AVAILABE (cont.)

Marconi Instruments Universal Bridge model TF2700, 0.1ohms to 10megohms, 0.1 H to 100H and 10 pF to 1000 uF at 1 kHz - good order. Also Advance Sig. Gen type E, 100kHz to 60 Mhz -requires some TLC. Reasonable offers.
Reg Motion, 2A Hazel Tce, Tauranga, Ph 075768733, email regmotion@xtra.co.nz

Inductance Specialists Ltd B9 and B10 receiver coil pack units, never used. What offers? John Walker, ph 03/3489084, email staf169@it.canterbury.ac.nz

WANTED

One 12AT7 (ECC81) valve, new for communications receiver. Phone Mike 09/2356903 evenings. M.F.Edwards, 47 Martyn St, Waiuku, 1852.

Valves type 845 and 805. Also any books on audio by N H Crowhurst. Phone Brian Smith 06/3637774

One Jensen M18 electrodynamic speaker to complete a pair. Also interested in other large e.m. speakers. Ian Sangster, 75 Anawhata Road, Piha, Auckland. Ph 09/8149597.

Copy of RCA tube manual about middle 1960s. Write R.A.Stevenson, 18 Lane Road, Weymouth, Manurewa 1702 or email RICH.STEVEN@xtra.co.nz

Manual and circuit diagram, or copies of, for Advance FM/AM Signal Generator model S.G.63E. Also circuit diagram for Klemt TV Signal Strength Meter (model unknown but dates back to "Flower Pot" transistors - OC71 and like).
Barry Grumwald, RD3 Tokerau Beach, Kaitaia 0500. ph 09/4087235 , email b-grumwald@xtra.co.nz

Two white push-on knobs with Zenith logo for Zenith 5-R-303 or 5-R-213A etc. Also Radio Corp chassis model 38 Columbus/Stella. Bill Meiklejohn, 56 Kokich Cres, Onerahi, Whangarei. ph 09/4361922.

Atwater Kent model 567 chassis (have cabinet and speaker). Prefer complete. Alistair Watson, 30 Newman Avenue, Brightwater, Nelson. ph 03/5423133.

RF coil for R/Ltd model RAG with it's can. The can is mounted with a 1/8 w/w screw central bottom. Model RAG is circa 1948. Also I would like to hear from any member that has been involved in any factory (i.e. H C Urlwins etc) that made 3 pin plugs and sockets or sold them in the 1930s. I would appreciate photocopies from any catalogue, pre 1930, (probably American) that shows 3 pin plugs - sometimes referred to as "tri-pole". Murray Stevenson, 3 Brandon Rd, Glen Eden, Auckland, ph 09/8133565.

BOOKS
(Available only to members)

Zenith Transoceanic: The Royalty of Radio - Bryant and Cones.
$31 plus $5 Post & Packaging

Philco Radio 1928 ~ 1942 - Ramirez $ Prosise.
$36 plus $5 Post & Packaging

Hallicrafters - Dachis.
$36 plus $5 Post & Packaging

Above available from NZVRS Secretary, 28A Oak Tree Lane, Browns Bay, Auckland 10.

N.Z.V.R.S. Bulletin

NEW ZEALAND VINTAGE RADIO SOCIETY INC.

Vol. 21 No.4 February 2001

NEW ZEALAND POST OFFICE HIGH FREQUENCY RECEIVING STATION ESTABLISHED AT MAKARA IN 1944

NEW ZEALAND VINTAGE RADIO SOCIETY INC.

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

(Web site - http//www.nzvrs.pl.net email address office@nzvrs.pl.net)

PRESIDENT: Ian Sangster, 75 Anawata Rd, Piha, R.D, New Lynn, 1250. Ph 09-8149597, email: mailto:sangsfam1anawhata@zfree.co.nz

SECRETARY: Grahame Lindsey, 28A Oaktree Ave, Browns Bay, Auckland. Ph 025-446293 or Ph/fax 09-4794033. General correspondence, requests for purchase of books, badges and power cable are handled by the Secretary.

TREASURER: David Crozier, 154 Grey St, Onehunga. Ph 09-6365954 or 0800-187161. email- dckh@pl.net Financial and membership matters are handled by the Treasurer. A list of members is available on application to the Treasurer with a self-addressed, stamped envelope.

LIBRARIAN, Ernie Hakanson, 17 Williamson Ave, Grey Lynn, Auckland. Ph 09/3766059. Requests for circuit diagrams, books and magazines are handled by the Librarian at a small charge. Back numbers of most NZVRS bulletins are also available from the Librarian at $3.00 each for Vols 1 to 10 and $4.00 for issues from Vol 11 onwards. Cheques to be made out to NZVRS.

NZVRS BULLETIN is published quarterly in the months of February, May, August and November. Opinions expressed by writers are not necessarily those of the Society. Contributions should be sent to the EDITOR , Reg Motion, 2A Hazel Terrace, Tauranga. Ph 07-5768733, email - regmotion@xtra.co.nz
Bulletin distribution is arranged by Rod Osborne, P.O. Box 2098, Tauranga.

AUCKLAND MEETINGS are held in the Horticultural Society Hall, upstairs in the old Chamberlain Park Golf Clubhouse, 990 Great North Rd., (opposite Motions Rd.). For dates, times and meeting subject see page 3 of this bulletin.

WAIKATO AREA. Next meeting will be at a time and place to be advised

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 Bob Hatton, 40 Rose St, Wadestown. Ph 04-4728788.

CHRISTCHURCH AREA. Contact Jim Lovell, 41 Yardley St, Avonhead, Christchurch 8004.. Ph 03-3427760.

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FROM THE EDITOR

Because it never sold any product to the general public and did not directly advertise it's services the part played by Radio Section of the New Zealand Post Office in the NZ radio world is little known. I have attempted in this issue to set down some of my own knowledge of Radio Section efforts. To write the whole history of Radio Section activities would take a number of books and is well outside my scope so I have covered only a few of the highlights of my own small part and have attempted to give the story a human touch while giving some idea of the wide span of the work undertaken by the whole section during the war period. I hope to cover postwar developments in a similar manner in future articles.

The other substantial article in this issue is an excellent discussion on the selection of grid leak value. Dr Holden has tackled the problem in a very professional manner as might be expected but his explanations are made in clear prose with a minimum of mathematics and accompanied by excellent diagrams so will be understood by those of us who are more practically than theoretically inclined. I, personally, had not realised the reason why so much emphasis was placed on grid leak selection in the 1920s.

There are three reprints of articles from other sources in this issue. Each has relevance to the practical tasks involved in restoring the "old and rare": hopefully you will find them interesting and of use.

Rod Osborne and Graeme Lea have shared their collecting and restoration experiences with us and Dick Stevenson his historical knowledge. Gerry Billman, from his scanning of the Internet contributes some humour in "Ask The Serviceman".

I look forward to further contributions to keep future bulletins interesting and informative. Give it a try and send me your own experiences.

Auckland and nearby members should note below the change of date and time for the AGM. This change is aimed at giving members outside of Auckland the chance to attend this important meeting. The enclosed sheet gives full details. Hope to see you there.

AUCKLAND	March 17th,	Saturday @ 1pm	AGM, Auction sale.
MEETING	April 16th,	Monday @ 7.30pm	Amateur Radio Equipment.
CALENDAR	May 21st;	Monday @ 7.30pm	Collecting and the Internet.

NEW MEMBERS

Owen Young	Auckland	Doug Dowling	Queensland
Joseph McVeigh	Auckland	Rodney Smith	Queensland

PROTECT YOURSELF - RESIDUAL CURRENT DETECTORS -

These are again available to members at $20 each plus $4 post and package. Cheques should be made out to the New Zealand Vintage Radio Society and sent to the Treasurer, 154 Grey St, Onehunga, Auckland. Ph 09/636954 or 0800/187161.

POST OFFICE RADIO SECTION IN WARTIME

Reg Motion

From early times the New Zealand Post and Telegraph Department (P&T) was charged by Government with providing and regulating communication within New Zealand and overseas; firstly by mail, then by electrical means (wire and cable) and lastly by radio. This delegation was not unique to this country; it followed the practice in many European countries and their colonies.

In 1959 the rather cumbersome though more descriptive name, New Zealand Post and Telegraph Department (P&T), was changed to just New Zealand Post Office (NZPO)

The general history of P&T development in the radio field is covered by Professor Robinson's "A History of the Post Office in New Zealand"(1964) and A.C.Wilson's "Wire and Wireless"(1994). As well as these two admirable histories there are numerous articles in the general press and NZ radio journals which cover various aspects of Post Office efforts in the radio field. However, I believe there is still room for personal observations so here goes.

As I grew up pre-WW2 in Dunedin, radio broadcasting was a rapidly expanding industry and little was heard of the use of radio in point-to-point communications apart from the service to ships and aircraft. Consequently, as a radio enthusiast I sought a technical job in the domestic radio field and joined the retail radio establishment of McCracken and Wall as a trainee radio serviceman. Then one evening I attended an exhibition at which the local radio amateur group gave a demonstration of communication with NZ and overseas radio amateurs. My enthusiasm was fired up - I remember not sleeping that night as I contemplated this field and decided that this was the track I must follow.

After a period of asking around I discovered that the Post and Telegraph Department was the provider of overseas radio services for the New Zealand public and that their radio activities were concentrated in Wellington in a Radio Section. I applied through the District Engineer, Dunedin for a position in Wellington and was politely told that there was no opening at Radio Section at that time but, if I joined as a Telephone Mechanician, I would be considered for a Radio position in due course. Telephone switching did not seem to me to be particularly attractive work. However, in 1936 I applied, was accepted and joined the staff of the Dunedin Automatic Telephone Exchange. At that stage I did not appreciate how long it would take to get into radio - a long enough time for me to qualify as a radio amateur, obtain P&T qualifications as a Controlling Officer (Telephone), pass the Technical Certificate in Broadcasting and become an NCO in the Territorial Signals Corp.

The war broke out and I was moved into camp at Trentham where I undertook the Territorial Signals Training Course - my! it was cold that Winter of 1940.

On return to Dunedin I found great changes. Arthur Michie, one of my Controlling Officers there had been transferred to Radio Section in Wellington to take charge of the radio construction workshop. Arthur had worked in an extramural capacity for Lorla Shiel who ran a radio manufacturing business in Dunedin and operated a "B" class radio station there (4ZL), so, I guess that was the reason for his selection in spite of the fact that his clandestine work with Lorla was contrary to P&T regulations - the exigencies of war probably over-rode those considerations.

