NZVRS is not responsible for any transactions between members.

AVAILABLE

Valve Cartons – plain white flat packs

- Small size $12 per 100
- GT size $12 per 100
- Medium size $15 per 100
- Large size $25 per 100

NZ & Oz supplied, contact Paul for post and package charges per order.

Contact: Paul Burt, 44 Hastings St West, Christchurch 8023.
Tel: 03 - 960 7158, Mob: 021 0236 1748
Email: **paulburt444@gmail.com**

Society Sales:

NZVRS supplied CAPACITORS for sale to NZVRS NZ members only please order via Bryan Powell, 279 Spur Road, RD3, Silverdale 0993. Tel: 09 - 44 22 514 or mob: 029 415 5119
Email: **bapowell@xtra.co.nz**

Please note we have reluctantly increased the price of the smaller capacitors to cover the reduced purchasing power of the NZ Dollar:

Metal polyester film, axial leads, (µF):

0.001	630 Volts	**60** cents each
0.002	630 volts	**60** cents each
0.005	630 volts	**60** cents each
0.01	630 Volts	**60** cents each
0.022	630 Volts	**60** cents each
0.033	630 Volts	**60** cents each
0.05	630 Volts	**60** cents each
0.068	630 volts	**60** cents each
0.1	630 Volts	**60** cents each
0.22	630 Volts	**60** cents each
0.33	630 Volts	60 cents each
1 µF	400 Volts	$1.00 each

Electrolytic capacitors, **polarized**, axial

10 µF	450 Volts	$1.50 each
10 µF	600 Volts	$3.00 each
20 µF	450 Volts	$2.00 each
40 µF	450 Volts	$3.00 each
47 µF	450 Volts	$3.50 each
100 µF	450 Volts	$5.00 each

Lamps 6.3 volts 150 mA (low wattage)
MES & Bayonet 50c each

Extra specials while stocks last:
Box of 10, globular 12volt, 250mA MES lamps at $2 per box. Limited supply – only one box per order please.

For all orders please add $3.50 for P&P.

Power plugs (Tilley white plastic type with unprotected brass pins as pictured above) available at 50 cents each plus $4 post and package per set of 4 (ie $6 for set of 4, posted to an NZ address).

KTW62 valves (actually VR100 10E/278 or 6U7 GT, CV1100) NOS $1 each collected club nights or $15 for packs of 5 P&P inclusive. Quantity limited and may be rationed per member.
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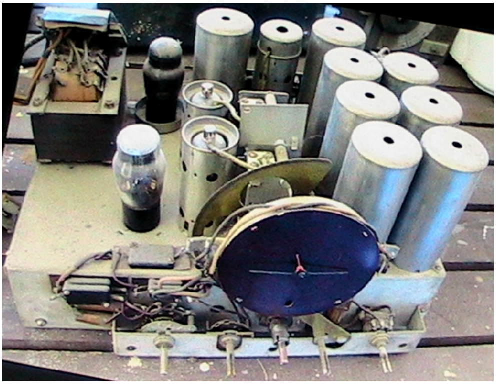
Email: **paul.woodcock@opus.co.nz**

All Society Sales cheques to be made out to the "NZVRS" and crossed "Not Transferable" please. Direct banking options are available to the NZVRS ASB bank account – see bottom of page 2.

WANTED.

A **chassis for HMV model 471, 1936**. Valve layout is :- 6B7 6D6 6A7 6D6 42 & 80. See picture. See Nostalgair for further description. Information to **albert.cross@ihug.co.nz**



AVAILABLE:

RCA AR88 LF Receiver. Looks like new and meets all specs, no mods. Also **RCA AR77E** Receiver, Cabinet repainted and re-lettered, set fully o/hauled. Contact Phil McGechie
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Antique Horn Speakers (Sonnarphone) now back in production in **kitset form**, assembled in 2 minutes. Comes complete with PM speaker insert. Height 21 inches (53 cm) when assembled. Kit consists of the following parts:

a) 12" (30.5 cm) diam. front horn of spun aluminium in black satin finish.
b) Swan neck shape in black satin.
c) 5" (12.5 cm) diam. base of spun aluminium.

Price: $145 inclusive of standard postage in NZ. Contact: Ian Ranson
iandianne@xtra.co.nz.

Wanted:

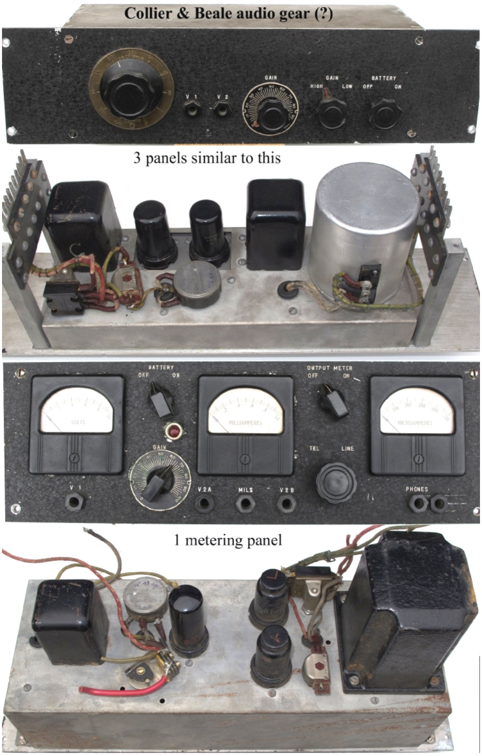
Still wanting **any** coilboxes for **941 SWB** series of receivers.
Contact Phil McGechie 07 862 7088 or **philmcgechie@xtra.co.nz**

Wanted:

A **dial escutcheon for an Atwater-Kent** Golden Voice **Model 84**, [1931] as per MGAR page 153. Kind regards, Albert Smith **alberte@xtra.co.nz**

AK 84 Dial detail

For Sale, radios, books and equipment available:



Five old domestic broadcast receivers suitable for restoration or parts (free!), a collection of books, mainly amateur radio but also some of historic interest, and three Collier and Beale units which appear to be part of a portable recording or broadcast system.
Contact: Peter Carran (03) 960 2548
Email **carran@paradise.net.nz** for details, photos etc, or phone to discuss.

Wanted:

An **Atwater Kent Cathedral Cabinet** for my **627 Chassis** or at least escutcheon for same. See page 92 The Golden Age
Contact Bill Meiklejohn Tel: 09- 459 5044

AK 627 Dial detail