In short time I, also, was transferred to Radio Section and my period as a Radio Mechanician began. It was an exciting time, I was employed together with about eight others in the quite well equipped Radio Development Workshop on the 4th floor of the Wellington East Post Office building, constructing prototype radio equipment for a purpose that I was not allowed to know. Circuits, diagrams and rough pencilled sketches of the desired physical form of these items appeared on my workbench. The names given to these units bore no relationship to anything in my previous radio experience and the circuits were indeed strange. These diagrams and sketches originated on the seventh floor of the building in which I worked, but this floor was a forbidden area for all but a few scientists from the Department of Scientific and Industrial Research (DSIR), P&T Radio Engineers and Senior Radio Technicians. I later found that redundant components and wiring had been added to the schematic of the units we were constructing to confuse the uninitiated constructors. These additions were then cut out on receipt of the finished unit on the seventh floor.

The additions were certainly successful in confusing me, it was a good 18 months later before I learnt that the units I had been constructing were for Radio Location purposes (known today as Radar). By that time the quantity of this type of work had grown and the P&T Engineering Branch had other urgent work for its radio workshop so DSIR had established its own facilities in a Majoribank St building.

The most interesting job I carried out in the radar field was the construction of a receiver for use on aircraft. This set designed by Mr Collins of DSIR used Acorn tubes in the RF end and a string of type 1852 metal octals in the high gain wideband IF section. Its diminutive size (for that day) required considerable ingenuity to fit in the essential bypass capacitors with short leads. Mica bypass capacitors in those days were about 20mm square and 6mm thick.

Personnel that I remember from that time were DSIR scientists, Charles Watson-Munro, and Ted Collins; P&T Radio Engineers, E.H.R. Green, Tom Clarkson, George Searle and Peter Suckling: Radio Mechanicians, Roy Schdroski, Jack Hogan, Arthur Michie: and Bill Wilkin .

Use of P&T Dept radio facilities for development and construction of Radar equipment in the first critical days of the war was a logical procedure. Since the days before World

War One the P&T Dept. had been developing International and National radio communication systems. Control of this development had been centralised in Wellington to make the best use of limited radio expertise and from the outset some of the equipment used had been developed and constructed in Wellington; firstly at the P&T Engineering Laboratory in the Hope Gibbons building in Wellington, then, when a Radio Section was formally established, in a building in Whitmore St. Just prior to the second World War, Radio Section outgrew it's Whitmore St facility and was transferred to use some of the six floors above the Wellington East Post Office in Kent Terrace. These floors had been vacated by Accounts Branch on its transfer to the newly constructed Herd St building. Radio engineering and operational staff occupied the sixth floor, the fifth floor was clerical, the fourth floor radio equipment development workshop and the first floor held the acceptance testing laboratory. Radio Section personnel became adept at climbing the stairs of this narrow gutted building - the lifts were rather slow.

At the outbreak of World War II Radio Section was responsible for all technical aspects of P&T radio stations established at Auckland (Musick Point), Wellington (Mt Etako and Mt Crawford) and Invercargill (Awarua) as well as for services conducted on behalf of the Defence Department, Civil Aviation (aerodromes and direction finding) and civil emergency communications. It also handled technical aspects of the National Radio Frequency Register and the Inspection of all radio installations on ships or on shore. The latter facility was probably the best known as it was the public face of P&T radio. Behind the scenes all ship/shore and overseas radio telephony for the public as well as most of the overseas radio telegraphy was conducted by the Post Office.

In Feb 1941, about a year after I joined Radio Section, I was transferred to carry out maintenance work at a defence station which the Post Office had established and was operating for the RNZAF in Suva, Fiji. This stations had two separate buildings about two kilometres apart - one at Tamavua housing the transmitting equipment and the receiving station at Samabula.

Both stations were within a few kilometres of Suva proper and Post Office personnel were housed in Macdonald's hotel in Suva with transfer to work by taxi. An arrangement which sounds luxurious but was far from so as staff worked on shifts seven days a week and sleep was difficult in the daytime under mosquito nets in a noisy hotel with no air conditioning. I well remember lying naked on a mattress with my body perspiration dripping into the mattress and adding to the smell which arose from that object.

Most of the equipment we used was of Collier and Beale manufacture. A one kW Medium Frequency transmitter and a number of 100W High Frequency transmitters with receivers of the drawer coil type.

All receivers worked off a common battery supply at the receiving station and there was a standby diesel alternator at the transmitting station. 100W light bulbs were run permanently in the base of each transmitter to reduce condensation but apart from that

there was no air conditioning and it is a tribute to C&B design and workmanship that the equipment remained reliable in spite of the tropical atmosphere. We had very few faults to service although the constant frequency changes caused some coil contact problems.

I well remember my arrival at Suva. I had been at sea for three days on the small Government ship, Matua, which had been wallowing in mountainous seas off Suva Bay in the midst of a tropical hurricane during which I lay seasick, braced in my bunk and not caring whether I lived or died. When eventually the hurricane subsided we entered a Suva which had been devastated by high winds and waves. I managed to get a berth at the Grand Pacific hotel and on reaching the Transmitting station next day found that Geoff Sandford, the only Post Office Radio Mechanician in Suva at the time, had been on duty for three days and nights without sleep. He just said "Thank God you have arrived" then lay down and went to sleep on the station floor. I looked at the array of transmitters in the hall and crossed my fingers against anything going wrong as I had only three days familiarisation with transmitter maintenance at Wellington Radio before my transfer. Fortunately my luck held and I managed the needed frequency changes without incident.

Following a period of sickness, hospitalisation in Suva and recuperation in New Zealand I resumed work in Radio Section at Wellington mid-1942 and was appointed to assist Carney Taylor with teaching at the newly established Radio Mechanician's training school. Post Office had relied on radio amateurs and radio enthusiasts together with a few seconded technical personnel from the Broadcasting Service to staff its radio services but these ranks had been rapidly exhausted by Armed Service demands. It became necessary to recruit direct from secondary schools and to train these lads in a pressure cooker course of three months duration with an 8 hour day, $5^{1}/_{2}$ day week. Most entrants had only a brief introduction to Physics and Mathematics before entry in the radio school and it is to their credit that few failed to satisfactorily complete the arduous training routine. We trained about 30 students at a time and the courses continued throughout the war and for a number of years afterwards although I was transferred to other duties after the first two schools but not before I had helped to write the original Radio Mechanicians Training Course. Altogether the Post Office trained a large proportion of its own technical staff many of whom later transferred to other Government Departments and to the New Zealand Radio Industry.

While I was not directly concerned with it a very interesting project of that time was the provision of an HF communications station for the NZ Navy at Irirangi.

Following my time as an instructor in the training school I was moved back into the radio workshop to produce the many items needed for wartime use as well as to assist with specialised maintenance work. An interesting assignment I had at that time was to carry out radio work for the US Naval Establishment. US Navy troop carriers used Wellington as a base when preparing for the assault on Japanese occupied islands in the Pacific. These troop carriers did not have radio technical personnel aboard and we carried out most of their radio maintenance work which covered a wide variety of electronic equipment including massive speaker installations. One always had to be wary as the troop carriers left port without warning, probably on their way to do a practice landing at Paekakariki but possibly on their way to a Pacific island assault!

Later we produced some of the specialised communications and test equipment required to expand and maintain the High Frequency receiving station which Radio Section established at Makara during 1943/44. This station took over many of the services from Wellington Radio receiving station which had been heavily overloaded by wartime traffic and was disadvantaged by being situated right alongside its companion transmitting station as well as being in a suburban area with considerable manmade noise. Until the end of the war Makara was largely employed in operating services for the NZ and American Armed Forces. Makara was an ideal site being located in an area where the noise level was so low that when, as part of a worldwide survey of HF noise level, a standardised noise measuring receiver was installed the recorded level was so low that it did not register on that receiver.

Antennas and switched transmission lines for Makara were all designed in Radio Section with most of the switching equipment being manufactured in the Section workshop. Four wire transmission lines were used to connect the many and varied antennas to short lengths of coaxial cable which carried the signals into the building. There the cables all terminated at a console where switching to the various receivers was carried out.. Equipment for measuring line impedance was also built in the Radio Section workshop.

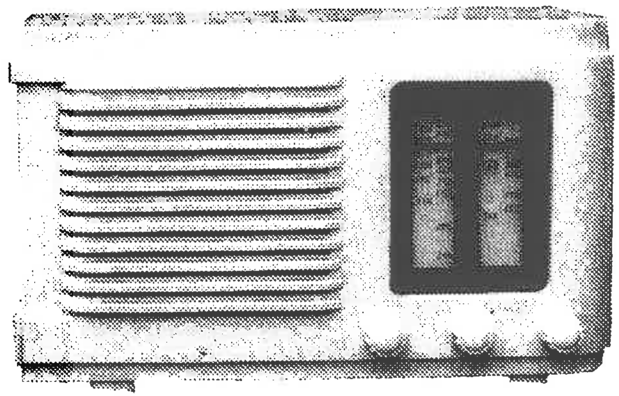
As the war drew to a close I was moved to a separate group within Radio Section which was set up to help in planning services and developing equipment for use in peace time. Percy Hill controlled this group which included Jock Lomas, Alan Ross, Arnold Ryland (seconded from Broadcasting), Alan Alderton and myself. Multichannel telephony over VHF, UHF and SHF radio circuits promised a way of rapidly meeting the need for inter-city toll circuits and we experimented with various ways of meeting this need. After trials with wideband amplitude modulation and with pulse modulation it became evident that wideband frequency modulation would be the way to go. During these tests a 12 channel AM system was installed across Cook Strait and SHF pulse modulation tests were conducted across the same Strait.

The five year wartime period had seen the fledgling Radio Section of 1939 expand from a staff of around 30 to about 140 in 1943 then drop to about 100 at war end. Practically all of the activities entailed providing Services for the Armed Forces and Government Departments other than the P&T. With the cessation of hostilities and the return of trained personnel from overseas these services were largely taken over directly by the Departments and Forces concerned. Radio Section lost a number of its staff on transfer at this time but was left free to concentrate on the public National and International communication services which the P&T was traditionally responsible for. A rapid expansion took place in these fields but this is a story for another day.

The Forgotten Clipper 5M4.

Rod Osborne.

Most collectors have a coloured Bell colt, Philco or La Gloria bakelite or plastic radio in their collection, but how many have a Clipper 5M4? This small radio is probably more deserving of a place than the others as not only was it designed and made in NZ, but the die for producing the cabinet was also made at Akrad's Waihi factory. This was the first cabinet die made in NZ. Bell imported their Colt die from Australia.



First produced in 1954, the 5M4 sold for £15-15 but as with other small radios the price eventually dropped several pounds.

Akrad's chief designer, Ted Grant, normally designed their radios, but Gordon Rowe, the Production Manager, (later General Manager) took it upon himself to create the 5M4. Woe betide anyone who held up the production of this model. I was employed by Akrad at the time looking after the technical side of production so was very familiar with the need to efficiently produce Gordon Rowe's baby. He once told me that modern design meant having one end of the cabinet rounded and the other end square. Hence the shape of the 5M4. Fortunately Bell were unaware of this design secret and sold their attractive symmetrical Colt.

The 5M4 cabinet was produced in about 5 colours with the rarest being the black. These black models were made and presented to the directors of the Company and to my knowledge they were the only people who had one. At the time they were made they looked so ugly that we wondered whether the directors would want them but anyone possessing one now has a real rare radio.

The model number 5M4 followed Akrad's normal designation with the 5 being the number of valves, the M standing for mantel and the 4 being the year of design, in this case 1954. As with other small 5 valve sets of the day, the 5M4 was very simple and most can easily be restored to working order.

For any non technical members wishing to restore a 5M4 I would suggest the following:
Replace all electrolytic and paper condensers. At the time the 5M4 was made, all NZ manufacturers were compelled to use NZ made components where possible. Akrad had to use Ducon condensers and these were very unreliable and intermittent components and caused continual trouble in production. The excellent imported Dubilier condensers were not for us.

Replace the volume control. The Government required that we use the noisy morganite pots instead of the lovely Lesa models available overseas.
Reglue or screw the speaker cone to the speaker frame .As the speaker is not mounted in the cabinet the cone will have separated from the frame.
Replace the 220K resistor feeding the plate of the first audio tube as this will be a ¼ watt morganite and will have gone high in value.
Check the HT voltage (about 200v) to make sure the rectifier valve is OK.
Check the bias on the output valve (about 6v) to make sure the output valve is OK and your 5M4 should go like new.

LETTERS TO THE EDITOR

Many thanks for the latest copy of the NZVRS bulletin which has provided absorbing reading. I was sorry to see that Alf Veart had passed away as I had met him a few times just before his war service. As a radio-mad 11 year old I sometimes stayed with an aunt in Dominion Rd Balmoral, opposite to where Alf lived. He had built a radio for my aunt using a kitset from Lamphouse and I was fascinated by the short wave band. I must have been a tiresome child as I insisted on tuning in every "blip" between 16 and 50 metres and although I found mostly morse code and Jamming there were also wartime propaganda broadcasts coming in loud and clear.
Just before Alf sailed away to war, I believe he and his father devised a map grid with names of friends as coordinates. As letters from servicemen could not mention any geographical details, Alf had only to ask about theses "friends" and it was soon revealed to his family that he was stationed in the New Hebrides (now Vanuata)!

R.A.(Dick) Stevenson

I have been instructed - no Sheena has asked me to congratulate the members and partners involved with the recent Waikato group Xmas Get-to-gether. The hospitality shown by all hosts was out of this world and is most appreciated. It is really neat to be able to travel from one side of the North Island to the other and be accepted and included as local friends. Thank you Tauranga.

Graeme Lea

In the bulletin issue of Feb 2000 you printed a most interesting article by George Newlands on the " Nostalgia of Radio". He recounted his early days with radio and mentioned that the first valve which he acquired was an RCA 221. Later I wrote that I had never heard of a valve of this number, but now I find that I owe George an apology!
on "surfing the web" I discovered the site www vacuumtubesinc.com and in it a brief description of all know valves from 00 to 99. It is, of course well known that these two digits were prefixed by a "2" when made by RCA, other manufacturers using "1", "3" or "4".
I found that an RCA 221 actually did exist and that it was apparently the export version of the 201A, but with a low current filament of 0.06 amp. It is most interesting to find one reached NZ as I had believed that , like the USA, we used the ordinary 201A with 5 volt, 0.25 amp filament. A Canadian equivalent was the 201C.

R.A.(Dick) Stevenson.

VALVE EQUIVALENTS

List supplied by John Walker and published with acknowledgemt to the RSGB Bulletin.

Type	Equivalents	CV No.
B36	I2SN7GT	925
B65	6SN7GT, 13D2	1988
B109	UCC8S, 10L14	
B152	ECC8I, 8309, 12AT7	455
B309	ECC81, B152, I2AT7	455
B319	PCC84, 7AN7, 30L1	5192
B329	ECC82, 12AU7	491
B339	ECC83, I2AX7, 6L13	492
B719	ECC85, 6AQ8, 6L12	
D77	EB91,DD6,6D2,6AL5,D152	283
D152	EB91,D77,DD6,6D2,6AL5	283
DD6	EB91,D77,D152,6D2,6AL5	283
DH77	EBC90,6AT6	452
DHI09	UABC80, 10LD12	
DH7I9	EABC80,6LD12,6AK8,6T8	
DP6I	EF95, 6AK5	850
EA50	SD61,6D1,	375/1092
EABC80	DH719,6AK8,6LD12,6T8	
EBC33	DH63, DH147, OM4	1055
EBC4I	DHI5O,6CV7,6LD3,62DDT	3882
EBC8I	6BD7A, 6LD13	
EBC90	6AT6, DH77	452
E8C91	6AV6	
EBF80	ZD152, 6N8, WD709	
EC90	6C4, L77	133
EC9I	6L34, 6AQ4	417
ECC35	6SL7GT	569
ECC8I	B309, I2AT7, BI52	455
ECC82	B329, 12AU7	491
ECC83	B339,6L13, 12AX7	492
ECC84	6CW7, 6L16	
ECC85	B719, 6AQ8, 6L12	
ECC88	6DJ8	
ECC9I	6J6	858
ECF80	6BL8, 6C16	5215
ECF82	6U8	5065
ECH8I	X719, 6AJ8, 6C12	2128
ECH83	6D58	
ECL80	LN152, 6AB8, 63TP	
ECL82	6BM8	
EF80	Z719, 6BX6, 64SPT, Z152	1376
EF85	W7I9, 6BY7,6F19	1375
EF86	Z729, 6F22, 6267	2901
EF89	6DA6	5156
EF9I	SP6,Z77,6AM6,8D3, 6F12	138
EF92	VP6,W77,6CQ6,9D6,6F21	131
EF93	6BA6, W727	454
EF94	6AU6.	
EF95	6AK5, DP61	850
EF97	6ES6	
EF183	6EH7	
EFI84	6EJ7	
EK90	X77, X727, 68E6	453
EL34	6CA7	1741
EL37	KT66	586
EL84	N709, 6BQ5, 6F15	2975
EL90	N727, 6AQ5	1862
EL9I	N77, 6AM5, N144	136
EL95	6DL5	
EL821	6CH6,ZDI0	2127
EM80	68R5, 65ME	1352

Type	Equivalents	CV No.
EY5I	R12,SU6I,U43,6X2,UI5I	427
EZ40	6BT4,UI50,UU9,66KU, U7I8	3891
EZ80	6V4	1535
EZ8I	U709, 6CA4, UUI2	5072
EZ90	U78,6X4	493
GZ30	R52, 5Z4GT	2748
GZ32	54KU	593
GZ37	53KU, U54	378
HBC90	12AT6	
HBC91	12AV6	
KT63	6F6G	1911
KT66	EL37	586
L63	6J5G	
L77	EC90, 6C4	133
LNI19	UCL82, I0PLI2, 50BM8	
LN152	ECL80, 6AB8, 63TP	
LN309	PCL83	5144
LN319	30PLI, 13GC8	
LZ319	PCF80, 9A8, 30C1, LZ329, 8A8	
LZ329	PCF80, 9A8, 30C1, LZ319, 8A8	
N77	EL9I, 6AM5, N144, 6P17, 7D9	136
NI19	UL84, 10P18, 45B5	
N144	EL9 I, 6AM5, N77, 6P17, 709	136
N145	10P13, N118	
N147	EL33, OM9, 6AG6G	2938
N152	PL8I, N359, 21A6	5077
N153	PL83, N309, 15A6	
N154	PL82, N329, 16A5, 30P16	
N309	N153, PL83, 15A6	
N329	N154, PL82, 16A5, 30P16	
N359	N152, PL8I, 21A6	5077
PC F80	9A8, LZ319, 30C1, LZ329, 8A8	
PC F82	9U8	
PCL83	LN309	5144
PC L84	I5DQ8	
PC L85	18GV8	
PL36	25E5	
PL81	N152, N359, 21A6	5077
PL82	N154, N329, 16A5, 30P16	
PL83	N153, N309, 15A6	
PL84	N379, 30P18, I5CW5	
PY32	U291	
PY80	U152, 19X3	
PY82	U154, U192, U319, I9SU, 19Y3	
R12	SU6I, U43, 6X2, UI5I	426
R20	U26, 21Z, U49	
R52	GZ30, 5Z4GT	2748
SP6	EF9I, 6AM6, 8D3. 6F12, Z77	138
SU6I	EY5I, R12, 6X2, UI5I, U43	426
U26	R20, 2JZ, U49	
U43	SU6I, EY5I, 6X2, UI5I, R12	426
U49	U26, R20. 2JZ	
U54	GZ37, 53KU	378

Type	Equivalents	CV No.
U78	EZ90, 6X4	493
U15I	U43, EY5I, R12, U43, 6X2	426
U154	PY82, I9SU,19Y3, U319,U192	
U192	PY82, I9SU,19Y3, U319,U154	
U709	EZ8I,UUI2,6CA4	5072
U718	UU9,66KU,UI50,6BT4	3891
UBF89	WD119. 19FL8, 10FD12	
UCC85	B109, 10L14	
V2M70	6X4, EZ90, U78	493
VP6	EF92,W77,9D6,6F21,6CQ6	131
W77	EF92,VP6,9D6,6F21,6CQ6	131
W719	EF85, 6BY7, 6F19	1375
W727	6BA6, EF93	454
WD709	EBF80, ZD152, 6N8	
X77	X727, 6BE6, EK90	453
X719	ECH8I, 6AJ8, 6C12	
X727	EK90, 6BE6	453
Z77	EF9I,SP6,6AM6,6F12,8D3	138
Z152	EF80, Z719, 6BX6, 64SPT	1376
Z719	EF80, Z152, 6BX6. 64SPT	1376
Z729	EF86, 6F22, 6267	2901
ZD152	EBF80, 6N8, WD709	
2JZ	U26, R20, U49	
5U4G	U52, GZ3I	575
SY3GT	U50	1854
SZ4GT	GZ30, R52	2748
6AB8	ECL80, LN152, 63TP	
6AJ8	ECH8I,X719,6C12	2128
6AK5	EF95, DP61, E95F	850
6AK8	EABC80,DH719,6LD12,6T8	
6AL5	EB9 I, DD6, D77.D152, 6D2	283
6AM5	EL9I, N77, N144. 7D9	136
6AM6	EF9I, SP6, Z77, 6F12, 8D3	138
6AQ5	EL90, N727, PM04	1862
6AQ8	ECC85, B719, 6L12	
6AT6	EBC90, DH77	452
6AU6	EF94	2524
6AV6	EBC9I	2526
6BA6	EF93, W727	454
68E6	EK90, X727	453
6BD7A	EBC8I,6LD13	
6BL8	ECF80,,6C18	
6BM8	ECL82,6PL12	
6BN5	EL85	3526
6BQ5	EL84, N709, 6P15	2975
6BR5	EM80, 65ME	1352
6BT4	EZ40, UU9, 66KU, U150	3891
6BY7	EF85, 6F19, W719, 6F26	1375
6BZ6	6F22, EF92*	131
6C4	EC90, L77	133
6C12	6AJ8, X719, ECH8I	2128
6C18	6BL8, ECF80	
6CA4	EZ8I, UUI2, U709	5072
6CA7	EL34	1741
6CQ6	EF92, W77, 6F21, 9D6	131
6CW7	ECC84, 6L16	
6D2	EB9I, DD6, 6AL5,D152, D77	140
6EH7	EF183	
6EJ7	EF184	
6F6G	KT63	1911
6F12	EF9I, Z77, 6AM6, SP6, 8D3	138
6F19	EF85, W7I9, 6BY7	1375
6F21	W77,VP6, EF92,6CQ6,9D6	131
6F22	EF86, Z729, 6267	2901
6J6	ECC9I, T2M05	858
6L6G	EL37, KT66, PP60	1741
6L12	B719, ECC85, 6AQ8	
6L13	ECC83, 8339, 12AX7	492
6L16	ECC84	
6L34	EC9I	417
6LD12	EABC80,DH719,6AK8,6T8	
6LD13	EBC8I, 6BD7A	
6N8	EBF80, ZD152, WD709	
6P15	EL84, 6BQ5, N709	2975
6T8	EABC80,6AK8,DH719, 6LD12	
6U8	ECF82	5065
6V4	EZ80	1535
6X2	R12, SU6I, EY5I, U43	426
6X4	U78, EZ90, 6Z3 I, V2M70	427
6X5GT	EZ35, U70	574
7AN7	8319, PCC84, 3011	
7D9	6AM5, N77, EL91, N144	136
8A8	LZ319,LZ329,PCF80, 9A8, 30C1	
8D3	SP6, Z77, EF9I, 6F12, 6AM6	138
9A8	8A8,LZ319, LZ329, PCF80, 30C1	
9AQ8	PCC85	
9D6	W77,EF92,VP6,6CQ6,6F21	131
9U8	PCF82	
10FD12	UBF89, WD119, 19FL8	
10L14	UCC85, B109	
10P13	N145	1977
I0P18	N119,UL84,45B5	
12AT6	HBC90	
12AT7	ECC8I, B152, B309, E8ICC.	455
I2AU7	ECC82, B329, E82CC	491
12AV6	HBC9I	
12AX7	ECC83,B339,6L13,E283CC	492
12BA6	HF93	1928
12BE6	HK90	
12BH7	6463 (Mullard)	
I2BY7	EL822	2882
15A6	N309. PL83, N153	
15AQ8	PCL84	
I5CW5	PL84, 30P18, N379	
16A5	30P16, N329, N152, PL82	
18GV8	PCL85	
19FL8	UBF89, 10FD12, WDII9	
19SU	19Y3, PY82, U154, U319	
19X3	PY80, U152	
19Y3	PY82. U154, U319, I9SU	
21A6	PL8I, N339, N152	5077
25E5	PL36	
30C1	PCF80, LZ319, 8A8, 9A8, LZ329	
30L1	PCC84, 7AN7, 8319	5192
30P16	N154, N329. PL82, 16A5	
30P18	PL84, 15CW5, N379	
45B5	UL84, NI19, I0P18	
50BM8	LNI19, UCL82, 10PL12	
53KU	GZ37, U54	378
62DDT	EBC4I,DH150,6CV7,6LD3	3882
63TP	ECL80, 6AB8	
64SPT	EF80, Z719, 6BX6, Z152	
66KU	EZ40. N150, U718, 6BT4	

* Near Equivalent

NEW LIFE FOR OLD VALVES

The following tips on rejuvenating unused and used old valves may interest some readers. They are reproduced here with acknowledgment to the author (Morgan Jones) and to "Electronics World" November 2000. The baking tips may be risky on other than all-glass valves (Ed.)

Baking tips

Valves that have no manufacturing defects, but have been in storage for many years may accumulate a little gas. It is possible to accelerate the getter and reduce gas current by a factor of five by heating the valve to 120^{0}C in an oven for 12 hours, without any risk to the cathode. Grid ionization current could easily be the dominant form of noise in high resistance circuits, such as condenser microphone head amplifiers. As a result, it makes sense to routinely bake valves intended for this type of use before selecting for low noise. However, because surface contamination on the glass envelope of the valve produces leakage paths that can cause noise, it is usual to clean the envelope scrupulously, and subsequently only handle the valve with cotton gloves[3]. This process should be done before baking, otherwise it might not be possible to remove any hardened contamination. Unfortunately, as a consequence of the baking, the painted lettering on the valve shows a little discolouration, appearing as if the valve has had a few hours use.

Other valve 'fixes'

Although baking appears not to carry any risk of valve damage, the final two 'fixes' carry considerable risk.

Low Heater to Cathode Resistance (Rhk)

The consequences of low heater-to-cathode voltage depend greatly on the circuit and on Vhk. An EL34 output valve passing a cathode current of 70mA, with Vhk at +35V, and Rhk at IOO,000 ohms will scarcely notice the extra 350 microamps leaking into the cathode. Any noise will be short-circuited by the cathode bypass capacitor.

Conversely, a cathode follower used in an active crossover requires a signal-to-noise ratio of at least 90dB. Although cathode resistance is low, it is not a short circuit. Worse, Vhk may well be elevated to 1OOV, so excellent Rhk is likely to be required. Contamination causing poor Rhk can sometimes be burnt away on a valve tester. The tester is set to test Rhk with normal heater voltage and the cathode allowed to warm to normal temperature . Heater-to-cathode resistance is then closely monitored and heater voltage is increased to 150%.

The resistance will fall, but if you are lucky, the rate of fall will slow or even reverse. Assuming this effect occurs, immediately reduce the heater supply, and allow the valve to cool. The result should be an improved Rhk. Some valves cannot be recovered by this technique, and others may need repetition to make them acceptable, but the success rate is quite high.

The risk is that by deliberately over-heating the cathode, some of the emissive surface may be evaporated and deposited onto the nearby grid. The grid now has its own emissive surface, and if the valve is operated close to its maximum anode dissipation, it may become warm enough to emit electrons, causing thermal runaway, leading to the valve's ultimate destruction.

Low emission due to cathode poisoning.

Valves that have been operated for a long time at very low anode currents are likely to develop a cathode interface resistance that effectively limits its electron emission, but the 'fix' is violent.

The valve is heated with 150% heater volts, anode voltage is set to a slightly higher than normal value, and Vgk is adjusted until enough electrons are dragged from the cathode that the anode glows deep cherry red. The valve is left to fry for perhaps five seconds, before all voltages are removed. With a bit of luck, the control grid has not been covered in evaporated cathode material. When tested a few minutes later, the valve might show better emission.

Rejuvenation carries a very high risk, and the results are not generally very good, so the process is only really worthwhile on picture valves. Dedicated television tube rejuvenators have been made, but the risk of destroying the tube is high.

Nevertheless, tube replacement. is expensive, so rejuvenation may be considered to carry an acceptable risk.

References

1. 'Principles of electron tubes', pp.112, 123, J W Gewartowski & H A Watson. 1965 Van Nostrand. Princeton. New is Jersey.
2. 'Valve Amplifiers', Morgan Jones, 2nd Ed. 0-7506-4425-7.
3. 'Electrostatic cardioid microphone M7', BBC Technical Instructions (Recording), Instruction S.2 Section 5.3.

BOOK REVIEW - THE BEST YEARS OF AUSTRALIAN RADIO
by ROD SMITH (NZVRS and HVRSA member)

This quality A4 size hard cover book has 22 chapters featuring Australian Valve Radios manufactured from mid 1920s to mid 1950s as well as imported sets of earlier years. The 190 odd pages of the book are illustrated with 600 black and white photographs and 150 reproduced illustrations of Australian radios printed on quality art paper.

While the coverage is extensive the author does not claim it as a definitive book on Australian radios. Most of the book consists of photographs, taken by the author, and reproductions of selected illustrations from advertisements and magazines. These are grouped strictly in chronological order with a chapter for each year. The result is an interesting review of radio and allied equipment as marketed in Australia through the years concerned. An invaluable reference for the radio collectors library

The book is available to NZVRS members at AUS$40 plus P&P, AUS$12-50. Enquiries to Rod Smith, 14 Ryan St., Loganlea, 4131, Queensland. Ph 07-32002339, email rodsmith1@optusnet.com.au

ULTIMATE MODEL CMU (1938)

Graeme Lea

I acquired a very original example of this set at the Waikato Branch Xmas Get-to-Gether held over the weekend of 2/3 December 2000. As the original guarantee card was still tied to the handle I just couldn't resist.

First impression by everyone was that the set was a battery portable. When I picked it up I mentioned that it was just too heavy to be a portable (even if the original battery was still installed) and that caused those present to have the beast disembowelled immediately.

What we found inside the cabinet was a chassis that was in pristine condition with all the original components on board just as it would have left the factory some time during 1938. The weight problem was simple - the set was designed to run from a 6-volt battery and had the necessary vibrator supply built in.

Valves used are 6C6G, 6S7G, 6D8G, 6S7G and 6Q7G. Circuit diagram is not available from the NZVRS library. This fact just adds to mystique of the set.

Work Needed - Replace aerial, earth and battery wires that have been cut off. Replace paper caps. Check out the vibrator supply and then trust that all works.

Because of the condition of the set (and the fact that both the guarantee card and engineers ticket are still attached) I believe that this particular set had its wires lopped at a distribution shop or the factory before dispatch to the local tip.

Grid Leak Detection in the 1920s, Finding the "Ideal" Grid leak.

Article by Dr Hugo Holden, Queensland, Australia. PO Box, 918, Maroochydore 4558 - submitted by his brother, Brett Holden

BACKGROUND

The inspiration for this analysis of grid teak detectors came about after reading D.K. Owens' excellent original article in the Feb 2000 OTB. His article involved the evaluation of the effect of tube bias conditions on the 200A and 201A detector tubes.

Having recently acquired my first 1920's receiver (a Grebe MU-1) I was very interested to examine the function of the detector, and specifically the effects of using different values of the glass/carbon grid leaks. A number of manufacturers made these in the 20's and the user had the choice of many different brands and values. Much like tubes of the time, these were marketed with very colourful advertising and promises of superior performance.

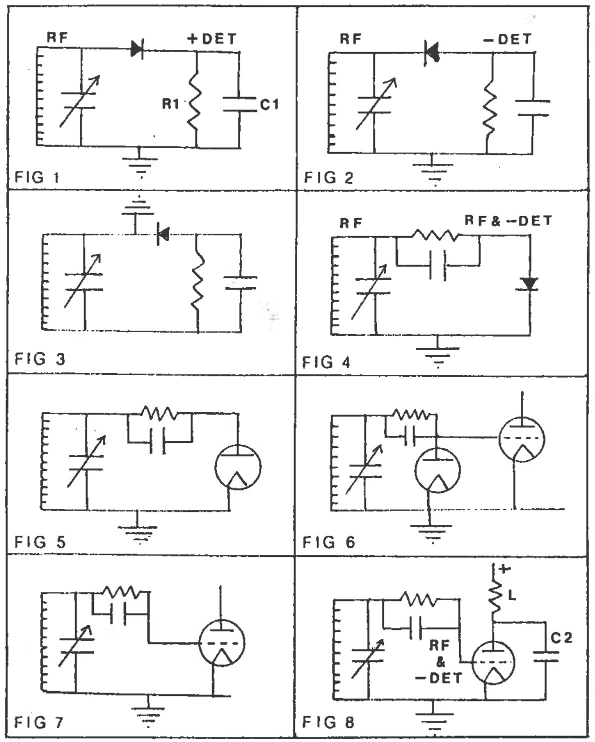
The question is how and why do different values of grid leak affect the fidelity of the signal?" This analysis reveals some startling features of the typical 1920's designs.

UNDERSTANDING AM DETECTORS.

As is usual the best place to start is at the beginning, with the simplest detector circuit, see FIG.I. This arrangement is the familiar half wave circuit. Positive peaks of the RF carrier voltage cause diode conduction and the capacitor, C1, is charged, discharging between the peaks via the resistor, R1. Between the positive peaks of RF carrier the diode is reverse biased. The RF voltage can be represented graphically, FIG. 9. The output from this detector tracks the envelope of the positive half cycles of the RF carrier, and the voltage developed across RI and CI is the recovered modulation, called +DET or positive detection.

With proper proportioning of values the signal has the serrated character, see FIG. 10. Between the positive peaks the detected signal falls away exponentially as the capacitor discharges via the resistor. This voltage is "updated" on the crest of each succeeding cycle of the RF carrier (shown as the dotted lines under the recovered signal for illustrative purposes). If the diode is reversed as in FIG. 2 then this is negative detection, -DET, and the negative envelope of the RF signal is detected, see FIG. 11. This is just as satisfactory as the AM carrier is symmetrical about its zero axis. This -DET circuit can easily be evolved into the grid leak detector circuit as will be shown. However in the analysis of the frequency response of the detector the easiest one to use is the +DET due to the positive voltage convention.

EVOLUTION OF THE GRID - LEAK DETECTOR-AMPLIFIER.



Taking the -DET circuit of FIG. 2, we move the earth to a different position, see FIG. 3, and simply re-draw the circuit, FIG. 4. Now the voltage with respect to the earth or ground connection (measured across the diode) is a combination of the RF carrier and the detected voltage across the resistor and capacitor. This is represented graphically in FIG. 12. Using a good silicon diode and efficient detection, the positive tips of the RF carrier get "clamped" a diode voltage drop above ground. Tube diodes are resistive and the "clamping" is less effective and the carrier peaks rise up above the reference level when the carrier amplitude is higher, to some level, as indicated by the dotted line on FIG 12. The detection is less efficient on account of this, and the demodulated signal amplitude is reduced, however it still works. The solid line in FIG.12 represents the DC axis of the signal for illustrative purposes only, and as can be seen this is the recovered "modulation". This is essentially the signal present at the grid of a grid leak detector.

Moving on to FIG. 5, the semiconductor diode has been replaced by a tube diode, and in FIG. 6 an amplifier has been added. The amplifier's grid/cathode behaves as a diode, so we can remove the original diode, see FiG. 7, and the circuit function is the same, assuming of course that the grid/cathode is as efficient as the original tube diode, which for practical purposes is reasonable, however the effective diode function is moderately resistive. In circuits FIG. 4 through 8, the resistor can be returned to the opposite side of the tuned circuit, with minimal effect except that the capacitor's discharge pathway includes the RF coil.

The tube's varying grid voltage, FIG. 12, results in changes in the tubes anode current, so a voltage is developed across the plate load, L in FIG. 8; again an RF voltage, see FIG. 13, which amplified and 180 deg out of phase appears on the plate. Again the solid line in the graph of FIG. 13 represents the DC axis of the signal, or the average value. So when the RF carrier is filtered off the plate by C2, the modulation is recovered.

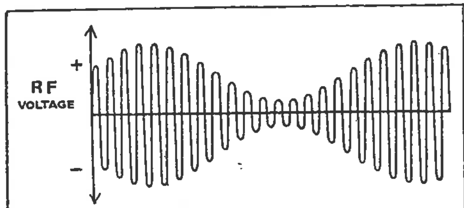


FIG. 9

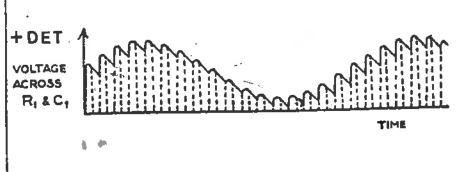


FIG. 10

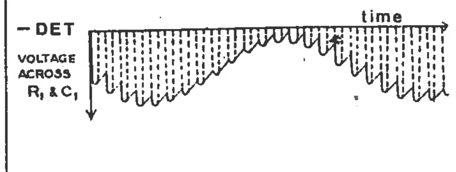


FIG. 11

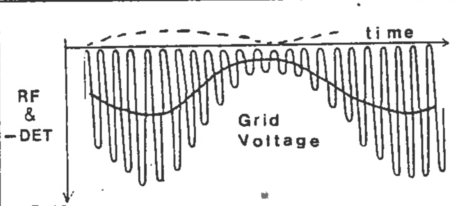


FIG. 12

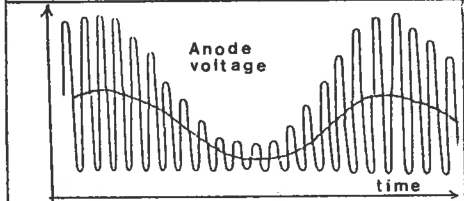


FIG. 13

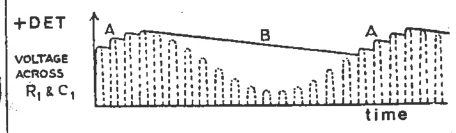


FIG. 14

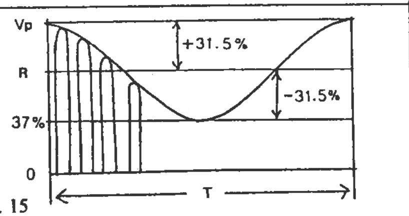


FIG. 15

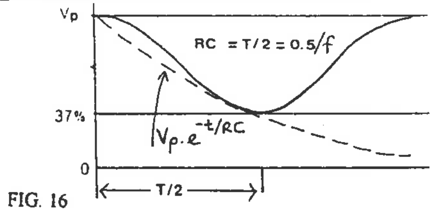


FIG. 16

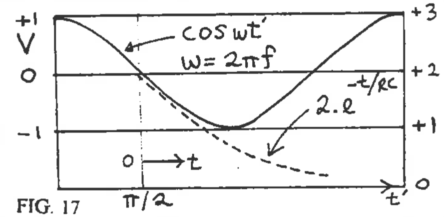


FIG. 17

FUNCTION	DERIVATIVE
$\cos \omega t'$	$-\omega \sin \omega t'$
$2.e^{-t/RC}$	$-\frac{2}{RC}.e^{-t/RC}$

FIG. 18

When $\omega t' = \pi/2$, then

$-\omega \sin \omega t' = -\omega$

$= -2\pi f$

At angle $\pi/2$, $t = 0$

for the exponential:

$\frac{-2}{RC} \cdot e^{-t/RC} = -2/RC$

FIG. 19

$$-2\pi f = -2/RC$$
$$f = 1/\pi.RC$$
$$f = 0{\cdot}32/RC$$

vs

$$f = 0{\cdot}5/RC$$

FIG. 20

The Grebe MU-1 has a very satisfactory arrangement here; the plate load is the primary of a 1:5 ratio transformer with an earthed core. In addition the transformer has no response at radio frequencies. The residual RF not fully filtered off cannot pass to the secondary, and the audio voltage is stepped up by a factor of 5 to drive the grid of the first audio stage, so the transformer performs two functions. This should not be forgotten when one considers replacing a failed transformer with an RC network. A substitute RC network cannot duplicate this exactly.

FREQUENCY RESPONSE OF THE DETECTOR

If the product value of RI and CI (ie the time constant) is too long then distortion results in the detected waveform. In general this takes the form of negative peak clipping of the recovered modulation. This occurs with the high frequencies first. The effect is to degrade the clarity of the audio, producing a "woolly" or "muddy" sound. This is illustrated in FIG 14. region B. During this period the diode is reversed biased and C1 discharges via R1 with the familiar exponential waveform. Regardless of detector efficiency, ie various tube types, diode or grid/filament of triode, or semiconductor, the behaviour of the circuit, between RF voltage peaks, is independent of the diode and dependent on the RC network. It is the analysis of this RC circuit that is important in determining the detector function.

I found it necessary to devise a way to predict the upper frequency that a particular RC filter could support without distortion, and the results are quite remarkable when one considers common values used in detector circuits of the 1920's.

Choosing the capacitor associated with the leak: This value is chosen to be relatively large with respect to the tube (or diode's) input capacity, but not so large that too small a value of grid leak resistor is needed. The lower the value of R, the heavier the loading on the driving tuned circuit. Also the efficiency of detection drops due to the diode's forward resistance when the resistor is too low in value. Typical capacitors for this purpose range from 100pF to 250pF (100pF is the superior value). This leaves one with the value of the grid leak to determine the circuit performance. Again this was a "user" variable in the 1920's.

The ability of the detector to resolve higher audio frequencies without distortion depends on the value of R1 and CI and the depth or extent of modulation. Negative peak clipping, if it is going to occur, will always be worse with heavier (deeper) modulation. We need to be able to calculate the maximum allowable value of grid leak resistor, and the associated capacitor, before negative peak clipping, and distortion of the higher audio frequencies occur. After consulting a number of texts, including Terman, it was clear that the formula was not easily forthcoming. Therefore I have solved the problem using two methods, also there is a third way which can be deduced from a concept presented by Terman.

Three ways to find the answer:

I) Fig 15 shows a hypothetical wave of audio modulation of an RF carrier, rising 31.5% above its resting level R (no modulation) to Vp and falling 31.5% below resting level. Therefore the RF carrier on its positive half cycles troughs down to 37% of Vp on account of the modulation. This value has been chosen deliberately to simplify calculations. If we look at the exponential decay of the voltage on an RC network starting from point Vp, so that it falls fast enough so it is below or equal to the trough in the modulation half a cycle later, see FIG. 16 ,the values are easily calculated. This is because the time taken for an exponential to decay to 37% of its starting value is the 'time constant" equal to R times C. So we can conclude that provided the RC value is equal or less than half the period of the wave, T/2 or put another way 0.5 divided by the frequency, f, then negative peak clipping will not occur. This relationship is then, f= 0.5/(RC) where f is the maximum allowable modulating frequency. This is a very good approximation, but not entirely accurate as it slightly over estimates the allowable frequency: as can be seen the exponential is not quite rapid enough to track the faster falling part of the modulating wave

2) FIG. 17 shows a better way, a cosine wave of modulation, rising and falling one volt above and below its resting value, which is 2 volts above zero. This could be described as 50% modulation. The rate of change with time of this modulating wave at its most rapid part, one quarter of its way into the cycle, an angle of pi/2 radians, can easily be found by taking the derivative of the cosine function and finding the value at that point. The functions and their derivatives are in the table, FIG. 18. Likewise if we consider an exponential starting to fall from the same point (quarter of the way into the modulating cycle) from its timing t = 0, toward zero, which is two volts away, we have the exponential function shown in FIG. 17 as the dotted line. We can easily calculate the rate of change of this function by the derivative, see table FIG. 18 again, and determine the value at t=0 for this exponential. See FIG. 19 where these two rates of change are calculated. If we make them equal, then the exponential decay of the grid leak capacitor charge via the grid leak resistor is just "fast" enough to track the modulation. This is done in FIG. 20 and the value we get is f =0.32/(RC).

3) A third way to calculate this is from information provided by Terman about AM detection, pg 555. That provided that the AC impedance (to modulating frequencies) divided by the DC impedance of the detector load is greater or equal to the modulation, m, and that this rule is not violated, then distortion (some form of negative peak clipping;) is avoided. "m" is defined as the crest of the modulating wave rising above the no modulation level, divided by the no modulation RF level. For the wave illustrated in FIG. 17 then m = ½ or 0.5. This gives an even more conservative result. It can be calculated from R.X/(R.(square root of(X squared plus R squared)) equals m. This is the AC impedance of R and C in parallel, divided by the DC impedance R, where X is the reactance of C. If we make this equal to 0.5 (50%. modulation), from this I calculate the formula to be f= 0.275/(RC). This clearly ensures that the time constant is fast (short) enough to track the modulation without ever ending up with the situation illustrated in

FIG. 14. It is interesting that for m = 1 or 100% modulation, the equation can't he solved for a value of R, which would have to be zero to satisfy the conditions. This means that with these diode and "RC" styles of detector, that 100%. modulated waves, with practical values of R and C, will suffer from some distortion. This is because the RC discharge cannot be made to fall to zero in a sensible time period, as it is an exponential. Modern precision detector techniques get around this problem.

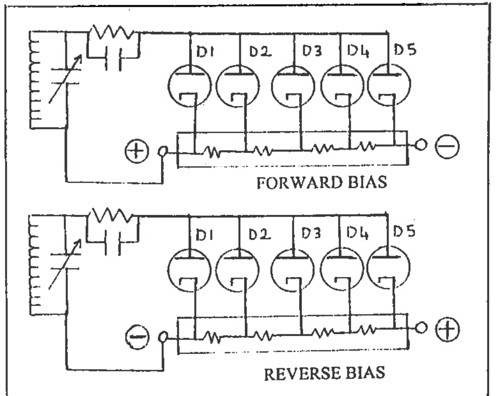


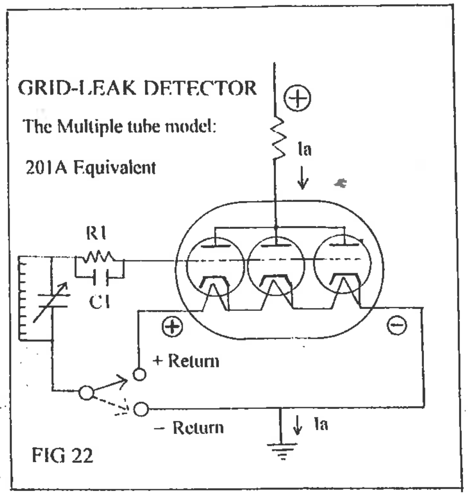
FIG.21

The practical reality of a directly heated tube diode (or triode used as a diode) throws in some interesting features. We can model this as a group of diodes (or grid/cathodes of triodes) and a voltage divider representing the tube's heater element. The heater element (filament) has a voltage distribution. See FIG. 21. When the RF circuit (and grid DC return) is to the positive side of the heater, then diode D1 has no forward bias, D2 a little and D5 has a good forward bias equal to the heater voltage. Forward bias is helpful. "The higher the plate potential, the less is the tendency for electrons to remain in the space charge region (near the "cathode") and repel other electrons". (RCA tube manual, section on diodes). Forward bias assists diode (detector) conduction and function at low RF signal levels. Good detector diodes like the 6AL5 have closely spaced electrodes that minimise the space charge, and rarely need a forward bias. Widely spaced elements such as the grid/filament of a 201A are not as good. Those of us who have tried to use a tube diode in a crystal set in the past know that they don't operate well without some forward bias because the signal level in this application is too low. Possibly though, this "more sensitive configuration" would be prone to overloading with stronger signals.

On the other hand if the return is to the negative heater, then the imaginary' diode elements D2 to D4 have increasing reverse bias. So this arrangement would probably handle higher input RF levels without overloading, but be less sensitive to weaker signals. The results (D.K.Owen's article) with the grid return to negative filament are poor with the 201A.

WEAK SIGNALS

It is still possible for the 201A tube detector stage to detect/demodulate AM even with a poor rectification effect at the grid. As long as there is some asymmetry produced by "diode" type conduction, then audio will be retrieved when the RF is filtered off the plate circuit. Anode bend detectors preferentially amplify the positive half of the carrier by being deliberately biased to produce this effect, while an efficient grid leak detector amplifies what amounts to a "voltage doubled" negative half of the carrier. The curved grid voltage versus anode current relationship of the triode can favour "anode bend", however in the boundary between "grid leak" and "anode bend" processes, no demodulation can occur.



We can now incorporate a model of a directly heated triode, like a 201A. This could be composed of multiple indirectly heated tubes with their cathodes distributed along a heater chain. Three tubes are shown for convenience, FIG. 22, however we could imagine larger numbers. It now becomes clear that the choice of the grid leak return has two fundamental effects. Firstly it configures the grid/cathode or "diode" component of our triode for generalised forward or reverse bias, and secondly it changes the triodes operating point via the average grid bias. This shifts the transfer function of the tube (change in grid voltage vs change in anode current) to a different part of the triode's curve. The placement of the ground, or earth connection, either to plus or minus filament, is academic, as the anode current, Ia, is very small with respect to the low resistance of the heater element in the tube. So you can ground either the plus or minus side of the heater in this example with no other effect.

SUMMARY

Lets look at some values of R and C in AM detectors. Values in the post war period (RCA Handbook) are typically a C of 100pF and an R of 250K. Using my second formula we get f=12800, or 12.8KHz, which is the upper audio frequency you could demodulate without distortion when the modulation is no greater than 0.5. An even shorter time constant is required if the modulation is deeper. This seems sensible, and gives pretty good fidelity out of an AM detector for typical voices and music. But what about a grid leak of 3meg and a 100pF capacitor in a 1920's radio? This gives about one KKz as the upper frequency demodulated without distortion. Combinations such as 3 meg with 250pF are obviously poor. I suspect that with a good grid leak of 1 meg, and a 100pF capacitor, then "f max' without distortion = 3.2 kHz. This is acceptable for a horn speaker with a metal diaphragm. It explains why there is a noticeable performance change with different grid leaks, and why users must have liked to try different values. After all many sets did not have tone controls.

Lower values of leak load the resonant circuit driving the detector and lower the gain by 1) resonant circuit loading 2) drop in detector efficiency and 3) broadening the

bandwidth; however the treble response is much better. Higher values produce more overall volume but a drop in the amplitude and quality of the higher audio frequencies, 'treble cut", as demonstrated even above 1 kHz for common values. In those early times I suspect that people had more of a quest for gain than fidelity. The horn speakers were not up to good high frequency responses, but cone speaker technology was improving, and clearly the detector time constants became shorter as fidelity became an issue,

I can clearly hear the difference in the tone of the sound when I substitute a 5 meg leak for a 1 meg in my Grebe radio driving an Amplion ARIII horn speaker.

From the point of view of detector tube bias conditions, the tube's grid current is so small that leaks ranging from 1 to 10 meg have little effect on the detector tube's bias conditions.

References:- Radio Engineers' Handbook, TERMAN, 1943.
RCA receiving tube manual (post war copy)

OBITUARY - Donald C Sutherland

Don grew up on the family farm at Fordell near Wanganui, receiving his early education at The Friends School then at Fordell school. A brief period at Wanganui Technical College was followed by a period boarding at New Plymouth Boys High School. As a young man he was very interesed in music and achieved a high standard as a pianist before being infected with the "radio bug".

Following High School he returned to the farm for a while then gained a job with Barlow Communications of Wanganui where he was involved in servicing largely communications equipment throughout New Zealand. His employer set up "Barlow Electronic Projects" and recognising Don's ability moved him into this venture in the field of development. There Don produced many designs and modifications of HF and SSB communications equipment. He left there about 1982 when Codan, Australia took over the firm.

Radiowise Don was largely self-taught and his enquiring mind would tussle with a subject until he knew it inside out. He was so good at his subject that he was elected a member of the Radio Club of America - an honour which only came by invitation from that club. Don held an Amateur Radio license from 1949 and was President of Branch 49 on two periods. He joined the NZVRS in 1981 and contributed a number of articles to this journal.

Don passed away in November last year. He is survived by his wife, Mary, a son and a daughter.

ASK THE TECHNICIAN

A highly qualified serviceman will be invited each issue to answer members questions related to the restoration of vintage radios.

Dear Tech,

I am as helpless as a fish on a bicycle since I dropped my multimeter and broke it. Is there any other way I can measure the voltages in my old radio?
Signed ... Clumsy reader.

Dear Clumsy reader,

In my day, we used to use the "finger voltmeter" on occasions, though I don't personally recommend it.
9-30V = Have to wet fingers to measure.
30-50V = Can barely feel if not sweaty.
50-90V = Can definitely feel, possibly uncomfortable.
90V-150V = Painful to say the least.
150-300V = Fingers start to sizzle.
300-400V = Fingers sizzle and eyes water.
400V-500V = Fingers burn, muscles hurt, toes curl, hair may change colour.
500v and up = Don't know, woke up with headache.

Dear Tech,

I found an old radio and thought it would be neat to use it. Shortly after I plugged it in and switched it on smoke came out and now it doesn't go. What is wrong with it? Signed , Newbie.

Dear Newbie,

I have been awake all night worrying about the problems you are experiencing with your new radio. I have come to the conclusion that it's unlikely to be the tubes or the metal chassis as these don't often go up in smoke.

I am now convinced that you are neglecting to consider the great importance of smoke to the functioning of electrical components in your radio. According to my calculations, it is smoke that makes components work because every time you let the smoke out of components, they stop working.

Like many discoveries, this one has eluded all other great minds of our time by its very simplicity. Of course smoke makes all things electrical work! I remember all of those times I allowed smoke to escape when I was repairing radios. Did they stop working? They sure did, every time.

In your radio a wiring harness carries smoke from one component to another, and when the harness springs a leak, it lets the smoke out of everything all at once, And then nothing works. Some radios parts require larger quantities of smoke to operate properly- that's why the wires going to them are bigger.

Repair this set by purchasing a can of new smoke from the club component salesman. It comes complete with installation instructions.
Signed, Tech.

Dear Mr. Tech.,
I recently bought a $4000 valve amp. My problem is that certain busy passages of music get congested and the upper mid frequencies are a bit more laid back than I would like. I have tried using those $450 gold plated RCA stereo jumper cables for all inter connects and the new $1200 gold plated speaker wires, but was unable to achieve any improvement in the overall sound stage.

I was told by the audiologist at the shop these cables would give me a massive improvement over ordinary old copper inter-connects but I am disappointed with the results and would like to know if there is any other method I can use to get the sound I prefer.
Signed. V. Amp.

Dear Mr. V. Amp.

All you have to do is elevate your amplifier seven feet or so and have the music run downhill to your speakers. You will also have to use a compass to check that you do not lay your speaker cables across the earths magnetic lines of force as this will degrade the signal.

If you connect a ground to the chassis of your power amplifier and use No.8 gauge wire connected to a bucket of salt water with a copper coil in it, your mids and highs will be the sweetest you have ever heard. Works with car audio systems too. Place the bucket in the trunk and reduce speed on corners and when braking, to avoid spillage."
Signed Tech.

OBITUARY - Arnold Douglas Smeaton Virtue

Doug joined the RNZAF in radio communications and served at Bouganville during World War Two. Following the War he joined the Civil Aviation Dept in communications at Nandi airport then returned to the RNZAF as a civilian instructor at Wigram. His next move was to manage his wife, Kay's family farm at Taumaranui for 9 years but communications lured him back to rejoin CAA at Auckland in 1964. Eventually he was transferred to Queenstown in charge of the airport and retired from there in 1981 to take up residence in Kingston where he carried out many jobs in the radio field including running a private station, "Radio Kingston". At one stage he was a guard on the vintage train "Kingston Flier" with his wife Kay providing scones and morning tea. Doug was active in amateur radio from 1948 finishing with the callsign ZL4PV. Members visiting Doug and commenting on the ivy creeper over his aerial tower were told "Thats what keeps it from being blown down!"

A member of the NZVRS since 1983, Doug wrote many letters to the editor. In later years his health deteriorated and he was confined to a wheel chair. He passed away at Queenstown Hospital on the 9th of November 2000. His wife, Kay, passed away in 1996.

THE END OF A DECADE

R.A.(Dick) Stevenson

At the end of the 1920's three developments made great changes to the design of radio receivers. The first was the supply of mains electricity to private homes, allowing the convenience of lighting, heating, cooking and ironing from one energy source. Near a large source of DC such as generators for electric traction, the residents might be offered a DC mains supply, but to cover longer distances, AC was the only choice with its easy transformability.

Entertainment broadcasting had mushroomed during this decade, but the valves still needed a DC power supply. The filaments were often supplied from lead-acid cells, which needed periodic charging and the HT supply was from expensive dry batteries. Altogether quite a pain, literally so with hernia-inducing "portables", which often contained a heavy lead accumulator.

If the mains were DC, then the valves could be in series with a dropper, sometimes in the form of a barreffer which contained an iron filament in an atmosphere of hydrogen. But most household mains were AC so "battery eliminators" appeared which could easily supply the HT using a transformer and a rectifier (sometimes a finned copper oxide affair). However this did not solve the filament supply which needed a low voltage at a relatively high current.

In "Popular Mechanics" of December 1929, the handyman was offered a "brute strength" solution, a full-wave battery-charger type circuit using two 2-amp Tungar bulbs. A transformer and two chokes were required, and it was expected that "the average experimenter would prefer to make his own". In the smoothing circuit, it is surprising to find at this early date that 4000 mfd "self-healing dry condensers" were available.

The Tungar bulbs (still available I believe) were filled with argon and contained a hefty tungsten filament, a carbon anode and normally produced a half wave DC quite suitable for charging. But for DC filament valves full wave rectification and adequate smoothing were found essential.

It is true that the valve type 226 had a filament suitable for AC (1 .5 volts, 1.05 amps), but only in AF stages. In RF and detector stages there was intolerable hum. Thus the Tungar supply would let the user cling to a DC set (usually containing 201A's) a little longer.

The idea of a metal tube cathode containing an AC heater had been around since 1923, but manufacturing difficulties were formidable. In "Popular Mechanics" of February 1929 a kitset for an AC set was offered by Hammarlund-Roberts. Somewhat mysteriously, the valves, made by Arcturus, were labelled as normal DC types such as 22, 46, 32 and 48. Yet in the circuit diagram they are all shown with a cathode connected to one side of the filament which was run from 15 volts AC Doubtless a "half-way house" before the general use of a successful commercial valve with separate

cathode, such as the RCA. type 227 triode, using 2.5 volts at 1.75 amps and having a five-pin (UY) base.

This construction revolutionised AC-only sets although the output valve could still continue as a directly heated triode (such as push-pull 45's in America and the PX4 in Britain and Europe). It was only a matter of time before "eliminators" became part of the radio circuit, valves with cathodes being fed with low voltage AC and the HT from high voltage AC rectified into DC by valves such the gas-discharge type BH or the venerable 280 (or U5 in Europe).

The second development at the end of the decade was the four-electrode or tetrode valve whose screen grid construction allowed considerable RF amplification without oscillation. In America the first tetrodes were the type 222 with 3.3 volt filaments, and considerable ingenuity was exercised to combine these with 5 volt valves such as the 201A, the 112A and 171A. Eventually, mains-supplied TRF sets containing types 224A and 235 tetrodes with single dial tuning brought easily-operated radio to everyone.

Such sets were adequate for Australasia with only a few widely spaced stations (I well remember our first TRF radio with "peep-hole" dial and scale from 0 to 100. Station IZM was on 20, IZB was on 35, IYX was on 50 and IYA on 80. At night 2YA could be picked up on 95). But in the USA, stations had proliferated almost without control, and sharper tuning was necessary to avoid co-channel interference.

This brings us to the third major development, the superheterodyne. If the incoming signal is mixed with a local oscillator the resulting difference frequency may be amplified strongly. For a while, this "intermediate" frequency was very low, often 50 or 75 kHz and the amplification was virtually at AF. However there was also a "sum frequency" and because of the low IF and dubious selectivity of early IF transformers, "images" of the required station could be heard on various parts of the dial. This was soon overcome by using an IF. of 175 to 465 kHz, more accurately made transformers and tetrode or pentode valves. In Britain and Europe the superhet was for a while less popular. It was complex to control, there were fewer stations anyhow and the greater number of valves was in some countries subject to a higher rate of taxation

Thus, as the 1930's dawned, radios could be easily powered from the mains, and the numerous stations could be separated. More efficient pentode valves appeared, as well as multigrid converters, but there were not the great design break-throughs that characterised the previous decade. Instead, manufacturers had to compete by offering more complicated dials, press-button or even "telephone dial" tuning, "bandspread" shortwave coverage, "magic eyes" and elaborate examples of cabinets made of wood or plastics.

References: Popular Mechanics, Feb. and Dec.1929

POWER TRANSFORMER PROBLEMS AREN'T ALWAYS EASILY DIAGNOSED

(These are abridged versions of two articles by Richard E Bradley in the Antique Radio Gazette)

The piece of equipment is a 1933 Truetone table radio. The power supply design is standard for that period. The power transformer has failed due to the usual problems with vintage filter capacitors and the lack of a fuse in the primary winding. The 80 rectifier is also defective - poor emission - but the rest of the tubes in the set are correct and show no signs of wear and tear, not even the 42 output tube.

I located a new "old stock" power transformer still in the original box which was marked $7.50 (the good old days). Upon removing the old power transformer and filter capacitors I also found some questionable solder connections and other small components needing attention. After inspecting the rest of the radio I connected it up to an external laboratory power supply and as I had expected it worked beautifully - short wave on a 3 foot piece of wire for an antenna down in the basement of a full masonry home. If anyone builds radios like that any more they are not sold to civilians. Now for the new transformer

I believe in testing a new power transformer; "as new" is not a guarantee. I like to energise the primary with all secondary leads isolated from one another. After an hour of no-load operation I like to check the core temperature by touch and the output voltages with a multimeter. The new power transformer passed these checks so on the installation of it, a new 80 rectifier and new filter capacitors the power was turned on and the radio played fine. However, after about an hour of continuous operation the new transformer started heating up - not a lot but more than I liked. After about two hours it was still safe but hot! In fact the whole corner of the chassis was hot! The chassis felt hotter than the transformer core but I figured it was my imagination which was getting the best of me. At this point I was pretty disgusted and put the set aside for a day or two before going back to it.

I decided to pull the 80 rectifier but on testing again the transformer still got hot. I pulled all the rest of the tube and tried again - still the transformer got hot after a couple of hour operation. Now I was lost. I plugged the unit into a precision power meter and found that the actual no-load draw was 45 watts! Wow!.

When nothing makes sense I go to the library.. After an hour of reading I found that losses are listed as copper loss, hysteresis losses (magnetic core loss), flux leakage loss (magnetism leaking from the core) and finally eddy currents (currents induced into the core and surrounding metalwork by transformer action - an unwanted side effect). Almost all of these losses are minimal in a well designed transformer and I had already tested this transformer out of the set. I concluded that the problems was external flux leakage into the surrounding metalwork in the set. It was now I realised that the chassis heating which I had noted and dismissed as a figment of my imagination was not the result of heat migration from the transformer core but the result of induction heating caused by significant eddy currents flowing in the chassis..

To prove it I energised the transformer via the wattmeter and removed the four core bolts while observing the meter - the meter reading dropped from 45 watts to 23 watts. The last 23 watts dropped to only a few watts when the core was lifted from the steel chassis. My hunch turned to a reality.

Now to correct it !. I purchased some 3/32" thick gasket material from an auto part store and cut out two pieces using the top cover of the transformer as a template. One gasket was used to insulate the top cover from the core and the other was placed between the chassis and the bottom of the core. The bolts and nuts were replaced finger tight and then snugged. Believe it or not! Four bolts equals 4 watts which, plus the watts of excitation power totals 7 watts no-load! much better than the 45 watts no-load experienced originally. I could have clearcoated the bolts and put fibre washers on both ends but the set now draws only 48 watts total now and sounds super. I can play this radio as much as I want.

MORE POWER SUPPLY TIPS

The piece of equipment is a 1933 Belknap table radio. The power supply design is standard for that period with a power transformer rated at 50 watts maximum power consumption. The output of the 80 rectifier is filtered in the usual manner with an inductive pi-type network using the speaker magnet coil as the inductance with electrolytic capacitors shunting each side.

This radio worked fine when I picked it up at the flea market but when I left it on for about an hour both filter caps failed overloading the power transformer and rectifier destroying them as well. The thing I find unusual about this particular power supply failure is that the unit never stopped playing even with smoke pouring from it. There was only a minor reduction in volume and slight increase in distortion.

I examined the speaker field coil and it was still in good shape so with complete replacement of the electrolytics and power transformer all was restored to normal with a minor modification in that there is now a fuse in the mains lead .

I wanted to share this experience with fellow collectors to save similar experiences. I learned a lot. I learned that because a unit plays does not mean it's OK. I learned that a fuse in the mains lead, even external and temporary, is justified when testing a new addition to the collection. I learned that some component failures do not fit the failure scenario of failing completely and abruptly and as a result the damage can be extensive.

I now check the mains power consumption every ten minutes over a two hour period. If it increases with time a thorough inspection of the power supply is justified. If the filter capacitors are warm to touch they are leaking and must be replaced - theory says they will only get worse with time. One last interesting note: the set used a humbucking coil. which presumably was effective enough to mask the noticeable lack of hum when the filter system failed. You cannot always trust what you hear when evaluating a power supply system of any unfamiliar radio.

FROM THE LIBRARY

The following are extracts of articles from vintage radio magazines received by the NZVRS library. Photocopies of these articles are available at $1 each, plus postage, from the librarian - Ernie Hakanson, 17 Williamson Ave, Grey Lynn, Auckland. Phone 09/3766059

405. The Grundig TK5 Tape Recorder. Photos, description, circuit. Radio Bygones no 62, Christmas 1999 p27.

406. Book Review - "Radio Tubes and Boxes of the 1920s", contains pictures of the tubes and their boxes. Antique Radio Classified, Vol 17/2 Feb. 2000. p11.

407 Capacitors in Old Radios - Mica and electrolytics. Photos, descriptions, replacement suggestions. Antique Radio Classified, Vol 17/2 Feb. 2000. p22.

408 Grid Leak Detection in 1920s Receivers. Operation, analysis, graphs, circuits. Old Timers Bulletin, vol 41/1, Feb. 2000, p16.

409 National model RPW-3 Communications Receiver. photos, description. Old Timers Bulletin, vol 41/1, Feb. 2000, p 20.

410. Regenerative Detectors. circuits, Armstrong's patent. Old Timers Bulletin, vol 41/1, Feb. 2000, p 22.

411. Alexander Popov; Father of Russian Wireless Telegraphy. History. Old Timers Bulletin, vol 41/1, Feb. 2000, p25.

412. A Structured approach to Fixing up those Nice Old Radios. part 1- reference sources. Old Timers Bulletin, vol 41/1, Feb. 2000, p57.

413. The Hallicrafters S-38B. photo description, circuit, alignment, hints on faults. Radio Bygones, No63 Feb/Mar 2000, p5.

414. A Russian Military Aircraft Radio - Russian version of the SCR 522. photos, description. Radio Bygones, No63 Feb/Mar 2000, p16.

415 Radios of the Canadian Independent Telephone Co Ltd. 1920s sets, photos, descriptions. Antique Radio Classified, vol17/3, Mar 2000, p4

416 Radios as Furniture. As lamps, tables etc, photos, descriptions. Antique Radio Classified, vol17/3, Mar 2000, p8

417 The story of Ferris Radio. Models 74, 184, 274, 294: photos, descriptions, history, circuit of 74. HRSA Radio Waves, No72, April 2000, p4

418. Using the AWA R7077 Beat Frequency Oscillator. Testing sets and speakers. HRSA Radio Waves, No72, April 2000, p10.

419 Breville Radio models 26 & 27. photo, circuit. HRSA Radio Waves, No72, April 2000, p13

420 The Astor GP/GPP Portable radio. photo, description, circuit. HRSA Radio Waves, No72, April 2000, p16.

421 Replacing Old Electrolytics. Replacing the interior of older can types. HRSA Radio Waves, No 72, April 2000, p18.

422 The Browning Drake: cabinet and coils. Cabinet restoration and coil winding. HRSA Radio Waves, No72, April 2000, p20

423 Power Supplies for Vibrator Set. Replacing with mains supply. HRSA Radio Waves, No72, April 2000, p23

424 Restoring a 1937 Breville "Pal". photos, circuit etc. HRSA Radio Waves, No72, April 2000, p25

425 Receiver Alignment. Part 1. the TRF, the superhet. HRSA Radio Waves, No72, April 2000, p27.

426 Restoring a Philips type 147. photo, description, circuit. HRSA Radio Waves, No72, April 2000, p34

427 Kreisler model 11-86 portable stereogram. photo, circuit, description. HRSA Radio Waves, No72, April 2000, p38.

428 Charles Begg and Co. Ltd. Historical notes. Wellington Vintage Radio Notes March 2000. p3.

429 The GRC-109 Special Forces Set. Clandestine radio, photos, description, circuits. Radio Bygones No64, April/May 2000. p4

430 HMV 542 Radiogram. Photos, description, circuit. Radio Bygones No64, April/May 2000. p13

431 The Saga of Marconi-Osram Valves, part 2, the Inter-war Years. 1920-1939. history, 9 pages with many photos of valves etc. BVWS Bulletin vol 25/1 Spring 2000 p9

432 Refinishing Wooden Radio Cabinets. method, materials processes. BVWS Bulletin vol 25/1 Spring 2000 p26

MARKETPLACE

Advertisements for the next issue must reach the editor by the 14th April 2001. Ads must be either hand printed, typed on a separate page or emailed. No verbal or phone ads. Remember to include your name address and phone number. There is no charge for ads but the NZVRS is not responsible for transactions between members. Address ads to Reg Motion, 2A Hazel Terrace, Tauranga, New Zealand or email regmotion@xtra.co.nz

AVAILABLE

Car radio, American 1936. Two metal boxes with dashboard cable tuning. Collectors item - working life not guaranteeable. 15 lbs weight. Also E7G, 2A5, 2A7, 2B7, 35/51, 1A4GT, 1A7GT, 807 valves: Sylvania, National, Tungsol, Arcturus, RCA in original cartons - emission tested. M.F.Edwards, 47 Martyn St, Waiuku, 1852.

Eddystone UHF receiver model 770 (Mk 11) with manual and circuit diagram. Paul Edgar, ph 09/5374354 or 025/488393

Trio model VT-104 all solid state high sensitivity electronic voltmeter. Brand new with manual and circuit diagram. Provides accurate voltage measurements from 200 microvolts to 300 volts within the range 5Hz to 500kHz. Also useful for noise measurement on high gain amplifiers
Valve manuals, Philips, Brimar, Mullard and RCA(transmiting and receiving) Also Radio Valve Data Book, 1958 with characteristics of 3000 valves.
Carton of TV receiver valves, new in original packets. Send S.A.S.E. for list.Ron Harrison, 29 Olena Avenue, Pakuranga, Auckland. Ph 09/5762479, email rfh@xtra.co.nz